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INDUSTRIAL ARTS AND TECHNOLOGY, PAST, PRESENT, AND FUTURE, ADDRESSES AND PROCEEDINGS OF THE AMERICAN INDUSTRIAL ARTS ASSOCIATION'S ANNUAL CONVENTION (29TH, PHILADELPHIA, 1967).

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Manuscripts of 158 individual conference presentations are included. Speeches in each general session were centered on one of the following major topics--(1) Philosophical Bases of Industrial Arts--Four Poles, (2) Industrial Arts and the National Image, (3) The Cultural and Educational Heritage of Our Technological Society, (4) How and Where Can We Develop Content for Teaching Industrial Arts from technologies of the Past, (5) Industrial Arts--Its Place in Our Present Technological Society, (6) Implementing Today's Technology into Industrial Arts Programs, and (7) Industrial Arts Programs in the Space Age--Directions for the Future. Special panel subjects included--(1) Our Cultural Heritage--A Rich Curriculum Source, (2) The Need for Artist-Craftsmen Who Can Design Objects to be Produced in Quantity, (3) Metals Technology of the Past, (4) Directions for Student Clubs, (5) The Oswego Plan and the Ohio State Pl n, (6) Industrial Arts and the Federal Aid Programs, (7) What Are the Challenges of Mass Production in the Ceramics Industry, (8) Photography--The Basic Tool of the Graphic Arts, (9) What Direction in Ceramics and Plastics--Machine Made Mediocrity or High Level Design, (10) Creative Design and Drafting in the Space Age, and (11) Metals Technology of the Future. Other sessions were devoted o evaluation symposia and special interest panels. (EM)

AIAA Convention Proceedings · Philadelphia, Pa. 1967

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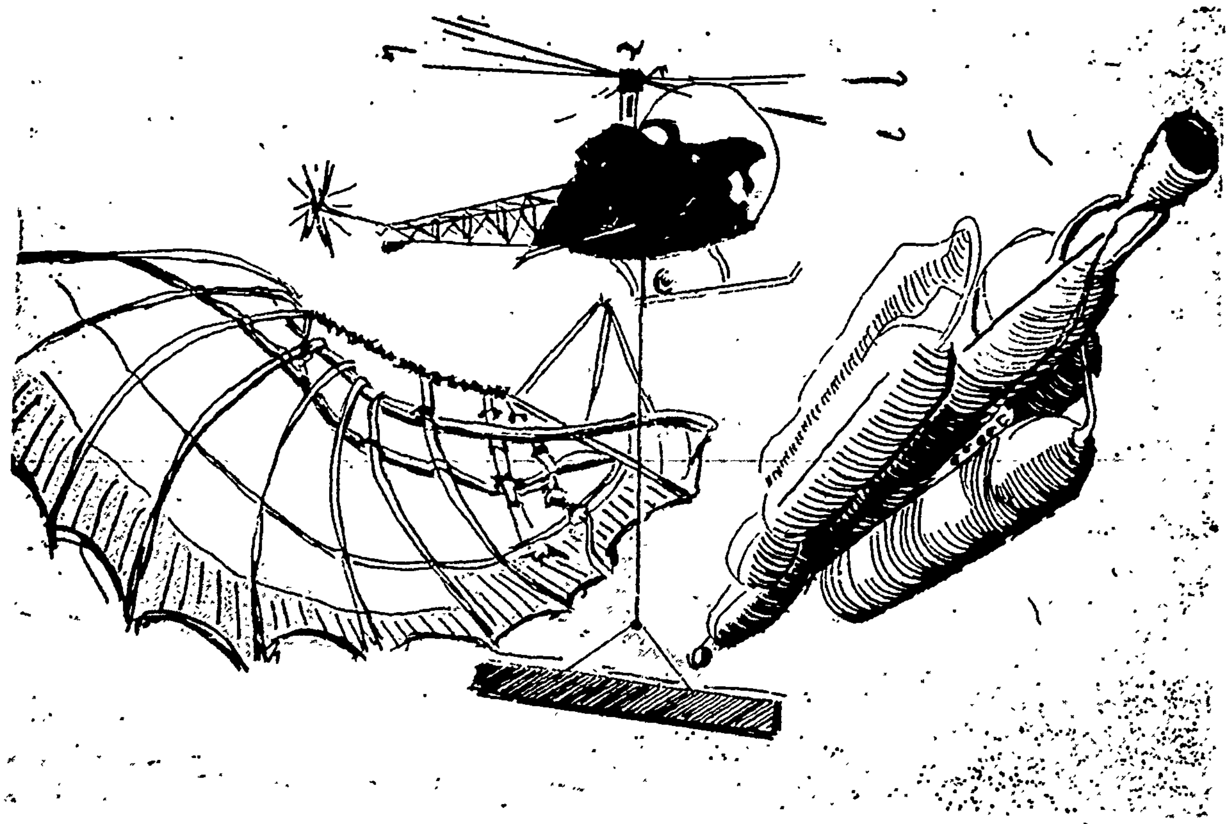
Industrial Arts and Technology-Past, Present and Future



ADDRESSES AND PROCEEDINGS OF THE AMERICAN INDUSTRIAL ARTS ASSOCIATION'S 29TH ANNUAL CONVENTION AT PHILADELPHIA

Industrial Arts and Technology-Past, Present and Future

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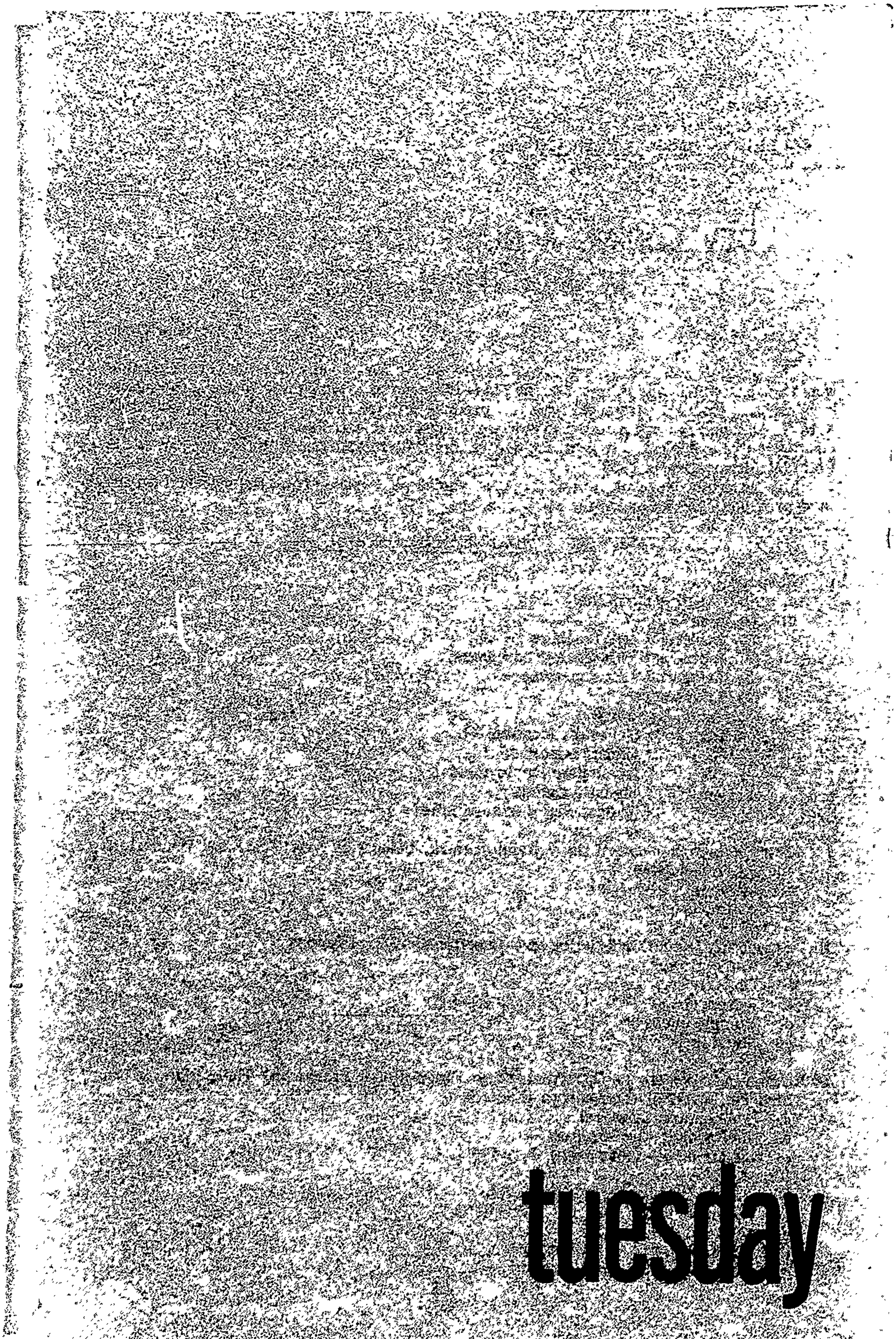
tuesday

Tu-1.2 ACIAS
Executive & Committee Sessions
GUIDANCE IN INDUSTRIAL ARTS EDUCATION
Chm., Leonard Glismann; Rec., Patrick R. Doherty, Jr.; Part., T. Gardner Boyd; Host, Jake Reams.

DEVELOPING A GUIDE FOR—GUIDANCE IN INDUSTRIAL ARTS

T. Gardner Boyd

The purpose of this program was explained by Mr. Boyd. He pointed out that this was a project which was initiated at the Tulsa Convention. During this meeting the members of the Council suggested that we produce a guide titled, "Guidance In Industrial Arts." The supervisors meeting in San Francisco also devoted some time to further discussion on this subject. It was decided at this time to continue with this project at the Philadelphia meeting in 1967.

Mr. Boyd discussed the following outline which was prepared from the material turned in at previous ACIAS Convention work sessions:

GUIDE FOR: GUIDANCE IN INDUSTRIAL ARTS

I. Purpose
   a. An overall description
   b. To be used by:
      (1) Industrial arts teachers
      (2) Industrial arts teacher educators
      (3) Industrial arts supervisors
      (4) Counselors
      (5) Administrators
   c. Guidance for: General education
      Higher education
      Immediate employment
      Specific career
      Avocational - leisure time

II. Communication between the Administrators, Industrial Arts Teachers, Counselors and Other Teachers
   a. Ideas
   b. Examples

III. Evaluating Materials Relating to Occupations and Professions
   a. Authenticity
   b. Objectivity
   c. Recency
   d. Completeness
   e. Suitability

IV. Orienting Students to Opportunities in Professional Fields and Their Place in Our Modern Industrial–Technological Society
   a. Elementary - general
   b. Junior high - exploratory
   c. Senior high - more depth

V. Studying an Occupation or Profession
   a. Nature of work
   b. Size and distribution
   c. Future
   d. Personal requirements

e. Preparation
f. Working conditions
g. Economic returns
h. Occupational relationship
i. Entry into occupation
j. Advantages and disadvantages
k. Sources of further information
l. Opportunities in related fields
m. Flexibility for the future

VI. Techniques and Procedures for Providing Information Relating to Occupations and Professions
a. Interviews
b. Materials in library
c. Career conference
d. Vocational day
e. Visitation to vocational classes
f. Others

The meeting was then organized into a work session in which the people in attendance were divided into six groups. Each group was assigned a discussion leader and a topic which dealt with one of the six chapters or sections which were being considered for the "Guide." Following is the list of discussion leaders and their topic:

Group I Louis J. Bazzette, Purpose
Group II James Gillilan, Communications
Group III Glenn Newhouse, Evaluating Materials
Group IV Wesley Ketcham, Orienting Students
Group V Marshall Hurst, Studying an Occupation
Group VI Paul Wighaman, Techniques and Procedures

The groups delved into their work hurriedly, and some very interesting discussions developed. They made many suggestions and prepared considerable material which will be used by an editing committee to complete the writing of the "Guide" project.

Mr. Boyd, president of ACIAS, is with the Board of Education, Kansas City, Mo.

Tu-1.2 ACIAS
Executive & Committee Sessions
DUTIES OF INDUSTRIAL ARTS SUPERVISORS
Chm., T. Gardner Boyd; Rec., James O. Gillilan; Part., Robert L. Woodward; Host, Ronald A. Rogers.

SIDELIGHTS TO "DUTIES OF INDUSTRIAL ARTS SUPERVISORS" STUDY

Robert L. Woodward

Under the auspices of the 1967 study of the "Duties of Industrial Arts Supervisors," a questionnaire was sent to all active members of the American Council of Industrial Arts Supervisors of the American Industrial Arts Association, as well as to certain other selected industrial arts supervisors. The questionnaire was based upon the findings of the original ACIAS study conducted in 1954.

Appreciation is expressed to all the supervisors who responded to the questionnaire. A list of the names of the respondents is presented in the last section of the study report. However, it should be pointed out that the number of respondents stated in the report does not include those who wished to remain anonymous or those who submitted their material after the deadline. Approximately two-thirds of those receiving the questionnaire responded—which is an excellent return.

The purpose of this presentation is to discuss the in-between-the-lines implications of the responses rather than the prepared factual report of the actual duties of industrial arts supervisors. An analysis of the responses to and additional notations on the questionnaires showed that the types and degree of responsibility of industrial arts supervisors varied not only between large and small school systems but among large systems as well as among small systems. Certain school systems have separate units to provide services for curriculum development, facility planning, personnel employment, equipment procurement, and others. In some systems, industrial arts supervisors are curriculum specialists with major responsibilities centered around curriculum development; under this plan, many of the typical supervisory duties are delegated to other personnel in the central office or to the principals in the schools.

It is surprising to note that even though there is a tendency to place supervisors in an advisory capacity and that modern experts on supervision do not favor the rating of teachers by supervisors, almost half (48 percent) of the respondents reported that they rate teachers. Further, according to the results of the study, when supervisors evaluate a course or program, they pay more attention to the personal characteristics of the teacher than to the other aspects of the educational environment (curriculum material, facilities, equipment, organization and others).

Approximately four-fifths of the duties of supervisors listed in the results of the original study appear in the 1967 report of the "Duties of Industrial Arts Supervisors." However, there has been a significant change in the rating of the importance of certain of the duties (i.e., the number of supervisors performing the duty). In the 1967 study report, the duties are arranged in two groupings: the first group lists duties performed by 85 to 100 percent of the supervisors; the second, those performed by 70 to 85 percent of the supervisors. In comparing the original list with the present list, it is found that certain duties considered less important in 1954 are now ranked in the first group. Another significant change is that the respondents favored words such as "assist," "advise," and "coordinate" over "conduct," "direct," and "administer." The supervisors indicated a greater team approach among the personnel of the central office and a closer working relationship between industrial arts supervisors and supervisors of other subject fields.

The questionnaire used in the study requested the listing of supervisory duties not previously covered. Two duties added by a significant number of the respondents were concerned with "active involvement in and promotion of professional organizations" and "involvement in the use of federal/state funds." Supervisors have until recently left to the general membership the functioning of professional organizations to which they belong. No doubt it is for this reason that "to become actively involved in professional organizations" was not considered a duty of supervisors in the original 1954 study. However, because of the aggressively active characteristics of some of the professional organizations today, many of the supervisors hold that all members, including supervisors, must openly support and assist the organizations of their choice.

The second duty indicated by the respondents is indeed a new responsibility to many industrial arts supervisors. It is concerned with the use of federal/state funds in industrial arts programs. With the advent of the Elementary and Secondary Education Act, research grants under the Higher Education Act, and the inclusion of industrial arts in NDEA Title XI, industrial arts supervisors and teacher educators have become involved in federally funded projects. And with the inclusion of industrial arts in NDEA Title III (effective July 1, 1967), supervisors will find that the promotion and coordination of programs funded under this Act will become one of their more pressing responsibilities.

The members of the American Council of Industrial Arts Supervisors should be reminded that the purpose both of the original study and of the one just completed was and is to provide information concerning the specialized nature of many of the responsibilities of the industrial arts supervisor. This information is for use in promoting positions of industrial arts supervision in school systems currently without this specialized service. Many school systems in the United States, because of limitations in size or other factors, are not able to provide this specialized service. For these reasons, it is strongly recommended that ACIAS embark upon a "grass roots" leadership development program. In other words, we should encourage industrial arts department chairmen in school systems without supervisors (1) to provide these specialized services and (2) to become participating members in ACIAS.

Dr. Woodward, president of AIAA, is consultant in industrial arts education, California State Dept. of Education, Sacramento, Calif.

Tu-2.1 ACIATE
General Session
PHILOSOPHICAL BASES OF INDUSTRIAL ARTS - FOUR POLES?
Chm., Charles B. Porter; Rec., Eckhart A. Jacobsen; Obsr., Daniel L. Householder; Panelists, Donald Maley, Donald G. Lux, Paul W. DeVore, Alson Kaumeheiwa, Wesley L. Face; Host, K. G. Heintz. Mr. Kaumeheiwa's manuscript was not provided.

INDUSTRIAL ARTS—A STUDY OF INDUSTRY AND TECHNOLOGY FOR CONTEMPORARY MAN

Donald Maley

"If we indoctrinate young people in an elaborate set of fixed beliefs, we are ensuring their early obsolescence. The alternative is to develop skills and habits of mind which will be the instruments of continuous change and growth on the part of the individual." (3, p.2)

—John W. Gardner

The above quotation is of vital importance in an age of great social, political, and technological change. Thus, the role of the school deserves a central focus, and certainly one that will demand constant attunement with society if education is to maintain, from a qualitative point of view, a proper relationship between output and demand.

What are the implications for industrial arts in the above comments? As an integral part of the total school program and as an important element of general education, it surely must strive to identify its role. Industrial arts must engage in those elements of human activity which contribute to the development of skills and habits of mind which will be the instruments of continuous change and growth on the part of the individual.

The processes whereby change as an order of expectation is developed, and the processes whereby the promotion of and the contribution to change become basic outgrowths of the school are indeed fundamental areas for concentration by any area in the school. This is especially so in those areas of general education whose contact bridges the broad spectrum of the school population.

The relevance of this position to the program ideas growing out of the University of Maryland is in the continuing emphasis on the process of how the individual arrives at his answers. This point has necessitated a radical change in the role of the teacher from one of a "dispenser" of facts, dates, qualities, numbers, etc., to one of a "manager of education". The role of the individual does not center alone on how one gets the answers. It also places great stress on what answers one wants and a host of student-identified problems that give rise to the need for answers.

The area of study in industrial arts is still maintained within the framework of the following definition:

> Industrial arts as a curriculum area is defined as those phases of general education which deal with industry—its organization, materials, occupations, processes and products—and with the problems resulting from the industrial and technological nature of society.

The definition has particular significance because it identifies certain broad areas (including organization, materials, occupations, processes, products and problems) which will continue to have special relevance to the broad study of industry. Programs in industrial arts can be developed that would deal with each of these facets in a realistic and meaningful way. Numerous examples can be found that would substantiate the fact. However, our teachers must, in themselves, have a level of sophistication about the organization of industry, the problems, products, processes, materials and occupations. The content is there, but it will demand a new or different brand of teacher. A neat, orderly set of demonstrations of tool processes will not suffice. Nor will a set series of sterile projects measure up to the requirement.

Two systems that have been tested over the past ten years that do in fact make possible a limitless study of all of these facets are the group project approach to the study of a major industry and the line production experience that extends from the various levels of personnel organization and finance through procurement, planning, production, distribution and dividends. The depth and scope of such study and student-mental-manipulative activity is chiefly a factor of teacher background, ingenuity, judgment and resourcefulness.

My second emphasis, which has been a consistent one, is that the principal function of industrial arts is the development of people and not of things. As a matter of retrospect I would like to present two points of view that have had a significant effect upon what is accomplished in industrial arts. The much older one and certainly the one in practice that has had the greatest effect as far as industrial arts is concerned, is the "things" orientation which is based upon a "job" or "thing" analysis. The second idea, which I feel we must accept, got considerable support in industrial arts in the late forties when such people as Hornbake, Ludington, Wilbur, Brown, Hammond and others attempted to move the profession to think in terms of human analysis rather than "thing" analysis.

The chart illustrates the points of difference between the two. (See below) I challenge you to start at the top (literally) side of that diagram, and I challenge you to design educational experiences that reach out towards the fulfillment of the human qualities of mankind. These two listings spell the difference between an institution or a program that is based upon a "factory" notion whose prime reason for being is the production of things as compared with the more difficult and less popular idea of a program that has as its base for existence the development of people—people capable of living in and contributing to the contemporary culture.

Industrial Arts Approaches

Thing or Job Analysis:
focuses upon projects
1. The materials to be used.
2. The finishes to be applied.
3. The glues to be used.
4. The fasteners to be used.
5. The tools to be used.
6. The processes to produce the item.
7. The following of a prescribed procedure to construct the item.
8. Etc.

Boy and Girl of Human Need Analysis:
focuses upon people
1. The developmental tasks of boys and girls.
2. The societal requirements and expectations of people.
   (a) social responsibility
   (b) economic sufficiency
   (c) self renewal
   (d) mobility
   (e) leadership
   (f) followership
   (g) problem solving
   (h) adaptability
   (i) social, economic, and political sophistication
   (j) Etc.
3. The individual's interests.
4. The individual's capacities.
5. The individual's objectives.
6. Etc.

It is quite apparent that the focus of attention in methodology is on what the individual does, and more specifically how he accomplishes what he does. I am concerned with the mental and manual learning processes by which the individual accomplishes what he does and how these learning processes contribute to the requirements of living in the contemporary age. As a point of retrospect again, I call your attention to a presentation that I made at the American Industrial Arts Association's national meetings in Indianapolis, Ind. in April, 1963, when I asked the profession to consider taking its direction from the outcomes of "Project Instruction" as presented by Dr. Ole Sands in a speech entitled "Curriculum Decisions for the Sixties". (8, p.9)

It is possible that in the next decade we should consider moving in the following directions:

From	To
1. The group	The individual
2. Memory	Inquiry
3. Stimulus-response psychology	Organismic psychology
4. Spiritless climate	Zest for learning
- - - - -	- - - - -
6. Repetition	Spiral reinforcement
- - - - -	- - - - -
14. Teaching as telling	Teaching as a creative art with a scientific base

As another instance in retrospect, this speaker presented at the Washington (1964) Convention of the AIAA a paper in which the idea of "Industrial Arts as a Cultural Experience" was emphasized. The topic was based upon the following postulates:

1. A comprehensive and in-depth study of industrial arts is a cultural experience dealing with one of the most dominant factors in the contemporary society.

2. Many of the basic elements of content for the study of industrial arts have persisted throughout the history of mankind as matters of vital importance and primary cultural focus in the evolving societies.

3. There is an increasing void in the education of contemporary man with respect to his understanding of "industry and technology" as dominant cultural factors.

These ideas were supported by a number of documents from the fields of sociology, anthropology, economics, history and technology. A few of these supporting statements follow.

Ashley Montagu, in his text Education and Human Relations, defines culture as "the way of life of a people". "It is the people's ideas, sentiments, religion and secular beliefs, its language, tools, pots and pans, its institutions." (7, p. 31) Martin and Stendler, in their text Child Development (5, p. 154, 155) discuss the "common denominators" of culture and direct our attention to "the Yale Cross-Cultural Survey", which includes several hundred cultures from all over the world, has set up an index of these common denominators in the following categories:

language	reaction to nature	finance
communication	religion	family
exploitative activities	ethics	kinship
technology	property and contract	social organization
implements	social stratification	government
housing	drink and indulgence	social control
food	dress	ingroup conflict
transportation	daily routine	war
travel labor	labor	art
numbers and measures	specialization	reaction
lore and learning	exchange	

From an historical point of view, the study of industrial arts in relation to the contributions of technology toward the evolving civilizations is vividly presented by Roger Burlingame in his discussion of "The Hardware of Culture":

".... The Carthaginian wars, the fall of the Roman Empire, the Norman Invasion, the Magna Carta, the discovery of America, the War of the Roses, the Spanish Inquisition, the French Revolution, the Louisiana Purchase, the Missouri Compromise were words with dates attached, loosely strung together by such terms and phrases as 'the rise and fall of civilization,' 'the struggle for liberty,' 'Renaissance,' 'Reformation,' 'Enlightenment' – abstractions cooked up out of hindsight to give 'dignity' to the record.

"It was only when I discovered from the exploration of rare or forgotten writings and artifacts that the vast gulfs between these events were filled with galleys and sailing ships, roads, wagons, mines, canals, magnetic compasses, catapults, crossbows, engines and dynamos that I began to see a real continuity and integrity to history." (1, p. 15)

Howard Mumford Jones, the noted professor of English at Harvard University, has described the inadequacies of many scholars in matters dealing with tool and technological developments and their contributions:

"....a hundred scholars know something about Lucretius for one who realizes what a revolution in human culture took place in the ninth century when Western man put draft harnesses on his horses instead of choking their windpipes with a rope attached to a cart. A hundred scholars can discuss Darwin, a master of scientific prose, to one who knows that among the causes for the celerity of Napoleon's armies is the fact that Napoleon knew how to exploit the Chappe telegraph, whereas his opponents – the Austrians, for example, – did not.

".... Among historians of ideas, then, a great deal of attention is given to the history of ideas, expressed in literary form, and very little attention to the history of ideas, chiefly technological, not commonly so expressed. It would, however, be jejune to remark that the effect of the idea of interchangeable parts upon the fortunes of mankind has been quite as great as the effect of the idea of progress." (4, p. 22)

Another issue of special significance to industrial arts is related to the topic of subject matter integration. I have long contended that industrial arts in its study of contemporary industry must draw its content and secure a great deal of its reality from the other subject areas of the school. Max Lerner, in a presentation before an audience at the National Education Association in Washington, stated that it is impossible to study any discipline or subject entirely within itself. I am therefore continuing to contend that the modern school is highly ineffective in many areas simply because of the compartmentalization of the total program. The interdependency and interrelationship of subject matter demands that greater effort be made to develop the school curricula in terms of an organismic approach to the development of people, as opposed to the "cellular" and "storage vault" processes of so many secondary schools and institutions of higher education.

Alfred North Whitehead spoke out about this same practice as follows:

"The solution which I am urging is to eradicate the fatal disconnection of subjects which kills the vitality of our modern curriculum. There is only one subject-matter for education, and that is Life in all its manifestations. Instead of this single unity, we offer children - - - - Algebra, from which nothing follows; Geometry, from which nothing follows; Science, from which nothing follows; History, from which nothing follows; a couple of languages never mastered..... It is a rapid table of contents which a deity might run over in his mind while he was thinking of creating a world, and had not yet determined how to put it together." (9, p. 18) Later on in the same writing, Whitehead summarized the need in education by stating that "....The pupils have got to be made to feel that they are studying something and not merely executing intellectual minuets." (9, p. 21)

No other area in the school as it is currently organized or constructed has potential for such integration of subject matter in a life-like situation as does the industrial arts laboratory. The realistic application of the elements of mathematics, science, communications, social studies, art, music and physical activity are inherent in the industrial arts objectives and functions.

Another concern that all education must face is the nature of experiences provided the learner. What are the forms of student participation? What are the levels of mental and physical involvement? And to what degree does the experience provide practice in living and learning rather than a series of isolated super-organized fragments of information to be memorized or recorded in a notebook? John Dewey some years ago challenged educators to examine these practices when he said:

"...We must conceive of work in wood and metal, of weaving, sewing, and cooking, as methods of living and learning, not as distinct studies.

"We must conceive of them in their social significance, as types of the processes by which society keeps itself going, as agencies for bringing home to the child some of the primal necessities of community life, and as ways in which these needs have been met by the growing insight and ingenuity of man; in short, as instrumentalities through which the school itself shall be made a genuine form of active community life, instead of a place set apart in which to learn lessons." (2, p. 14)

Industrial arts can and should be a direct, first-hand encounter with major segments of the materialism, the idealism and the technology of mankind. It can be a living and learning experience completely compatible with the guidelines as previously referred to in the Ole Sands speech and in the statement by Dewey.

Support for this line of reasoning is found in the work of Whitehead, as follows:

"...First-hand knowledge is the ultimate basis of intellectual life. To a large extent book-learning conveys second-hand information, and as such can never rise to the importance of immediate practice. Our goal is to see the immediate events of our lives as instances of our general ideas. What the learned world tends to offer is one second-hand scrap of information illustrating ideas derived from another second-hand scrap of information. The second-handedness of the learned world is the secret of its mediocrity. It is tame because it has never been scared by facts. The main importance of Francis Bacon's influence does not lie in any peculiar theory of inductive reasoning which he happened to express, but in the revolt against second-hand information of which he was a leader.

"The peculiar merit of a scientific education should be that it bases thought upon first-hand observation; and the corresponding merit of a technical education is that it follows out deep natural instinct to translate thought into manual skill, and manual activity into thought." (9, p. 61)

One final item of retrospect that this speaker has ardently pushed for these many years is that the industrial arts teacher should be an expert in the "design of learning experiences" – and in this respect it is implied that they be directed toward the development of people.

"....Through experiential laboratories, industrial arts offer those learning experiences which assist boys and girls to understand the industrial and technical aspects of life today. This curriculum area makes a realistic contribution to education as a process and shares with other areas of the school the responsibility for promoting the continuing development of the good citizen." (6, p. 46)

The accomplishment of this idea of "design of learning experience" involves a broad perspective of what is possible by way of pupil experiences within the framework of the laboratory setting and the broad study of industry. Here again I challenge our teacher education institutions to produce teachers who are capable of designing learning experiences rather than the predominant emphasis on "project design." The implementation of this broad and functional approach to industrial arts has had considerable success through the use of such flexible and "experiential" processes as:

The Unit Approach
The Group Project Study of Industry
The Line Production Study of Industry
Research and Experimentation
The Individual Project or Problem Approach

The industrial arts laboratory in its general framework is unequaled in its environmental hardware of electronics, metals, woods, drawing, design, testing, graphics, power, fabrication, communications, etc. The remaining essential elements so vital to maximum human potential development center in the areas of program, methodology and the teacher, as well as in educational administrative leadership and support. A program for the junior high school has been developed along the lines of this presentation. It is in use in a number of Montgomery County, Md. schools and is being developed in the Fairfax County, Va., schools. Selected facets of the program are being used in many other centers in and out of the State of Maryland.

FOOTNOTES

1. Burlingame, Roger. "The Hardware of Culture." Technology and Culture. Vol. 1, No. 1, Winter, 1959, p. 11-19.
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Dr. Maley is head of the Dept. of Industrial Education, University of Maryland, College Park, Md.

PHILOSOPHICAL BASES OF INDUSTRIAL ARTS—FOUR POLES?

Donald G. Lux

The twenty minutes allotted to me will be used to establish a point of view about industrial arts as an essential element in a well-balanced liberal education program for all citizens in an industrialized free enterprise social system.

The rationale I am presenting is my personal one, but it is inextricably interwoven with the formal rationale of the Industrial Arts Curriculum Project. I will not try to distinguish between personal convictions and those of the Project. Some of the points of this paper, and points which we may discuss here, may not have been treated in published Project materials. For those, others of the Project staff should bear no burden.

Some initial assumptions are essential to place my rationale within the broader context of a total school program. Among these are the following:

1. The primary objective of the school program is to communicate to future generations man's accumulated disciplined knowledge.

2. Industrial arts can make a distinct contribution to an integrated total program of studies, e.g., it may teach how to communicate graphically a material product design as a supplement to other program areas which teach communication as a central focus.

3. The disciplined knowledge which is studied in industrial arts can be related to man's total knowledge and also can be organized and taught with the major focus on its own conceptual framework.

4. Industrial arts has a primary responsibility to communicate effectively its body of knowledge.

At this point, some definitions will provide for more efficient communication. Definitions basic to this rationale are:

1. Liberal education: that education required for at least a majority at a given level of educational attainment.

2. Industry: a societal institution, that subcategory of the economic institution which produces materials in response to man's wants for goods, therein also providing the knowledge of how efficiently to use and service these goods.

3. Discipline: a branch of organized knowledge.

4. Praxiological discipline: a branch of organized knowledge of efficient action (practice) as opposed to knowledge of form, value or natural phenomena.

5. Industrial arts: a study of the disciplined knowledge of the practices of industry.

6. Industrial technology: a common term which may be equated with industrial praxiology, that is, knowledge of efficient industrial practice.

In an attempt to synthesize within the above assumptions and meanings, I am suggesting that industrial arts is fundamentally an essential part of a total school liberal education program, that its subject matter relates to other school subject matter, and that the focus of industrial arts studies is upon the knowledge of efficient action in industry. To quote from Industrial Arts Curriculum Project materials:

The objectives (of industrial arts) cover the cognitive, affective and psychomotor domains of educational objectives, and emphasize both mastery and transfer dimensions. A study of industrial arts will enable pupils to:

1. understand the concepts, principles, generalizations, problems and strategies of industrial technology.

2. have an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants for those goods.

3. demonstrate knowledge and skills that will be useful in life situations of occupational, recreational, consumer and socio-cultural significance.

What has been precented to this point offers ample opportunity for discussion for the balance of our professional lives, but even further to promote the discussion our presentations are supposed to stimulate, I shall shift now to two major discussion areas: (1) what are the implications of this verbiage for program? and, (2) what are some points of conflict with other "poles"?

It is no secret that much of what has been stated and written in our profession has had little implication for program if the degree of program change in the past half-century is a criterion. We have changed much in what we say we are doing. We have changed relatively little in what we are doing. Despite this troublesome observation, it is a common contention that our programs must better reflect our objectives, or the demands for more efficient use of student time to master our expanding disciplined knowledge will force handicrafts (i.e., woodworking, metalworking and drafting) outside the formal school program. What is the alternative?: provide an effective program of study of industrial technology which can be defended as a program essential not only for today, but for the foreseeable future.

What should this program provide for the student? It should give him a firm grasp on an intellectual "road map" of industrial technology, a framework which has meaning based upon first-hand use of the fundamental concepts and principles in life-like situations. More specifically, students can gain fundamental knowledge in the disciplines which are developing to provide American man with his unmatched material standard of living. The branches of engineering, industrial psychology, industrial labor relations, industrial management and other disciplines will provide him with important knowledge which largely has been kept hidden in existing school programs from nursery school through advanced graduate work, except for those few who major in one of the disciplines in college. These disciplines provide only part of our body of knowledge. Much of industrial practice remains to be organized and codified. "Experts" may be used to fill this gap.

Within this program, students must come to grips with the knowledge of planning, organizing and controlling an industrial material production system; the knowledge of preprocessing, processing and post-processing as entities in the production part of the managed industrial input, process, output system; and the knowledge of efficient personnel practices within the system. This knowledge needs a new program framework other than one of drafting, metal working and woodworking. It further implies quite a different program for the professional preparation of industrial arts teachers.

The program being developed by IACP is designed to teach students that industrial management practices, when combined with industrial production practices, yield industrial material goods. Within that major conceptual framework, ever more specific concepts are developed within the time and ability limitations of the students, the limitations of the teachers and the environmental limitations. The instructional system, based on developed criteria for the selection of learning activities, may complement other learning activities in the school, but the focus will remain on industrial technology.

There are a number of points of similarity between other rationales for industrial arts and the one advanced by IACP. Points of divergence also exist. The principal points of contention hinge on delimitations and basic assumptions. Therefore, I would suggest that subsequent discussion and our attention focus on these. We can discuss countless details or we can focus on the major underlying premises. I favor the latter approach.

I will now point up some of the major issues which should be considered. I cannot speak with authority about the relative stands on these pivotal issues, but I will advance the IACP position for comparison with statements by experts on other points of view.

Issue:

1. Is industrial arts general or special education?

Position:

1. Industrial arts offers programs which are fundamentally general education, but the body of knowledge from which industrial arts draws its subject matter may be taught and studied for many purposes: liberal, professional or vocational.

Issue:

2. Is industrial arts a suitable name or is it time for a change?

Position:

2. Let's work for the further acceptance of industrial arts.

Issue:

3. Are we discipline-oriented or something else (process, material, activity, etc.)?

Position:

3. We derive our body of knowledge from selected disciplines to the extent they are developed, and work for their further explication.

Issue:

4. Is industry focused on material production or on production of any economic value?

Position:

4. Industry is defined as the societal element which exists to produce constructed and manufactured goods.

Issue:

5. Is the ability to do essential to industrial arts or is cognitive development the essential?

Position:

5. The proof of praxiological achievement is the ability to do. Ability to do is essential.

Issue:

6. Is there a "service industry" for servicing industrial goods or does a discipline-knowledge approach to curriculum deny any intellectual distinction?

Position:

6. The knowledge of how to service industrial goods is one with production knowledge, and, for purposes of study, distinctions need not be made except as to time and place.

Issue:

7. Are there two or more major subdivisions of industrial activity?

Position:

7. Construction and manufacture constitute the major sub-elements of industry.

Issue:

8. Are transportation, communications, advertising, money and banking and other sub-elements of the economic system part of industrial arts subject matter or not?

Position:

8. All of these are technologies but none of them substantially change the form of materials. Thus, they are peripheral to the central focus of industrial arts.

Mr. Lux teaches at Ohio State University, Columbus, Ohio

CURRICULAR CONSIDERATIONS—OSWEGO

Paul W. DeVore

As a profession, we are critically examining our field of endeavor, and this is good. Our examination reveals that many of our memorized cliches in the areas of definition, objectives and methods are not valid. We have discovered we are continually on the defensive educationally because of a lack of relationship between what we say and what we do. The increasing complexity of man's creative endeavors in the technologies forces us to re-examine our point of view, to look at our field differently.

Our curriculum efforts at Oswego have been based on a study of man and his technologies in an attempt to identify the discipline and knowledge base and common bodies of technological knowledge from which to derive curriculum structures and content.

We are searching for answers to rather basic questions: (1) What is and what is not meant by the name "industrial arts"? (2) What should and what should not be a part of this area of study? (3) What relationships exist between industrial arts and similar activities? (4) What criteria do we use to measure the validity of what we are doing?

Several observations can be made which are relevant to the problem. One concerns objectives. Everyone believes objectives are important. However, there are distinct problems resulting from objectives as that term is used in education. Most are multiple and diverse and seldom have a direct effect upon what is taught. The premises upon which objectives are based are often unclear. Yet, we labor under the belief that there is broad agreement on objectives and that the objectives are specific enough to be used for curriculum development and analysis. But they are not. Industrial arts objectives have concentrated attention on broad idealistic educational goals which are nice to have, but which are almost useless for analysis and specification of program content because of vagueness and limitation of choice.

In order for progress to be achieved, there must be recognized a distinction between broad educational objectives and the objectives of an identifiable knowledge field. The objectives of an area of knowledge are derived from the discipline itself. The structure, content and methods or strategies of teaching are indigenous to and inherent in the discipline. Whereas educational objectives are unique to a given country or school system, the objectives of a given discipline are universal and are derived from the knowledge field itself. (2, p. 10.)

For years, we have practiced the definition, "industrial arts is". My late colleague, Dr. Snygg, maintained that the knowledge field is plural and that the definition should be "the industrial arts are". This point of view recognizes the industrial arts as being concerned with several knowledge fields, as are the sciences and the humanities. The function of the definition as an identification of the field of study, and not for delimitation, is inherent in this point of view. The field of study should define itself. What is the content and discipline base for the industrial arts?

Several current curriculum efforts at Oswego are based on the premise that the industrial arts are a study of man's creative endeavors in the technologies and that these endeavors have an identifiable organization and structure. Evidence is that this premise provides answers to our question with profitable results. Structure, content, objectives, methods, procedures, questions and problems can be derived from identifiable bodies of knowledge in the technologies. The structures evidence unifying themes, continua of abstractions, and theories and laws of technological progress which provide answers to the more critical questions relating to the study of the industrial arts.

Concern for the development and structure of knowledge and the methods of the discipline of technology as a foundation for the derivation of curriculum in the industrial arts rests on the following rationale. General education, of which the industrial arts should be a part, is concerned with common learnings based upon cultural universals. This is distinct from concern with specialities which consist principally of vocational callings. (10, p. 230.) According to Phenix, disciplined understanding is the foundation of general education. The content of general education is not "knowledge in general", which everyone has, but authentic disciplined knowledge. It is general in that it is based upon cultural universals and relevant to all students—not to members of special groups. (7, p. 314.)

Any system developed must be productive in solving problems of curriculum design, provide a measure of excitement to students when they comprehend it, accommodate new advancements in the discipline and provide a continuum of scholarship and study from the most elemental concepts to advanced study at the terminal degree level and beyond. The problem therefore becomes:

Develop a curriculum structure based upon the study of man and his creative endeavors in the technologies which is externally stable and internally flexible and adaptable to change.

Two problems are involved: (1) the structure of the discipline itself and (2) the teaching of the discipline. Basic to the solution of both problems is the identification of the universe of content in the technologies common to all cultures, however, primitive or sophisticated. Progression in the analysis of the system of technology, encompassing technical and socio-cultural elements, is from a general overall framework, to an identifiable knowledge structure, through the derivation of a taxonomy, to theories and laws of technological progress. From this system, content for the curriculum can be identified in the form of principles, concepts, units of instruction and courses of study.

All discipline and knowledge fields are schemes of unifications. They are attempts to order, classify and make intelligible vast areas of knowledge. As with objectives, two different categories exist: the discipline organization and the educational or curricular organization. The discipline structure is arrived at by structural analysis, which is concerned with the organization of things. The curriculum structure is developed through functional analysis relating to processes or types of activity. This difference is important to note.

Essentially, we have a need for two types of endeavors in our field; (1) those concerned primarily with the discipline of technology and its structure, taxonomy, theories and laws; and (2) those concerned primarily with the educational process or curriculum and its structure, principles, concepts, units of instruction, courses of study and learning environment. Both fields of study are closely interrelated and interdependent. In addition, the content universe involves both practical and theoretical elements, and the knowledge field involves a continuum from concrete to abstract, thereby providing curriculum possibilities from the most elemental to the most advanced degrees.

Concern for the structure of the body of knowledge and level of abstraction of the body of content permits the development of a curriculum structure combining various types of learning in relation to student ability and content level.

By looking at ourselves differently and by basing our curriculum endeavors in the industrial arts upon discipline and structure, technology provides answers with profitable results.

First, we discover that technology, as a form of human knowledge, is identified by the character of thinking involved and that it is associated with tools—tools in the broad sense of the term. As Ayers (1, p. 112) points out, the character of technology is implicit not in the skill-faculty of the human individual but in the character of the tools, tools created by man. We also note that technology is a field of creative technical endeavor identifiable in all cultures. A common body of knowledge exists. Schmookler identifies technology as the social pool of knowledge of the industrial arts and states that any piece of technological knowledge available to someone anywhere is included in this pool by definition. (8, p. 1). As a function of human behavior it is significant to call attention to the fact that technology is problem-centered and activity-centered. Man's efforts in the technologies are his creative endeavors in the determination of what is to be. Thus, the character of the thinking required by man in his technological endeavors is determined by the nature of the problem. (4, p. 387).

Technology is an area of human knowledge, as are the sciences and the humanities, and is an endeavor common to all mankind at some level of sophistication. By emphasizing the relationship of man and technology, we are concerned with the human elements in the body of knowledge. The concern is with the modes of thinking, the problem solving and the solution of technical problems together with the socio-cultural relationships involved.

It is important to recognize that technology is not science, nor is it applied science. The nature and statement of the problems, the methodology and the goals are different. Progress in the technologies, according to Jarvie (p. 388), depends upon the increasing clarity with which technological problems are posed and by our improved ability to think ahead. The structure and character of technology are complex and interrelated and require analysis on the level of generalization rather than on the level of the skill-faculty of individuals. The complexity of technology results from the fact that the problems are environmentally centered and involve socio-cultural components. Jarvie (4, p. 388) illustrates this point as follows:

For example, much of our technology must be changed when we enter weightless or low gravity environments, just as big Tokyo buildings are different from big New York buildings on account of earthquakes.

Technology is concerned with the possible within given environments. Where science is concerned with the investigation of the whole universe and the discovery of the structure and laws which govern nature, technology is concerned with the creation of structures for specific, delimited purposes. The goal of pure science is the discovery of new knowledge. The goal of applied science is in understanding and extending this knowledge. Both deal with a reality that is given. Technology sometimes utilizes the knowledge and information of science and applied science in creating. At other times problems are solved without the benefit of science or applied science. As Skolimowski notes (9 p. 374), "In science we investigate the reality that is given; in technology we create a reality according to our own designs."

The problems of science are dictated by the scientific field of investigation; whereas, those of technology are dictated not only by the environment but by the social setting as well. (4, p. 388)

In our society, we cannot discuss economics intelligently without a knowledge of technical innovation, invention and the function of these elements in producing goods and services. The body of knowledge created by technology is vast, and inter-related to all fields of knowledge. Although only a few in a society are directly involved in the pure sciences, all are involved, to some degree, in the creation and utilization of technology.

Much effort has been directed by the profession in defining the industrial arts with little attention to identifying, ordering and classifying the body of knowledge on the basis of valid taxonometric principles. Machlup (5, p. 15) believes that attempts to classify and order knowledge (in the sense of what is known) are often more enlightening than attempts to define it.

What base is appropriate from which to begin a classification analysis for the industrial arts? If industrial arts are to be a part of formal education, then formal education provides the base from which to determine the major areas of man's knowledge. Ten Hoor provides a logical answer based upon three questions: "Formal education, it can be said, is concerned with three different though interrelated kinds of knowledge, each of which is man's answer to questions he has been asking himself since the beginning of civilization: (1) What is there to be known about the external world and about those who live in it? (2) What use can we make of this knowledge? (3) What use ought we to make of this knowledge?" (11, 1. 423) These three questions identify respectively the distinct but interrelated knowledge fields of The Sciences, The Technologies and The Humanities, (11, p. 423).

Utilizing a basic criteria of structure, namely, simplicity, these three knowledge areas can be accepted as the foundation upon which to base further analysis and to derive a structure and content for the industrial arts. These fields of knowledge contain discipline areas which meet the criteria set forth by Phenix as being an identifiable organized tradition of men of knowledge and evidence fields of inquiry in which learning has been achieved in an unusually productive way. (7, p. 316-17). They represent universal institutions created by man or universal endeavors engaged in by man. These universal institutions and endeavors make up the fabric of all progressive societies.

What universal institutions or endeavors are evident in the social pool of knowledge known as the industrial arts? An historical and social analysis of man's endeavors in various cultures, for instance, establishes a number of man's universal technological endeavors. We discover in our analysis that man in all stages of his technical development has been a builder, a communicator, a producer, a developer, a transporter and an organizer. All progressive societies evidence three major areas of technology, namely, production (including manufacturing and construction), communication and transportation, together with supporting areas of research and development and an hierarchical division of labor. These are universal technological endeavors that have developed and progressed, establishing bodies of knowledge which have survived. Each has a specific structure, raises certain questions, has definite lines of progression and has been productive in an unusual way. Each of these areas meets the criteria of a discipline and is a body of knowledge determined and agreed upon by specialists in the identified field.

An educational program of the industrial arts based upon the disciplines derived from the body of knowledge created by man in the technologies provides a structure which is externally stable and internally flexible and adaptable to change. The structure accommodates present problems and enables the establishment of fruitful patterns of investigation for future developments.

Attacking the problem from the point of view of the disciplines of technology, rather than from the vague and ambiguous education end, provides insights into the structure, objectives, problems, methods and characteristics of thinking so necessary in curriculum development. Valid content selection rests upon a knowledge of the structure of the discipline and the analysis of activity and thinking patterns.

We discover as we investigate the structure of technology that continual evaluation is in progress pertaining to classification systems in the technologies. There is evidence that more and more of what was once separated into different categories, with separate functions and purposes, is now being incorporated into a total system, such as communication systems, transportation systems or production systems. Concern is with the "whole" and not only with the component parts. For instance, the function of the knowledge area of communication concerns information dissemination, storage, retrieval and use. The methods of accomplishing this, whether in a man-to-man, man-to-machine or machine-to-machine system, vary with the task. Elements of radiant energy, printing, photography or graphic representation by man or machine are utilized to attain the most valid solution to a given communication program.

There are a number of reasons to engage in efforts in taxonomy or classification of knowledge areas, not the least of which is to obtain an accurate perspective of the content reservoir. Without a full perspective of the content reservoir a valid curriculum cannot be developed.

A taxonomy of the area of technology would:

1. Eliminate confusion and simplify the task of curriculum planning by providing a perspective of the relationships between the elements and the structure and order the knowledge area into specific categories, thereby assuring a balanced allocation of con-

tent (7, p. 250.);

2. Facilitate communication among the membership of the field of knowledge together with others such as administrators, curriculum specialists and scholars in related fields (3, p. 10.);

3. Simplify understanding and economize intellectual effort by treating large numbers of different things as though they were identical in respect to the aspects by which the categories are defined (6, p. 47-4, p. 36 and 42-13, p. 45.);

4. Provide a base for long-term research and inquiry into the nature of the discipline area by ordering the area of knowledge in such a way as to reveal significant relationships and properties as well as the interrelationships between the elements of the structure (3, p. 17.);

5. Provide a base for developing valid evaluation instruments by identifying elements of content to be evaluated; and

6. Aid in identifying difficulty levels of content areas for establishing instructional sequences at different learning levels.

One test of an adequate taxonometric structure for the study of man and technology, in addition to the basic principles of taxonomy, is universalism. The structure must be applicable to technology in general and not only to the indigenous technology of any one country or civilization. This is true, since no one country or civilization can claim credit as the sole creator or utilizer of technology. The structure must accommodate change.

The purpose of taxonomy is not to limit a field of knowledge arbitrarily but to ascertain its totality, together with the component elements and their interrelationships. Curriculum development thus follows the determination of the structure and its elements.

A taxonometric structure for the study of man and technology identifies three major areas of technological endeavor with which the industrial arts have been concerned to varying degrees. These areas represent the essence of the discipline, are consistent with major components in other technological classifications and provide for internal adaptability to change through the use of non-transient terms. The technical areas are:

AREA	FUNCTIONS
1. Production	Providing goods and services of economic value for man's needs and wants
2. Communication	Providing information dissemination, storage, retrieval and use.
3. Transportation	Providing movement of man, materials, products and services.

The technological areas of production, communication and transportation are found in all cultures regardless of their stage of development. Hence, they meet the criteria of universalism.

A study of each of these physical areas indicates that they vary in their primary function, being unique discipline areas in their own right, and, as do other discipline areas, they require their own taxonometric classification scheme. However, a close interrelationship exists among the areas of production, communication and transportation and their elements, thereby meeting a requirement of structure.

An analysis of each of man's major areas of technological endeavor identifies distinct technical and socio-cultural elements. Each area has an identifiable taxonomy or knowledge classification together with inter-related elements common to all major areas of technical endeavor.

The logical progression of the main elements of the structure for curriculum investigations in the industrial arts develops as follows:

I. Man's major areas of formal knowledge	Science	Technology	Humanities
II. Elements of technology	Technical Elements		Socio-Cultural Elements
	Energy-matter People-Information Environment		Culture-Social Change, Systems, History-Men, Innovation-Invention
III. Areas of technology	Production	Transportation	Communication

Each discipline area has its own structure, problems and line of progression. The most valid structure or system will provide the best answers for the various contingencies.

Curriculum designs being investigated indicate specific inter-relationships existing between the study of transportation technology and communication technology, together with certain sciences as indicated in the diagram below.

Communication	Transportation Land Marine Air Space	Natural Science
Communication Graphics (Photography)	Energy & Power	Geography
	Guidance Control	Meteorology
Communication Electronics		
Radio (Navigation & Com.)	Support & Suspension	Astronomy
Radar	Structures	
Information Systems (Computers)	Operations & Safety	

Once a general structure has been developed which best meets the criteria of the discipline, the next step is to proceed to a definitive taxonomy from which content can be derived for curriculum development. After the general framework has been developed, the four steps to curriculum development in the industrial arts based upon the creative endeavors of man in the technologies are:

1. Establishment of the content reservoir, a taxonomy.
2. Establishment of the basic concepts and principles of the content area from the content area from the content reservoir.
3. Establishment of the units of content instruction based upon an analysis of the basic concepts and principles and the relationship of educational objectives to the objectives of the discipline.
4. Establishment of courses of study by the grouping of logical combinations of the units of instruction.

In evaluating the concept presented, there are several advantages which have accrued from such an approach in our study of the area of transportation and communication:

1. Criteria for content selection are established and curriculum development ordered and simplified. Optimum learning sequences can be planned by identifying complexity levels of content.
2. Flexibility and adaptability to change and internal consistency are intrinsic through the use of technological universals as a base. The overall structure is stable.
3. Rather than isolated and repetitive courses, programs of studies are inherent.
4. Teacher competency can be increased through the medium of specialization in a field of knowledge such as communication, transportation or production.
5. Teacher education programs at both the undergraduate and graduate levels would be improved, both from the point of view of the student and the faculty.
6. Utilizing the discipline and knowledge base would permit and require theoretical and laboratory study of technical programs through both the masters and doctoral levels. Advanced study programs, based on the content area in which one is expected to perform and not on peripheral or available content areas, would become meaningful. The structure provides a base for a lifetime of learning and professional contribution through legitimate, recognizable specialization.
7. Communication would be improved in the profession.
8. New and more profitable research problems would become evident.

9. Both program and student evaluation would be enhanced and improved.

From a structure based on cultural universals in the technologies, the curriculum problem can be delimited and a specific content reservoir identified.

From the content reservoir, the several objectives of the industrial arts and general education can be determined and implemented.

Through a knowledge and understanding of the nature of the content, together with the stated and agreed-upon objectives, the basic concepts, units of instruction, programs of study and methods of implementation can be determined.

Without a definitive content base, however, the goals of general education, to which the industrial arts should contribute, cannot be attained.

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Dr. DeVore is director of the Division of Industrial Arts and Technology, State University College, Oswego, New York.

THE AMERICAN INDUSTRY PROJECT

Wesley L. Face

"Industry is an institution in our society which, intending to make a monetary profit, applies knowledge and utilizes natural and human resources to produce goods and services to meet the needs of man."

This definition of industry is the most fundamental aspect of the American Industry Project. It is the intent of the project to develop a new curriculum area for the secondary school. The objectives of this program are: (1) to develop in the student an understanding of industry, and (2) to develop in the student the ability to solve problems.

The source of content for this program is industry and not technology. Many educators have proposed that an understanding of industry should be developed in the school, but most have viewed industry in a more restrictive sense or as referring only to specific aspects of selected industries. This is not the case with the American Industry Project.

Man is surrounded by the products and services of industry, and his life is constantly being affected by industry. But how much does the average person really understand about this institution? It is the assumption of the project that all boys and all girls, regardless of their vocational ambitions, should be given the opportunity to develop an understanding of industry.

It has been asked: "How can you possibly expect to develop an understanding of all of industry?" If it were our intent to develop an understanding of every known list of information, this would be an impossible endeavor, but this is not our intent. All of the existing industries have common elements, regardless of the products they distribute or the services they render.

One of the major tasks of the project has been the identification and classification of these common elements into a logical structure. The structure has evolved over the last five years. As a graphic representation of the knowledge of industry, it attempts to show that industry exists in a societal environment which can and does affect how it operates. It also attempts to convey the idea that there are thirteen major elements or groupings of knowledge which can be isolated and studied, but which are interrelated.

Each of these major areas is further subdivided into a conceptual model. These models identify a hierarchy of the concepts which are present in each area. A concept has been defined as a psychological construct resulting from a variety of experiences (detached from the many situations giving rise to it), fixed by a word or symbol and having functional value to the individual in his thinking and his behavior.

The structure and its accompanying models have been developed through consultation and a review of the literature. They are presently being used to develop a three-level curriculum for the secondary school. The first level attempts to develop a broad foundational understanding of industry, the second level will be an in-depth study of the major conceptual areas, and the third level will allow the student to do research and experimentation in one or more of the conceptual areas.

First-level materials, which include an instructor's guide, student booklets and various media, are now being used by twenty teachers in Minnesota and Wisconsin. Second-level materials are being developed and tried by five teachers, and third-level materials will be developed during the coming year.

As the program gains acceptance, it will be necessary to have teachers trained specifically for the purpose of teaching American Industry. A pilot teacher education program has been developed at Stout, and presently twelve students are enrolled. (Additional sections will be added this year.) This curriculum incorporates the latest thinking in teacher education and is based upon the theoretical model of the effective teacher.

The project staff is confident that this program can bring about some of the needed changes in our schools. We have, however, developed an evaluation program to determine what behavioral changes are resulting from our efforts. An undertaking of this magnitude cannot be accomplished in a few years, and ultimately it will require the cooperative efforts of many schools and teachers. We welcome your suggestions and help in developing American Industry as a subject which can make a realistic contribution to the education of all men.

Dr. Face is co-director of the American Industry Project, Stout State University, Menomonie, Wisc.

Tu-2.3 ACIAS
Business Meeting
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REPORT OF ANNUAL BUSINESS MEETING—ACIAS

Ralph V. Steeb

This report is a summary of the major items discussed during the annual business meeting of the American Council of Industrial Arts Supervisors on March 14, 1967. Gardner Boyd, President of the Council, presided at the meeting. Mr. Boyd gave his report to the members, commending the Executive Committee, reporting the progress of the Guidance Bulletin Project, and announcing the results of Dr. Woodward's study on the Duties of Industrial Arts Supervisors.

Dr. Ralph Steeb, Secretary-Treasurer, in his report announced a fiscal balance of $737.52 in the Council's checking account and $3,105.52 in the Council's savings account.

He also reported that the membership list contains 218 names of persons who paid dues during the last two years. Certain difficulties were expressed in the relay of dues from the national office during the year. Two membership letters were sent to members during the year.

Dr. Woodward's study of the Duties of Industrial Arts Supervisors was discussed in view of the contribution that it makes to the supervisory field. The Council decided to revise the format of the report and have it printed for duplication and distribution to all Council members. The title when printed will be "The Supervision of Industrial Arts Education." One thousand copies will be printed initially and will be made available to persons who request the report.

Arthur Dudley, chief of the Bureau of Industrial Arts Education, New York State, offered a new curriculum guide which had been developed in his state for grades seven and eight to Council members for their review. The Council accepted the offer to be involved in the assessment of this guide and expressed an opinion regarding its timeliness in view of the current movement toward a middle school organization. The Council further directed its president to appoint a committee to study the possibilities of developing another Council bulletin regarding "Industrial Arts for the Early Secondary Grades."

Dr. Marshall Schmitt reviewed the progress of the Terminology Study. He also endorsed the previous action of the Council regarding a middle school curriculum bulletin. He suggested that the Council also examine the senior high school curriculum, which needs to be reviewed. Council members are encouraged to take advantage of the ESEA Title III possibilities which established innovative centers. Too few industrial arts proposals have been submitted under this Title.

Dr. Steeb pointed out to the members that the profession needs an action program regarding the teacher shortage and recruitment. While there has been considerable informal discussion regarding this major problem during the convention, no program of action has been adopted by any association or council. Dr. Woodward supported this opinion and recommended the appointment of a recruitment committee by the AIAA. A recommendation was forwarded to the AIAA that a recruitment committee be appointed to study the teacher shortage problem and establish an action program toward its solution.

The meeting adjourned following the announcement regarding next year's Minneapolis meetings.

Mr. Steeb is consultant for industrial arts with the Department of Education, Tallahassee, Fla.

Tu-2.5 Student Clubs
Recruitment Dinner
RECRUITMENT OF INDUSTRIAL ARTS TEACHERS—A MAJOR PROBLEM?
Chm., Rex Miller; Rec., Denis J. Foley, Jr.; Obsr., Herbert Siegal; Panelists, Kenneth W. Brown, Don Davies. Mr. Davies' manuscript was not provided.

RECRUITMENT OF INDUSTRIAL ARTS TEACHERS

Kenneth W. Brown

Those responsible for employing or placing teachers need not be told there is a growing shortage of qualified personnel to fill the ranks. Researchers who gather data used in forecasting educational conditions and events are unable to offer much encouragement for the future on teacher supply.

Looking ahead to the year 2000, it is estimated that the population of the world will double, at least, by that time. Since the figure was something in excess of three billion in 1965, it will increase considerably beyond the 6 billion mark during the last third of the present century if conditions affecting the predictions hold. It is unlikely that the population of the United States will double during that period, but the increase will be substantial if present trends continue. There was an 18.5 percent gain during the decade between 1950 and 1960. The population of the country today is estimated to be 200,000,000, of which there are better than 2,000,000 teachers.

Looking ahead again to the year 2000, it is evident that every teacher presently in service must be replaced once and some two or three times. Thus, for recruitment over the next thirty-odd years we start with a figure of something like 2,500,000. To this must be added the number of teachers to take care of the increase in population, as well as the number to meet the continuously mounting demands for more and better educational services. The result is that a base figure of at least 5,000,000 teachers must be in service by the 21st century. Taking into account the present attrition rate of college students and teachers in the ranks, but trusting that ways will be found to reduce losses from each group, it will be necessary to recruit something like ten million persons to enter preparation for teaching during the next 35 years.

Thus, recruitment is not simply a case of interesting college seniors, or teachers in other systems, to enter a particular school or to move to a different locale.

Turning to industrial arts, a conservative estimate of 40,000 industrial arts teachers in the country today is used to apply the above calculations. Doing so furnishes a figure of 100,000 industrial arts teachers to be prepared and pressed into service during the next 30 years, just to break even with present demands. To this figure must be added the number who enter college and those who enter teaching but do not remain. Then, it is more-or-less inevitable that there will be an expansion of programs and services in this country, as well as in others around the world. In total, therefore, something like 225,000 persons must be recruited for industrial arts teacher education by the end of the present century.

Obviously the principal source from which teacher personnel must be recruited is the secondary school. Consequently, the schools should assume a major responsibility for teacher supply. Inasmuch as they have custody of all children at career decision times, this can be made part of the regular instructional program. That is, if the schools are really dedicated to meeting the needs of youngsters, they will pay particular attention to one of the gravest problems with which most every young person must contend—"Who am I, and what talents have I that can be exploited?" Thus, every secondary teacher should provide opportunity for students to become acquainted with a wide range of occupations within the field represented by that teacher. Teaching, of course, is a major occupational category in most every field and youngsters should be made aware of the importance of these services to society.

To recruit for industrial arts means that every vestige of the manual training tradition must be abandoned forthwith. Industrial arts is an entirely different program and requires a vastly different teacher. The theme of this convention, "Industrial Arts and Technology" furnishes the cue to the type of talents needed to be an industrial arts teacher. In one sense of the word, industrial arts is in competition with engineering for recruits. In reality, however, this is not the case. While both need talents in mathematics, the physical sciences and things technical, industrial arts will recruit those youngsters who prefer to concentrate upon the development of people rather than upon the production of things.

Immediately following the stroke of midnight on January 1, we slipped into the last third of the 20th century. We have been forewarned about the vast changes and extensive opportunities that lie ahead. All efforts on recruitment should be underwritten with the realization that those entering teaching henceforth will be developing people to life in the 21st century.

Mr. Brown teaches at State University College, Buffalo, NY.

Tu-3.0 AIAA
First General Session
INDUSTRIAL ARTS AND THE NATIONAL IMAGE

Chm., Robert L. Woodward; Pledge of Allegiance, Robert L. Woodward; Invocation, Lt. Cmdr. Stephen M. Reynolds; Greetings, Dr. C. Taylor Whittier, The Honorable James H. J. Tate; Address, Seymour L. Wolfbein; Rec., Wade Wilson; Hosts, Rufus Johnson, Arthur W. Earl. Shriver L. Coover, Charles Story.

INDUSTRIAL ARTS EDUCATION AND THE TECHNOLOGICAL REVOLUTION

Seymour L. Wolfbein

Something has happened to education and training on the way into the last third of the twentieth century in the USA.

Education, the first round of formal experience in learning, has expanded both at the secondary school level and into the colleges and universities, among all sectors of our population. Already, the average worker in the US has 12.5 years of schooling. For each of the major occupational groups in the expanding sector of the workforce—the white collar jobs, including professional, technical, managerial, clerical and sales—average educational attainment already has moved beyond the high school. The average education of professional personnel is already the equivalent of a master's degree.

Training and retraining, the subsequent rounds of learning following our first formal exposure to education, has increased enormously under the impact of new, publicly-financed programs and an expansion in the private sector. We are beyond the half-million mark in the number of trainees authorized just under the four-year-old program under the Manpower Development and Training Act. Industrial and union sponsored programs, designed especially for combatting the inroads wrought on skills by technological change, many of them sponsored under labor-management agreements, have increased significantly.

The big story, however, lies not so much in the numerical increases involved, although that in itself represents a major change. What has happened, and is bound to continue to happen in the foreseeable future, is the blurring—in concept and in practice—in what used to be considered cardinal differences between education on the one hand and training and retraining on the other.

More and more, education has its antennae out for alerts on what is happening in the social, economic, and political milieu to which it helps orient the people for whom it is provided. More and more education is coming to be defined as the process which helps the individual withstand the inevitable changes which are going to occur in the relationship between what he learns and what he is going to be called upon by his environment to do. And more and more, training and retraining, the reskilling and re-endowment of individuals during their lives, takes on the job of imparting not necessarily vocationally specific knowledge, but, for large segments of our population, basic training in numbers and language in basic processes and industrial concepts which they missed in the first round, acquired only inadequately during their formal education, or simply have to augment because of new developments in the work environment.

Education and training, therefore, are becoming more fused, more interrelated, more synchronized, more of a tandem operation as they aim, in a continuum over the lifetime of an individual, to make the citizenry in general, the work force in particular, more responsive, more adaptable, more maneuverable, more flexible in their relationships to their environment.

In this kind of milieu, industrial arts education becomes the sequence of choice, the course most responsive to what an individual needs in the context of changing technology. In the new technological world, what matters least of all, if at all, is the learning of the ability to read and perceive the materials of technology, eg., a drawing or sketch, the forces affecting our changing industrial and occupational profile, problem-solving, the relationships among tools, materials, processes, etc.

Two major developments—our changing manpower profile and our changing technology—have begun to bring these developments about and there is nothing in the offing which will change their impact in the foreseeable future.

The manpower profile of the US is being recast during the decade in an historically unprecedented manner. It has taken the shape of an hourglass, with a big bulge at both ends, representing the younger and older age groups, and a very narrow waist in between representing persons in the middle adult age groups. For example, the net increase, by age, in the American labor force between 1960 and 1970 will distribute itself as follows:

Total	100%
14-24 years	47
25-34 years	13
35-44 years	- 1
45 plus years	41

Thus, in the midst of very substantial increases scheduled among new young workers and men and women 45 years of age and over, a prime working age group (35-44), from which we would normally draw our people with career development and experience into supervisory, executive, managerial, professional jobs, will actually decline in numbers and percentage.

This gap in our manpower resources will actually get worse as the years go on. If we shift to the period 1965-1975, then the -1% for the age group 35-44 becomes -7%. In fact, by 1975, there will be one million fewer workers in that age group than in 1965. These are the persons, of course, who were born in the 1930's when the birth rate was depressed under the impact of depressed economic conditions.

We are therefore in the midst of a one-two manpower punch which will continue to be delivered at us for a long time to come: the necessity for finding viable employment opportunities for the million new young workers, while meeting the shortages in a vital working age group.

The minus sign for the age cohort 35-44 should be put together with a factor involving the very significant increases in demand for personnel in a great many substantive fields. The last session of Congress put some dramatic additions to the list of occupations for which personnel may turn out to be in short supply. We are going to need a 100% increase in guidance and counseling personnel in the next three years; 2 3/4 million more elementary and secondary school teachers will have to be added between now and 1975; we need 100,000 more librarians (colleges graduate 2,000 of them each year). These are just a small sampling in the professional and technical fields to which demands for such skills as repairmen of our cornucopia of equipment and machines have to be added.

Yet, there is another equally surpassingly important arena in which adult education and training will be called upon to operate. Of the 26 million new young workers, 7 1/2 million are scheduled to drop out of school prior to completion of high school; one out of every three jobless never went beyond grade school, two out of three are high school dropouts; there is a perfectly negative correlation between educational attainment level of the head of a family and its income and poverty status.

Advancing technology represents the framework, the context in which these manpower developments are taking place. We refer here to the steady, persevering non-spectacular changes in procedures, techniques, processes, designs, methods which have occurred in the USA and to which we ask our labor force to adjust. In some sections advancing technology has had a major impact on job declines (e.g., agriculture); in others, it has helped employment to a substantial uptrend (e.g., instruments). But again, this has not been the major impact of technology on our problem—especially under conditions of substantial economic growth.

What has counted is the upending of our occupational and industrial distribution, the steady stream of changes in job design, the increased emphases on job mobility. Our most recent studies show that a young man of 20 embarking on his career will have eight different jobs during his working life, involving seven job changes, giving him an average of a little over five years per job.

And perhaps the most vital impact of technology has been the changing and generally increasing educational and training prerequisites for getting and holding on to a job.

It turns out, therefore, that education and training in general, industrial arts education and training in particular, are critical to American strategy and tactics for assuring a fully employed work force capable of meeting a decade of enormous potential. In the immediate years ahead, five dimensions in particular will have to receive the undivided attention of the adult education field. I will, for brefity's sake, put them rather starkly as predictions. Here, then, are our five predictions for the next decade in the field of industrial arts education:

Industrial arts education will extend its principles and practices toward both ends of the age scale. It should and will embrace the 18-year-old drop-out engaged in a basic literacy retraining program as well as the 58-year-old engineer updating his skills and knowledge in the arena of space aerodynamics. Its domain should deliberately and will designedly include everyone outside of the first round of formal education.

Industrial arts education must and will move into the neighborhoods, as well as expand in its more familiar arenas of operation in the evening high schools, in the colleges of continuing education, in on-the-job factory sites, in special courses sponsored by labor, management or a combination of both. If we are to deal with the more intractable problems of unemployment and poverty, the principles, practices and practitioners of industrial arts education have to move into the places where the problems are—and deliberately bring the necessary programs to the disadvantaged.

This is why industrial arts education, as we have described it, should and will be a critical part of the strategy of bringing civil liberties through meaningful economic and educational opportunity to all who need it. The enormous educational and training deficiencies among the unemployed and poor and discriminated-against have to be overcome before civil liberty can become a viable concept in our society. It turns out that at this juncture of our history, industrial arts education has to provide the wherewithal for helping bring this about. It will have to zero in on these disadvantaged deliberately and develop the techniques for doing the job.

Industrial arts education as we have described it should and will play a critical role in the labor-management arena, particularly in the development of continuous, pre-crisis bargaining. More and more, training and retraining become the prescribed course of action for mitigating and even preventing the manpower displacement potential of technological change. I will predict that industrial arts education—again the form we have described—will expand enormously as a company-financed, on-company-time part of the new trend in the labor-management arena which emphasizes the need to develop patterns of employer-employee relations on a continuous basis rather than see them move into a crisis stage as contracts come to an end.

Industrial arts education must and will enhance the quality of its personnel. All of us have had to and will continue to fight the battle of quantity, the problem of sheer numbers in the places and people we must help and work with. But we have to leave room in our efforts for the better-and-better as well as for the continuing race for more-and-more. The trainers themselves, the educators themselves have to become at least as responsive and flexible and adaptable as we want our clients to be.

Dr. Wolfbein is the Dean, School of Business Administration, Temple University, Philadelphia, Pa.

Wednesday

W-4.0 AIAA
Second General Session
THE CULTURAL AND EDUCATIONAL HERITAGE OF OUR TECHNOLOGICAL SOCIETY
Presiding, Robert L. Woodward; Chm., Sherwin Powell; Greetings, Wade Wilson, Arthur Hertzfeld; Presentation, Melvin Kranzberg; Rec., Merrill Campbell; Hosts, Raymond J. Ross, Stanley Brooks.

TECHNOLOGY AND CULTURE OF THE PAST —CONTENT FOR INDUSTRIAL ARTS

Melvin Kranzberg

Recently the newspapers have been filled with talk about what is called "the technology gap". By that is meant the difference between America and Western Europe in the acquisition and exploitation of technical knowledge. European politicians, economists, industrialists and educators fear that the United States, which already has a commanding technological lead, is steadily widening "the technology gap" and that Europe might fall so far behind that it might never catch up. Then Europe will remain forever technologically backward, with all that this implies in terms of international power, standards of living, social and educational level and the other hallmarks of a progressive society in our modern scientific world.

One of the reasons advanced to explain the technology gap is the snobbish attitude of Europeans toward the technologists who are in large measure responsible for industrial growth. The result of this snobbism is that inadequate funds are provided for technical education, that technologists are poorly rewarded for their efforts in behalf of society, and that the best minds tend to shun technological careers. European social analysts contrast this situation with what they imagine exists in the United States, where they claim the technologist is amply rewarded and is deferred to by other elements of society. Europe, they say, can never hope to narrow the technology gap unless its basic social attitudes are transformed into a true appreciation of the technologist and his work.

Granted that the technology gap is real and, further, that one of the reasons underlying it is the social snobbery toward the technologist and the resultant inability of the Europeans to foster technological growth, the fact is that the European concept of the elevated status of the technologist in American society is a myth. While the position of the technologist might be relatively higher in the United States than in Europe, the fact is that the technologist's rewards in American society, both material and psychical, are not commensurate with his contribution to our society, and that the snobbishness toward the technologist of which the Europeans complain is also prevalent in America.

We have but to look at our educational system, where the position of the technologist reflects in microcosm the prevailing social attitudes within the larger macrocosm of American society. In our universities, the faculties of liberal arts look with disdain upon the scientific and engineering faculties as "cultural barbarians" and "plumbers." In our secondary schools, the teachers of industrial arts are looked down upon by their colleagues in the humanities and social sciences; these latter regard industrial arts courses as making no intellectual demands upon teachers or students, and the students who find fulfillment in such courses are looked upon as dolts who are incapable of being educated along traditional lines. Even in our elementary schools, the time spent on tasks requiring manual skills is considered a trivial diversion, almost as a recess, so that the child can return refreshed to traditional subjects which are presumably more taxing intellectually.

I find this attitude shocking for several reasons. First, it is in blatant contradiction to psychological studies which demonstrate that technical skills and technological insight require as high a degree of imagination, ingenuity and creativity as do those subjects based upon verbal facility. Second, it divorces much of our education from realities. To downgrade the importance of technology and technologists is to forego the possibility of analyzing and understanding American society. Third, it ignores the fact that the humanistic superstructure of our society—its arts, literature, music, philosophy and all the other so-called "higher things of life"—has been made possible by man's technological progress throughout the centuries. In other words, the contributions of technology to human society and culture are glossed over, if not completely obliterated.

What is perhaps most shocking is that even those of us who teach technological subjects are guilty of the same errors. We fail to challenge the imagination and creativity of our students by presenting them with technical problems which would stimulate those qualities. We do not ennoble our subject matter because we fail to acquaint our students with the significant role which technology has played throughout history and in creating our contemporary world. Indeed, we are largely ignorant of this role because we ourselves have neglected the history of our own subject. Finally, we have failed to educate our colleagues to a proper awareness of the role of technology throughout history and of how their own disciplines have been affected by it.

Now, I could discomfit our modern "intellectual Luddites", who hate the machine and the technological world which it has created, by showing how they use technology while at the same time abusing it. They sit in their centrally-heated studios or in air-conditioned offices while voicing their diatribes against technology on a dictating machine. If they are not yet so wealthy or famous as to afford a secretary to transcribe their notes, they hunt and peck on a typewriter to vent their spleen against the machine and what it has done to modern man. From their publishers they demand that their strictures against technology be published quickly and in great quantity and achieve wide distribution—all of this made possible only through advances in the technology which they profess to despise. Their fondest dream is to promote the sales of their anti-technological books through appearance on a nation-wide television program, utilizing the latest technological devices in order to denounce technology itself.

I am an historian, so instead of attempting to confound the critics of technology by showing the logical inconsistency of their position, I prefer to turn to the historical record. While history reveals man's brutality towards his fellowman, as well as his social and cultural progress and his institutional and economic advances, all of these, bad as well as good, are bound up with technology. If engineers, technicians and teachers of industrial arts were to look into the role of technology in the past, they would discover that they have no reason to feel inferior before their brethren who glorify the humanities and liberal arts. Instead, they might feel superior, because so much of civilization and so many of man's triumphs in philosophy, literature and the fine arts have been dependent upon the technological and industrial arts.

Indeed, looking back to the very beginning, we find that man himself is a product of the interaction of our beastly ancestors with technology. Anthropologists distinguish between man and his sub-human ancestors by the fact that man makes and uses tools. Man probably could not have evolved or survived without tools—he is too weak and puny a creature to fight nature with only his hands and his teeth. As anthropologists dig up older and older fossils of human-like skeletons surrounded by primitive tools or implements, they postulate that technology is perhaps responsible for our human form. Thus, men stood erect in order to throw stones; they did not throw stones because they were already standing erect. We call our species homo sapiens, "man the thinker," but we are coming increasingly to realize that man could not have become a thinker had he not been at the same time homo faber, "man the maker." Man made tools—but tools made the man as well. Technology is thus one of the most ancient and basic of human activities.

Not only was technology essential to the emergence of our species, but also it played a major role in the development of human society. The very terms by which we measure the progress of civilization—Stone Age, Bronze Age, Iron Age, and even today's Atomic Age or Space Age—show a growing technological mastery by man of his environment. The development of settled communities, upon which the rise of civilization was based, rested upon a technological innovation: agriculture. In pre-history before then, men had been hunters; in a sense they had been parasites upon nature. But once they learned to grow crops, there arose the possibility of settled and civilized life. Instead of being parasites upon nature, men began to cooperate with nature.

Agriculture meant that men could derive a little more from nature than was absolutely necessary for their own subsistence. In a subsistence economy, one where men are barely able to scratch out a living, cultivation of the arts is minimal. Only when technology had enabled men to eke out a surplus from nature could they afford the leisure to attend to intellectual and cultural pursuits.

Because our contemporary civilization is so greatly advanced technologically over that of our prehistoric forebears, we tend to downgrade the technical skills which our Stone Age ancestors must have possessed in order to be able to survive. When, a few years ago, a class at the University of California was provided with a pile of flints and given the task of shaping simple stone implements from them, they found that after many hours of repeated trial-and-error they could not produce tools which would have sufficed even for a run-of-the-mill Stone Age man. Such primitive skills are not easily come by, and Stone Age man himself had difficulty with his tools. The glassy fracture of flint, which made it so distinctively useful to him, also made it fragile, with a tendency to chip or break, so that flint tools had exasperatingly short lives in service. We can see evidence of this today at a paleolithic site in Kenya, where hunters had skinned and cut up the animals they killed. There, around the skeleton of a single animal, are over 20 hand-axes and flakes, dulled, broken and discarded.

With tools and with agriculture, men could produce a bit more than was required for their own subsistence. They could even support people who were no longer engaged in growing or hunting food. Some men could begin to specialize in mining and smithing to produce metallic tools which would be superior to stone instruments. These metallic tools, together with other technical advances, made possible further increases in productivity, and society could support "non-productive" individuals—priests, philosophers, artists, writers. Indeed, the cultivation of the so-called "finer things of life" would have been impossible without the increased production available through technological development.

It is easy to demonstrate how man's material progress—from savagery to barbarism to civilization—throughout the ages has been closely linked with technology. In terms of energy, there has been the transition from human muscle power to that of animals, to wind and water, to steam and oil, to rockets and nuclear power. With machines, we have witnessed changes from hand tools to power tools, from craft shops to mass production lines, from the beginnings of job definitions and quality control to computer control of factories.

The ceaseless march of technology has done more than alter the material conditions life and work; it has also changed many other aspects of human civilization: political institutions, social organization, economic concepts and practices, legal codes, and indeed, our entire cultural life. By this I do not mean to suggest that technology has by itself determined the course of civilization; rather, it has often been a pre-condition for changes in other aspects of society, although sometimes it has been the major determinant of developments. For example, we can see how those ancient empires which relied upon stone tools and weapons were conquered by those which possessed superior weapons made of bronze and then later of iron. We can see how the feudal system, which prevailed over Western Europe for centuries, gave way to centralized monarchical states with the introduction of gunpowder, and how technological advances in weaponry help shape the international power structure in our contemporary world.

I could go through the entire course of history selecting various political, social and cultural developments and indicating how these have been affected, either to a greater or lesser degree, by technological developments. But time would not permit such a dazzling display of erudition on my part, even if I were able to do so. Instead, I shall concentrate on examples drawn from a single field of technology: communications.

Communications technology is especially relevant to our discussion. For one thing, communication developments are familiar to all of us, and their social and cultural implications can easily be grasped. Besides, the detractors of technology come largely from our literary subculture, and they have used the communication devices furnished them by technology to denigrate technology. It is only poetic justice that they be shown how communications technology has had a profound effect upon their own methods of thought and action.

Leaving aside the early development of speech and of writing, which, of course, had a technological component, we can begin our story with a much later communication medium: printing. The history of printing is a fascinating case study showing how different developments in separate fields, made by many anonymous craftsmen, could be gathered together into a great synthesis eventuating in a simple yet important device, the printing press; but we are primarily concerned here with its sociocultural consequences. Before printing, the communication and dissemination of information was chiefly by the spoken word or through expensive and laboriously handwritten texts available only to a select few. Of necessity the literary culture was aristocratic, while the popular culture was rarely submitted to writing for the simple reason that the mass of people could neither read nor write.

It would be useless for me to belabor the profound significance of printing for Western civilization. Its impact was felt almost immediately in such diverse fields as theology, where reformers ushered in a religious revolution by using printed tracts and published translations of the Bible in the vernacular as the instruments for conveying their thought; in science, where printed journals and books became the vehicle for the diffusion of knowledge and stimulated speculation and experimentation; in trade and commerce; in literature; and in technology itself, where technical knowledge could be communicated without recourse to the oral transmission used by the craftsmen who dominated the productive system of the time.

Nevertheless, the full consequences of the invention of printing did not make themselves felt all at once. For several centuries after the introduction of printing, the cost of printed matter still remained high, far beyond the reach of the mass of the population. Literary culture remained the province of an aristocratic and intellectual elite, and literacy remained confined to a small minority of the population. It was not until the 19th century, with the development of the rotary high-speed press, cheap inks and inexpensive paper that the printed word began to filter down to the masses. There were profound repercussions in many different areas of human endeavor.

With reading materials within the price range of virtually all, the demand for education could begin to be satisfied, and by the end of the 19th century most of the Western nations were well on the way toward wiping out illiteracy. Political democracy, dependent as it is upon an informed electorate, grew apace, accompanying the rise in literacy. There had been democratic states before, but these were only viable when the political unit was so small, as in the Greek city-states, that everyone could be well informed simply by word of mouth; now democracy was possible in larger nations, even of continental size, such as the United States. The principles of democracy had been enunciated long before technological developments made it actually possible to apply them in practice—and once technology had done so, democracy was not slow in coming. Our democratic system of government, upon which we pride ourselves so greatly, can be shown to be directly related to technological developments in communications and in other fields.

Printing not only made possible political democracy; it fostered cultural democracy, for ever-larger segments of the population could become acquainted with the knowledge of the past and informed of present happenings. The result was social and cultural revolution, transformation of the old arts and the development of new ones. Take, for example, the development of photography during the course of the 19th century and its effects upon the arts. Prior to this time, one of the prime purposes of representational painting and drawing was to portray historical events and personages in as realistic a manner as possible. Photography did away with this function of the older art, for the camera could capture with instant realism the appearance of things. Since the artist could no longer compete with the camera in the outward portrayal of events and people, he was forced to show the inner appearance lying behind the outward reality, just as the greatest artists of the past had done. Released from the bondage of a representational realism, the artist was free to experiment with colors and forms, and with the inner world of perception. It is not surprising that the later 19th century witnessed new directions in painting and experimentation along many different lines which are still continuing today.

When photography was combined with printing, reproductions of the great works of fine and plastic arts could be communicated throughout society. Similarly, the development of the phonograph enabled the performance of musical works by great artists of the past and present to be diffused throughout society.

Many other advances in communications could be mentioned. There are the telegraph and the telephone, which speeded up communication between people, and electronic devices, the radio and television, which made possible still faster communication and the dissemination of information to ever-larger groups.

Perhaps the communications developments affecting in most revolutionary fashion the social attitudes and values of our times have been the motion picture and television. Leaving aside for a moment value judgments as to the quality of movies and television shows, we can see how these devices are creating an integrated and unified—some might even say homogenized—society than was ever before possible. Throughout most of human history there has been a great gulf in patterns of living between people of different nations, between people of different regions within a nation, and, equally significant, between city dwellers and rural residents everywhere. Advances in communication are gradually narrowing these gaps. The people in East Dogpatch watch the same television shows, read the same news on the same day, indulge in the same amusements, and read the same books and magazines as do the "city slickers" from New York. Social critics raise their hands in dismay at the thought that the culture of the United States is becoming uniform, that local variations in dialect, accents, food preferences, clothing fashions and the rest are disappearing. I do not know whether this is good or bad. All I can do as an historian is record the fact that this is a more unified nation socially and culturally than it has ever been in its entire history—and this is the work of technology. And we know that the motion picture and television, now assuming international ramifications, are disseminating American standards and values, the American "way of life", to other peoples throughout the world. The result can be for the first time the development of a truly international culture, something about which people have dreamt for aeons, but which was not possible without the miracle of modern communications technology.

Not only can culture be spread through communications, but its level can be raised. By long-playing records, by inexpensive art reproductions, by paperbound books, and by movies and television, great masses of people can be brought into contact with the best of human thought and creativity in both past and present.

It is an interesting sidelight to note that the critics of modern technology look down their noses at what they derisively refer to as "mass culture". They ignore the statistics which indicate that even in the "materialistic" United States, attendance at concerts exceeds attendance at organized baseball games, that more books are being published every year, and that the amount of money spent on theatre and the opera has almost doubled in the past decade. To the "bleeding heart humanist", this argument is meaningless—largely because it is stated in numerical terms. Technology, they say, provides only a quantitative rather than a qualitative advance in man's culture. They declaim against the debased aesthetic taste of the masses, and then they turn and attack the technological means by which that taste can be elevated.

Now I am certainly not going to defend the bad taste of television shows and radio programs, the drivel printed in many books, and the trivial messages which can be instantaneously transmitted over our modern communications networks. Nevertheless, when we look at the defects of our modern culture, we might ask who is to blame—the technologist or the humanist? The triumphs of technology during the past several decades stand in growing contrast to the failures of the humanities. It took only 25 years from the enunciation of the fundamental physical concepts to attain intercontinental television transmission by satellite. It may be true that few have anything important to say on television, but whose fault, over 25 years, is that? Who writes the movies? Who writes the television shows? The technologist merely makes possible these means of communication, but it is the gentlemen of our literary subculture who determine what is communicated. The technologists have provided them with enormous means to reach vast audiences, waiting to be educated and entertained. Technologists have not been lacking in creativity and imagination, but our humanists have failed to take advantage of the new audiences which the new means of communication have placed at their disposal. The technologists have provided the humanists with a great new birthright, and the humanists have sold out for a mess of porridge!

What I have been saying implies that technology is, in a sense, culturally neutral. It simply provides means and has no control over the use of its techniques. But there is a body of thought which claims that the technology subtly but truly transforms the culture itself, providing it with new and different modes of thought, attitudes and values. The extreme statement of this position, at least in regard to communications technology, is Marshall McLuhan's famous dictum: "The medium is the message."

Although it is sometimes difficult to understand what McLuhan is trying to say—and McLuhan admits that he cannot always understand himself—what he means is that the techniques and means of communication—the media—are in some way determinate of the message transmitted by the medium. He argues, for example, that the invention of printing caused men to order their thoughts along specialized, professionalized, individualistic lines which were determined by the linear, sequential, mechanical method of printing and, of course, manner of reading printed matter. Stating that man's tools are essentially extensions of man himself, McLuhan claims that communications are especially significant: "They are so persuasive in their personal, political, aesthetic, psychological, moral, ethical and social consequences that they leave no part of us untouched, unaffected, unaltered."

"Societies," McLuhan writes, "have always been shaped more by the nature of the media by which men communicate than by the content of the communication." Because our communications medium is changing from books to electronic technology, everything else is in the process of changing with us. Our new mass electronic technology is no longer linear, sequential, and specialized; it is instantaneous, and it involves many of our senses. Because media, as tools, are extensions of man—the book, for example, being an extension of the eye—McLuhan compares electric circuitry to an extension of the central nervous system. With our old communications media we saw only through the eye; our new communications media, electronic in nature, enable us to "feel" throughout our entire nervous system.

Now even if what McLuhan is saying is not entirely comprehensible, the thrust of his argument confirms my point. Not only has technology played a major role in the development of our material civilization, it has played a significant part in determining the non-material aspects of our civilization and culture. To this argument McLuhan adds the point that communications technology determines even our conceptualization of the world.

There is yet another lesson to be drawn from the story of man's technological progress. This is a simple lesson, one of which you are already quite aware, but one which nevertheless bears repeating because it runs counter to an argument drawn loosely and falsely from the history of technology itself. That argument is one which claims that our modern scientific technology is producing devices of such complexity and ability that they are superseding man himself. If carried to its logical extreme, this argument would make education in the industrial arts obsolete and teachers of industrial arts extinct.

It is a compelling argument because it is founded on two elements which are historically sound. First, the most advanced and sophisticated technological fields, such as aerospace and nuclear engineering, represent a wedding of science and technology. Second, our contemporary computer-based machinery, as machines through all past history, reduces the amount of human labor necessary for a given task. The skill is built into the machine, and the machine can perform more rapidly and accurately the work of numbers of men. In brief, the machine displaces human labor. Ergo, we don't need the industrial arts, for they do not train students to participate in a science-based technology, and, in any case, automation dispenses with the need for the technically skilled students who are the products of industrial arts training. At least, so the argument runs.

While it is true that technology is becoming more science-based and that automation replaces workingmen, the implications drawn from these facts are historically false. They are false because the proponents of this argument have applied these facts in too narrow a context. A conclusion more in line with the historical lessons of the past would be that we need more, not fewer, technical personnel, and that education in the industrial arts, far from being doomed, is more necessary than ever before. Let me explain.

Because our technology is becoming increasingly complex and scientific, our engineers have had to become more scientific in their approach to technological problems and to extend their training into graduate school. But this does not mean that the middle and lower ranges of technologists have become obsolete. Instead, it means that their educational level and skills must also be raised to meet the rigorous demands of a more complex technology. While certain breakthroughs at the frontiers of knowledge might be achieved only by highly trained technologists who are thoroughly grounded in high-powered science, there is a large range of technical innovation which still depends upon the skilled technicians who are in constant touch with the machines and processes themselves.

Note that I differ here from those who, at one extreme, state that only those possessing doctoral degrees will be responsible for all meaningful innovations in future technology; I also differ from those at the other extreme who point to the fact that the landmark inventions of the Industrial Revolution in Britain in the 18th and 19th centuries were made by men who had no training either as scientists or engineers, and hence claim that the great innovations of the future will likewise be the product of untutored geniuses. The fact is that these earlier inventors, plus those who came later, advanced technology to such a complex stage as to make the basement tinkerer and the lone inventor obsolete as for major innovations. Yet even in highly automated modern plants, many innovations can still be made by skilled technical personnel who possess no Ph.D.'s in engineering science, but who possess imagination, ingenuity, and, most importantly, a thorough acquaintance with the technical processes and their problems. A recent study of technical improvements made at rayon plants of the DuPont Company from 1929 to 1960 showed that a series of so-called "minor improvements" added up to major technical advances. Furthermore, the larger part of these improvements were developed within the plants themselves by personnel intimately concerned with current operations, whose function was often to keep existing operations trouble-free, rather than by formal research and development groups containing high-powered scientists and engineers. In other words, the skilled technician still plays a large part in producing technological innovation.

Even if future innovation were restricted to highly trained scientists and engineers, they would require the services of large numbers of trained and skilled technicians in order to make optimum use of their own advanced training. I know of no statistical studies indicating the number of technical personnel required for every scientist and graduate engineer working in a laboratory or plant. Such statistics, if they existed, would probably show that the number of "backup" technical personnel varies from industry to industry or even within an industry, depending upon the type of work performed. The point is that the demand for engineers is growing, and the demand for skilled technicians is keeping pace with it. A recent study by the Engineering Manpower Commission of the Engineers Joint Council shows a projected national growth in engineering employment of 33% from 1965 to 1976. The demand is far in excess of the supply; 830,000 graduate engineers will be required during those years, but only 500,000 will be graduated from the nation's engineering schools during the same period. This "engineering graduate gap" is paralleled, or even outstripped, by the demand for engineering technicians, whose employment is expected to increase by 36% in the 1965-1976 period. As our society becomes increasingly dependent upon more complex technical devices, we require more technologists—at all levels—to build, operate and maintain them. This demand comes not only from our great industries but also from our consumer economy. For there is an equally pressing need for qualified technical personnel to repair and service the technological products which are purchased by the consumer.

Can history also reassure us about the onrush of automation, which presumably results in both a downgrading of skills and a decrease in the work force?

A look at isolated examples of automation can be very misleading in this context. We read about a machine performing 500 manufacturing functions which formerly took 70 men to perform, and about the 48 men with automated equipment who replaced 400 men and turn out the same finished products in half the time. But that is only part of the story, and we have similar examples in past history of machines replacing workers.

What happened to the spinners and weavers when Kay's flying shuttle and Crompton's mule and Cartwright's power loom appeared on the scene in the mid-18th century? Did spinners and weavers disappear while the machines took over? Far from it! Within fifty years more people were engaged in weaving and spinning on machines than had ever been engaged in these processes when they were manual operations. How did this come about? The cheapening of the products through machine manufacture increased the demand. And not only were there more people engaged in spinning and weaving, but also there was more industrial employment because many men had to be drawn into factories in order to build the machines utilized by the spinners and weavers.

While it is true that many individuals will be thrown out of specific jobs by automation, and while this process will accelerate with every passing year, it is also true that science and technology are advancing at a pace never before witnessed in history. This, we know, will create new lines of productivity, new and better jobs, new professions and untold wealth. It always has. There is no reason to believe that this process will cease or slacken, especially in a world whose population is growing and whose technology must keep pace if this expanding population is to meet its needs of food, clothing and shelter.

Although the need for manpower on our production lines might lessen with the introduction of automated machinery, we will require more technical personnel to man a whole host of auxiliary activities required by automated factories. If industrial plants are to operate efficiently, a score of auxiliary technologies are called into play: air-conditioning, heating and ventilating; building materials and services; communications systems; instruments and control maintenance; lubricants and lubricating systems; materials handling equipment; plant protection equipment; pollution control equipment; power generation and distribution equipment; safety equipment; sanitation and cleaning equipment; storage equipment; and so on. All these supporting elements to industrial production cannot be left to hit-and-miss procedures and unskilled personnel. We cannot leave the servicing and maintenance of machines costing millions of dollars in the hands of untrained and uneducated dolts. The technician must have maturity, judgment, motivation, extensive training in technical fields and in non-technical fields; he must have an appreciation for his work, and a recognition of his role and status in society.

The need for more technologists does not derive solely from our own advanced industrial system. It also derives from underdeveloped areas. The need of the emerging countries for American "know-how" is massive. We have already learned some valuable lessons from our brief historical experience with technical assistance programs. Too often in the past, developing countries have reached for sophisticated technologies—nuclear reactors and steel mills—when what they needed were technical skills which were more commensurate with their stage of technological development. In addition to meeting our own needs for technical personnel, we must also meet the needs of the underdeveloped countries. Industrial arts educators thus have the opportunity to be educators for the world, not only for their own locality.

The task before us, then, is one which poses severe challenges. We need more technological education from the highest to the lowest levels, from Ph.D.'s through graduate engineers, from two-year community colleges and technical institutes through vocational schools and industrial arts courses in secondary schools, down to the primary grades. Although this is a task of unparalleled magnitude compared to the technological education of the past, we have several things going for us.

For one thing, there is a growing awareness of the importance of technology in our society, and this might help us channel more students into meeting the demands for skilled and educated technical personnel. When, in the late afternoon of November 9, 1965, a tiny electrical relay in a power station in Ontario, Canada, failed, that did more within 24 hours to convince Americans that ours is a technological society than did their daily and continual confrontation with the well-functioning products of modern technology. Everyone had at sometime or other a vacuum cleaner that went on the blink, a car that stalled, or a watch that stopped. But these were isolated instances. The "biggest blackout", however, gave a dramatic demonstration of the complete and total dependence of our modern society upon technology's machines, tools, vehicles and processes. It should no longer be necessary for us to justify the importance of the subjects we are teaching. Our contemporary civilization could not exist in its present form without the technologists whom we are educating.

Furthermore, we now recognize that technological skills require just as much keenness and sensitivity as do literary and other types of intellectual activity. Experimental programs throughout the country are developing curricula to challenge the student's imagination and ingenuity with technical problems and to lead him to a higher level of intellectual exercise through technological studies.

In addition, we are aware of the need for more, and more highly trained, technologists if we are to keep pace with the changing and growing needs of society. In other words, technological education must grow both quantitatively and qualitatively, and that is no easy task.

The challenge to teachers of industrial arts is especially great. For too long they have been relegated to the basement of our educational system, both literally and figuratively. This situation will only come to an end if and when industrial arts teachers meet the challenge of this new technological age. It will come to an end only when industrial arts teachers develop new curricula to meet the needs of our expanding and more complex technology. Teachers of industrial arts must not only upgrade their teaching of technical skills but also must interest and challenge their students by imbuing them with a sense of the significance of the industrial arts in the past, the present and the future.

John Gardner, Secretary of Health, Education and Welfare, challenged all educators when he said that the society of the future must strive for excellence in both plumbing and philosophy, so that its pipes and its theories alike will hold water. My brief summary of the importance of technology in civilization attempts to extend Dr. Gardner's remark by demonstrating that if our pipes do not hold water, our theories will never hold water. Modern civilization is dependent upon a high level of technology, and there is no retreating from it. As educators of future technologists, we can strengthen the technological foundations of society. Then the other aspects of our culture, resting upon technology as they have throughout the history of civilization, will also be stronger and greater.

Mr. Kranzberg is Secretary of the Society for the History of Technology, Case Institute of Technology, Cleveland, Ohio

W-4.1 ACIATE
Special Panel Session
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Gen Chm, Charles Porter; Chm, William A. Bakamis; Rec., Marcus V. McWaters; Obsr, Robert E. Blum; Panelists, Eugene R. F. Flug, Donald Maley; Hosts, Harlyn T. Misfeldt, Carl J. White

THE AMERICAN INDUSTRY PROJECT

Eugene R. F. Flug

There have been many reactions to the American Industry Project since its beginning in 1962, so perhaps I should dispel some of the misconceptions that have come about as the result of the tendency for the practitioner to leap to unwarranted conclusions.

American Industry is not just a patch on the old industrial arts curriculum. It is not "a shop taught without tools" as a Milwaukee paper once headlined. It is not ignoring appropriate skill development. It is not intended for the gifted student alone, nor is it only for boys. It is not intended to introduce a national, univariate curriculum into our schools. It is not a program designed by social studies specialists in order to gain more time in the school curriculum. It is not an ivory tower approach to curriculum building. And finally, it is not represented as the only approach, nor the final answer to all of the problems of industrial arts and vocational education.

What, then, is American Industry? That was one of the Project's first questions and the focus of our inquiry. In order to help you understand our project, it is necessary for us to examine together the basic ideas upon which our efforts have been predicated.

So much has been written and spoken about change, I'll merely note in passing that this is accepted as a root cause of the need for increasing and continuing attention for curriculum work.

Two major ideas have guided the recent efforts of curriculum makers and must be understood if the American Industry Project itself is to be understood. These are the idea of "concept" and the idea of "structure". Let us examine each of these ideas in turn.

I've found that one of the best ways to gain an insight into what a concept is, is to look closely at a concept which is held to some degree by everyone. Recall how, from your earliest days, your mother shaped your understanding of the importance of certain events by using such phrases as: "It's bedtime, suppertime, tomorrow, sometime, it's time to get up - hurry up, you're late for school." When you grew older and obtained your first job you found that an hour had monetary value; you might forget your birthday, but your wedding anniversary, never! And if you hadn't learned that childhood lesson of rising early you'd occasionally miss the bus to work. When the job became routine, Friday came to have special significance. If you used a camera, you discovered that a fraction of a second became important. Only recently the radioed report "one more orbit to re-entry" became commonplace. The concept of time, one of our most abstract concepts, is held to varying degrees by everyone. If we look back on the lessons through which we learned this important concept, the nature of a concept and of concept learning may be seen.

Very briefly: Concepts may be held at various levels of understanding; they are formed through a variety of experiences; they are expressed in words or other symbols, but the concept is much more than just the word itself. Therefore, mere verbalization is not the best evidence of knowledge of a concept. A concept may be likened to a categorization system of related knowledges, and the concept term a kind of flag indicator in the mind. The working definition which we have built from many sources defines a concept as "a psychological construct resulting from a variety of experiences (and detached from the many situations giving rise to it), fixed by a work or idea, and having functional value to the individual in his thinking and behavior."

The transfer power of conceptual thinking represents a basic reason for its emphasis in curriculum building. If you link your concept of time to the concept of distance, for example, much meaning can be attached to other understandings. An example of the power of conceptual thinking could be seen in the laboratory of a conceptual teacher introducing the concept of skill to a student. His emphasis, rather than teaching only the steps of an operation, would be on the skill-learning process itself. He would indicate the importance of following a good model performance; analyzing the skill for its constituent elements; comparing each step of performance with the model; and the need for supervision until the learner has reached the point of integration and performed the skill successfully. The learner would record the results of his practice and compare with other learners the results of massed practice versus spaced practice. In short, the conceptual teacher, when teaching skills, would guide his student so as to help him to become a skills learner, not the learner of isolated skills.

We have on our staff, teaching laboratory courses to our college students in American Industry, a talented young man from East Cleveland. Doug Stallsmith taught at Shaw High

School and, with two others, developed a fine technology program which was conceptually oriented. In his approach to teaching machine technology, Doug had defined a machine as a device which, through movement, applied forces which made use of mechanical advantages to produce work. By examining each of these attributes of the concept of machine, the students were able to make learning transitions from one machine to another with considerable facility. They were able to go beyond the machine as it stood in the shop, and adapt it to processes within the capability of the machine, but for which it had not been designed. "They were able not only to analyze the machine but to improve upon it."

Through their analysis of machine motions along the XYZ axes, Mr. Stallsmith's students were able to automate a radial arm saw in a production problem. The only manual step automated in the particular operation involved feeding a piece of stock to a limit stop. A tape recorder informed the operator of each step as it was performed. From the speaker mounted at the work station would come the instructions: "Advance stock to limit stop; air vice closes, linear table moves into position; saw turns on; saw moves through stock; blade returns; saw turns off; linear table returns; air vice opens; stock is ejected onto conveyor." These separate actions were triggered by a tone on the tape which was detected by an oscillator which in turn tripped a rotary table which had been rigged as a distributor. An oscilloscope was hooked into the control equipment to show the difference in wave patterns of the voice and actuating signals.

Earlier in your reflections upon the formation of your concept of time, it was apparent that it had been developed in an informal, largely unplanned manner, and concepts do develop in this way. It is the task of the school, however, to identify important concepts to be learned and then to plan for the deliberate development of these concepts in the school-provided setting.

The second major idea about which curriculum makers are concerned is structure. Very simply, structure is concerned with the parts of an object and the ways in which they are interrelated. The structure of a house could be seen in the ways the floors, walls, roof, windows, doors and other parts are arranged. The structure of a molecule would be revealed by its atomic arrangements. A curriculum structure can be seen in the vertical and horizontal arrangement of the various subjects and educational activities.

Vast quantities of seemingly disparate data are difficult to comprehend; therefore, if an apparently logical structure is lacking, man imposes an organization upon that data in order to better understand it. A pile of 2 x 4's of apparently random lengths has little meaning, but when arranged into the framework of a house, the formerly confused mixture of lengths assumes an integrated meaning.

The ordering of knowledges within a given body of knowledge is known as structuring a discipline and affords man the meaning he strives for by providing simplicity and revealing relationships. By comparing new knowledge with his structure he may experience discovery. If the knowledge fits his structure he has added to his understanding of the structure; if it does not fit, perhaps he must restructure his knowledge. In other words, that random assortment of 2 x 4's might conceivably fit as well, or better, into another structure. This does not negate the value of the earlier structure, for without it he may not have learned of the newer structure.

To speak of structuring the same knowledge differently may confuse you, and believe me, structuring a body of knowledge is not a simple task. Most of the other disciplines under reform already possessed an identified body of content which has since been restructured. In developing American Industry, however, we were faced with that pile of mixed-up 2 x 4's.

How does one go about structuring a "new" body of knowledge? We certainly could not simply look for relationships among the knowledges typically taught in industrial arts. Taken all together they were not representative of a unified body of knowledge. Too much was left out, and too many random bits of knowledge were included. How could all of the hundreds of tools, or materials, or specific industries be represented in our schools? What rationale could possibly justify the inclusion of some and the exclusion of others?

How indeed, does one go about structuring a "new" body of knowledge? As in all curriculum work, it was necessary to start with objectives in order to determine an initial direction and identify the limitations of the task. At Stout we accepted but two of the objectives of industrial arts as the objectives for the American Industry Project. These objectives are:

1. To develop an understanding of those concepts which directly apply to industry.
2. To develop the ability to solve problems related to industry.

With our objectives providing orientation, the major task of defining the discipline had to be faced. Was industry a discipline? Could its knowledges be ordered into a meaningful structure? Industry as an entity, a unified whole, was represented nowhere in the school curriculum, although bits and pieces of it appeared in social studies, science, math, English, and yes, even in industrial arts.

We approached the task of structuring the discipline of industry based upon a review of literature in the area of concept learning. Pooling the experience of some of the interested staff at Stout, we first defined industry in broad terms to identify the possible scope of our investigation. The definition we have accepted holds industry to be an "institution in our culture which, through the application of knowledge and the utilization of men, money, machines and materials, produces goods or provides services to meet the needs of man, and which results in a profit for the institution or society". This definition is admittedly broad, but we depended upon our conceptual analysis technique to help us categorize the knowledges of industry so as to reduce them to comprehensible terms. In making our conceptual analysis of this broadly defined body of knowledge, we first posited a tentative model to represent an initial, categorical breakdown of the knowledges. This model was then used as a "tool of inquiry" to be continually revised and improved as the literature and experts in industry were consulted. Applying our conceptual definition to the literature on industry we would try to fit the knowledges identified within the categories first established in our model. As data was accumulated, and commonalities appeared, sub-categories were established, each of which, in turn, became a model substructure to be tested. Some, it was found, could be combined under an emerging master concept. Each change brought us closer to an integrated understanding of industry.

It is important to emphasize here that we were structuring the body of knowledge of industry using a conceptual analysis technique. This does not presume a curriculum structure, nor does it necessarily impose a particular teaching methodology. If we were to look at our communication model in its broad sense, we would see that any communication is made up of a source, message, channel, receiver, depends upon feedback and is hampered by interference. If enough of the sense of each of these subconcepts is grasped, the learner, in applying this total model to new situations, increases his total understanding of communication. He does not have to know everything about all of the subconcepts in order to make use of the model. If he learns enough of the structure of this concept to establish categorical scope and limitations, he has a powerful tool of inquiry.

The early overall structure of industry, although somewhat naive, did provide a way of gaining knowledge of our subject and improving our study techniques. We have consulted with over 100 knowledgeable people in industry and education on the West Coast and in the Midwest and applied their insights to our model structure. We will be talking to consultants on the East Coast and in the South this year.

We are trying to build a theoretical structural model of which we will be able to say, "This is the best we've been able to do up to now," but which we can also say will be adaptable to change. The function of the theoretical model is to enable us to continue to ask the kinds of questions that permit us to discover significant changes in the discipline. This approach clearly recognizes the revisionary character of knowledge.

Utilizing this structure, we are attempting to develop three levels of courses, to begin in the eighth grade. The broad objectives for the first level are (1) to develop a knowledge and understanding of the major concepts of industry and their relationships, and (2) to develop the ability to solve simple problems related to industry. This first course is intended to establish that broad frame of reference to which the student can relate other learnings. As he confronts these other learnings he will be encouraged to match them against this framework, in much the same way as we have developed our theoretical structure. He will, in a sense, become an applier of our logical, theoretical structure in the development of his own psychological structure. The approach for this first course is therefore cyclical in nature, emphasizing the total unity of knowledges of industry and we hope, here, to communicate the excitement and importance of industry.

At the second level of American Industry our purposes are to (1) develop in-depth understanding of the concepts of industry, and develop refined understandings of the relationships among the concepts, and (2) expand the ability to recognize and solve complex problems related to industry. At this level considerably more attention is devoted to study of each of our concept areas as an entity in itself with some less attention continuing to be placed upon interrelationships between content areas. This suggests less emphasis upon the cyclical approach, although an integrated experience should be provided here, too.

Level III would be concerned with the development of knowledge and problem-solving skills within a concept area or cluster of concept areas appropriate to the individual's level of ability and interests. The student would be expected to identify a problem area of significance involving one or more concept areas. With the help of an advisor he would plan his approach to the problem and develop his search and solution on a largely independent basis, utilizing other subject matter specialists as resource people. In this work he would be encouraged to use any and all resources available to him in the school and in the community.

I have spent the greater portion of the time allotted to me in describing our basic rationale and method of inquiry, because without a clear understanding of the underlying basis for our project, description of the mechanics of the project implementation might be of interest but would have less meaning. To put it in contemporary terms, if our guidance system is unreliable, or firmly locked on the wrong star, we may never get into orbit.

Now for a quick look at the Project organization and progress. In 1962 a number of staff members at Stout began a series of informal discussions regarding the conditions of the field of industrial arts, which led to a small grant from the U.S. Office of Education. This was used to release Wes Face part-time to review the literature on concepts and concept learning. A year's meetings of the staff working on the initial structure resulted in a Ford grant for a one-year period to begin implementation and further development of our ideas in the classroom. Ten teachers from Wisconsin and Minnesota were brought onto campus for the summer to refine the structural model and develop a resource file for teaching. Production of materials was done in a dormitory laundry room. We even took time to get acquainted. That fall the teachers began to implement developmental first courses on a tryout basis in classes from grades 7 – 11. Based on these experiences a proposal was submitted to the U.S. Office of Education for funding over a four-year period to meet the following program objectives: (1) to complete the development of the American Industry curriculum leading into vocational preparation; (2) to complete the preparation of teaching materials for the American Industry curriculum; (3) to establish at Stout State University a resource center for the American Industry curriculum; (4) to conduct a pilot teacher education program parallel to the developing secondary curriculum, as a basis for a recommended teacher education curriculum; (5) to continue a series of institutes for the preparation of in-service teachers; and (6) to promote research on related problems.

We now have twenty-three teachers at seventeen participating centers and two cooperating centers, with about 1600 students involved. Roughly half of these are in American Industry classes and half are serving in control groups. Data are being accumulated on all these students with comparisons planned with Project TALENT's data to find if our results may be more broadly generalizable. A written test is being completed, to be administered this year in industry as a validation check on our theoretical structure and our curriculum structure.

Our resource file is growing as a result of our early contacts with over 1500 industries. We have generated seven paperback student booklets for use in the first level, along with a teacher's guide. Five of our teachers are teaching second-level American Industry on a developmental tryout basis this year. It is planned to introduce standardized materials at second level next year, and begin a third-level course on a developmental basis. Our teachers (all industrial arts teachers) range in experience from one to thirty-five years of teaching, our centers are representative of a range of socio-economic levels, from urban culturally-disadvantaged areas and low-income small rural schools to the opposite extremes. Our students exhibit similar diversity.

We have twelve pioneering students (of whom three are girls) enrolled in a pilot teacher education program and who will be certified as American Industry teachers when they graduate in 1969.

Our professional staff (all former industrial arts teachers) consists of two codirectors, a research specialist, a teacher education specialist, an instructional media specialist, a curriculum specialist and a coordinator of participating centers. We also have nine research assistants on part-time assignments and four overworked secretaries. The university has, in addition, provided us with one and one-half laboratory teachers and a micro-teaching coordinator for the teacher education program.

We do have some problems which need attention. These include: (1) improving the design of activities for the teaching of concepts introduced at each level; (2) improving the backgrounds of our participating teachers; and (3) providing answers to the school administrators and teachers who want American Industry now.

I'll close on a more positive note than I began by summarizing what the American Industry Project is.

The American Industry Project is a new curriculum area designed by industrial arts teachers to provide a better answer to teaching industry; it is using the laboratory as a tool in making concepts meaningful; it is trying to provide an integrated body of content in an attempt to solve the riddle of articulation between general and vocational education; it is concerned with providing a structure of knowledge for industrial arts teachers; it is appropriate for all levels of ability in our secondary schools; it is for all boys and girls in secondary schools; it is involved with local schools, administration, teachers and students (and has been since its inception); and, finally, it is both developmental and experimental.

With the knowledge explosion and the accompanying dizzying pace of change, we as educators are engaged in competition, a competition for the minds of youth. I'm hopeful that the American Industry Project has something of substance to offer.

Mr. Flug teaches at Stout State University, Menomonie, Wisconsin.

THE JUNIOR HIGH SCHOOL PROGRAM IN INDUSTRIAL ARTS—A STUDY OF INDUSTRY AND TECHNOLOGY FOR CONTEMPORARY MAN

Donald Maley

This discussion is a continuation of the presentation entitled "Industrial Arts—A Study of Industry and Technology for Contemporary Man". The specific content will center around the junior high school program that was designed to make industrial arts a "Study of Industry and Technology for Contemporary Man". It is a program that has been developed in the Industrial Education Department at the University of Maryland in cooperation with the Montgomery County (Maryland) School System.

The need for a junior high school industrial arts program based upon the idea of program and not a series of things to be made presented an interesting challenge. It was felt that the content and activities should be developmental and should be related to what precedes the junior high school, as well as what follows. But, more importantly, the educational processes should be directly related to what the individual is attempting to accomplish during the period of his junior high school years. This latter item has a strong bearing on the activities or experiences which contribute to the accomplishment of developmental tasks identified with the group.

The methodology and the content have been tried out over a period of years in a series of pilot situations in the Montgomery County schools. At the present time, a major part of the junior high schools in the county are on this program. This has, in a large measure, been facilitated by excellent support and leadership from the county as well as by a fine cooperative teacher-education workshop which was operated through the Industrial Education Department of the University of Maryland.

Time and space in this presentation limit the discussion of this particular junior high school industrial arts program to the following remarks.

It is a program that has been designed to take advantage of or make use of the following:

1. the integration of mathematics, science, communications and the social sciences into the industrial arts activities;

2. the maximum use of the community resources extending from the total school to the state, national and even international sources;

3. the use of a wider range of reading materials at all levels of difficulty and sophistication;

4. the extensive use of inquiry, problem solving and experimentation in arriving at solutions and procedures to follow;

5. the effective and meaningful use of "role playing" as a technique for greater student involvement and direction by the student;

6. the extensive use of a broad range of student activities that go far beyond the making of objects; the contriving of activities and experiences that will permit a diversity of involvement, a greater display of talents and a greater use of the individual's special

abilities, and finally;

7. the development of experiences in keeping with the behavioral characteristics and developmental tasks of youth.

The seventh-grade program is based upon an anthropological approach to a study of certain basic elements common to all civilized mankind. It uses the unit-seminar-contract-project approach to teaching. The units are as follows:

1. The Development of Tools and Machines and Their Contribution to the Growth of Civilization.

2. The Development of Power and Energy and Their Contributions to the Growth of Civilization.

3. The Development of Communications and Transportation and Their Contributions to the Growth of Civilization.

These units are established for the seventh grade program, and each student selects his specific project and sub-topic that will contribute to the total unit topic. He does his own research, investigation, planning, construction and presentation. Each presentation is made in a seminar setting as opposed to the usual up-front class presentation. Each student is encouraged to use his ingenuity and full range of capabilities in the development of his written and constructional contribution. Each is encouraged to explore fully the range of community resources available to him in his pursuit of his part of the contract to contribute to the unit topic.

The eighth grade program is a contemporary approach to the study of American Industry. It uses the group project and line production techniques of teaching in the group process approach to methodology:

(1) The group project involves an in-depth study of modern industry. This particular approach is aimed at studying an industry using a project-industry as an industry-organization format. Such an industry organizational structure would be similar to those that are involved in the Apollo Project, Mercury Project, etc. The project-industry organizational format is used only from an organizational point of view, but the industries studied may include steel, paper making, aluminum, copper, coal, oil, plastics, etc.

The end product from the constructional activity is a major project of considerable size, complexity and ingenuity. The large project is supplemented by additional products produced by the students in the pursuit of their roles on the personnel organization plan.

The students organize into a functional line and staff (project orientation) personnel plan comparable to those used in contemporary industry. This is in essence the organization of people to accomplish a major industry study. The positions would include such titles as project director, research director, industrial director, personnel director, safety director, construction engineer, project coordinator, electronics engineer, design engineer, public relations director and many more. Each position represents an area of student responsibility, as well as an area of meaningful role-playing.

The role-playing involvement is a major factor in the group project. It also provides for a wider interpretation of the organization, procedures, problems and contributions of industry. This role-playing activity enlarges the realm of student participation in keeping with his interests, aspirations and capabilities. It also establishes the setting for the exercise of authority, responsibility and leadership on the part of the student. The social interaction and peer-culture relationships make this personnel organization an invaluable component of the total process.

The major project is the result of student ingenuity, planning, construction, problem solving, social interaction and the boundless application of resourcefulness on the part of the class.

(2) The second form of group methodology uses the line production technique to make an in-depth study of the volume-producing industries with their organizations, problems, products, processes and contributions.

The value of this latter approach is highly dependent upon the degree to which the teacher sees it as an experiential opportunity involving organization, role playing, financing and economics, ownership, planning, designing, public relations, tooling-up, quality control, labor relations, occupational studies, sales, stocks, communications, etc.

Here again, the resourcefulness of the students in seeking outside-the-laboratory assistance and advice is encouraged. The total school and community should become the sources of help for the student as well as the teacher.

This is definitely not a case where the teacher does the planning, jig-making, the problem solving and the supervising. It is a student enterprise that has few limits in the realm of human opportunities to grow, to explore, to test and to gain a greater understanding of contemporary industry.

The eighth grade study of contemporary industry is intended to assist the student in developing concepts related to the broader aspects of the subject such as:

1. concepts related to the organization of industry,
2. concepts related to productivity,
3. concepts related to occupational opportunities,
4. concepts related to mechanization,
5. concepts related to automation and cybernetics,
6. concepts related to labor-management relations,
7. concepts related to the financial structure of industry, and
8. concepts related to the changing role of the individual in industry.

The ninth grade program is aimed at a different level of individual as well as at a different level of study. It is based upon a concept of the location of the ninth grade in the 6-3-3 school plan as well as upon the developmental tasks associated with that age and grade level.

Basically, the content centers around contemporary units of study, increasing depth study in industry and a greater understanding of the problems of industry. From the human needs point of view, it is a multi-pronged approach taking into account the psychological needs of the individual, his resourcefulness, capabilities, future aspirations, problem solving and ingenuity. The specific approaches that may be used at this level include:

(1) contemporary units,
(2) research and experimentation,
(3) group project study of industry,
(4) line production study of industry, and
(5) technical development (group or individual).

The ninth grade program includes the research and experimentation program as another possibility for student activity. This is a program that has had a great deal of acceptance and recognition since its first development at the University of Maryland in 1952 and especially since its introduction into the public schools in 1959.

The "Research and Experimentation" approach is basically an attempt to put into practice what the best of educational psychology and practice tends to advocate. The program is an individual-centered approach with the scientific method of problem solving being the principle element. It is a program that starts with the curiosity of youth and then proceeds through a well-ordered inquiry based upon acceptable research procedures. The problems are all selected by the students, and special emphasis is placed upon this fact. This is a student-centered approach. It is the student's curiosity that provides the momentum for the program. Teachers that insist on selecting problems for the students to work on, and published booklets that suggest a guided series of experiments for the student, have no part in this program. It is at this point where many teachers are unable to visualize and perform a role that takes them out of the "telling", "lecturing", "demonstrating", and "assignment-making" kinds of teaching which have dominated their education all of their school years.

The pursuit of the problem by the student involves the development of a scientific approach to the object of his curiosity. He learns and practices the techniques of research. He uses the language of research—statements of problems, hypotheses, assumptions, variables, findings and conclusions. He soon learns that reading, letter writing, telephoning, visiting, interviewing and observing are some of the tools he can use in gaining the information he needs. And, above all, he soon learns that the sources of information may take him beyond the teacher, beyond the other teachers in the school, and beyond county, state or national boundaries.

During the days and weeks of research, constructing the necessary apparatus, and developing the experimental objects, a series of seminars is held to provide for a system of communication and an opportunity for challenge among the young researchers. It is here, in the seminars, where the communication skills are developed and the opportunity for the unique talents of each to contribute to others is made a reality. The seminars provide a sounding board for problems, ideas, sources of information and the completeness of the research. These seminars have become one of the most important phases of the program.

The individual project or technical development phase is another selection open to the teacher. He may wish to engage in this form of activity after he has made a thorough study of the needs, aspirations, characteristics and capabilities of the student.

These experiences may range from the simplest of tool and manipulative experiences to highly technical work in the areas of numerical control, metallurgy, material technologies, bonding and adhesive studies, forming processes and automated control devices. The range of opportunities is present, and the nature of the experience again lies in the point of view and concept of education (industrial arts) held by the teacher.

It is of vital importance that the teacher again be a "manager of education" and not a dispenser of facts. The teacher's role should center around those actions that promote maximum student growth and development through stimulation, guidance, evaluation and facilitation.

The development of the art of "learning to learn", of resourcefulness, problem solving and self-dependency should be encouraged. The process by which one gets his answers remains a matter of central focus.

The above brief outline of the projected junior high school (an actuality in a number of schools) is based upon some of the issues that were presented earlier. It is an attempt to put educational theory into operation. It has had an excellent acceptance by some of the most outstanding educators of the day.

But, more fundamental than its acceptance or plaudits, the program has focused on an experiential-laboratory-for-people concept. It has emphasized the individual's role as well as his differences in his engagement in the learning processes. It has put the process of self-education ahead of teaching-as-telling to the extent that the process whereby the answer is obtained is more important than the answer that is achieved. It is based upon a concept of education through inquiry rather than the memorization of isolated facts.

Dr. Maley teaches at the University of Maryland, College Park, Md.

W-4.2 ACIAS
Special Panel Session
KNOWLEDGE-TECHNOLOGY AND CURRICULUM
Gen. Chm., Leonard Glismann; Chm., Oscar F. Haynes; Rec., Gene Brightwell; Obsr., Kenneth L. Shank; Part., Paul DeVore; Interrog., Roger Barton, Elwood Padham; Hosts, William H. Middleton, John Miller

KNOWLEDGE—TECHNOLOGY AND CURRICULUM

Dr. Paul W. DeVore

What justification is there for being concerned about the development of knowledge and for suggesting that the structure of knowledge and the methods of the discipline be utilized in deriving curriculum content for the industrial arts?

For one thing, the industrial arts are concerned with general education and based upon cultural universals. This, according to Smith, is distinct from concern with specialities which consist principally of vocational callings. (20, p. 230.)

In addition, Phenix believes disciplined understanding is the foundation of general education. He states that the content of general education is not "knowledge in general", which everyone has, but authentic disciplined knowledge. It is general in that it is based upon cultural universals and relevant to all students and not to members of special groups. (14, p. 314.)

Knowledge is basic to and a means of implementing the objectives of education. For instance, development of problem-solving abilities or interests or attitudes or appreciations depends on the student obtaining new knowledge and new information as opposed to mere opinion. This is true if we desire certain specific attitudes, abilities or interests to be developed. A curriculum based on organized knowledge fields is better learned and retained than knowledge which is specific and isolated. The discipline structure also provides meaningful relations required for efficient learning. In addition, knowledge in a discipline is cumulative, utilizing a hierarchy of concepts applicable to numerous situations in an individual's learning experience, thereby providing a greater efficiency and permanence of learning through continual reinforcement of the basic ideas, principles and concepts. (4, p. 19 and 42.) Fundamental to this point of view is the need to stress that the student learn the methods whereby new knowledge is added to the field and how present knowledge is altered or eliminated.

"He also observes that when problems are solved, they are solved through the utilization of similar methodologies and techniques. The techniques of postulation, deductive reasoning, empirical verification, inference, proof, trial and error and discovery are recognizable elements. Each of these techniques for solving problems is shared by all engaged in technology in essentially the same manner in each development." (5, p. 8.)

Determination of the fields of knowledge which can be classed as cultural universals is not an easy task. Many systems have been devised for different purposes. Our purpose is formal education, and, for this, Ten Hoor provides a logical answer based upon three questions:

"Formal education, it can be said, is concerned with three different though interrelated kinds of knowledge, each of which is man's answer to questions he has been asking himself since the beginning of civilization. (1) What is there to be known about the external world and about those who live in it? (2) What use can we make of this knowledge? (3) What use ought we to make of this knowledge? (21, p. 423.)

The three questions identify respectively the distinct but interrelated knowledge fields of the sciences, the technologies and the humanities (21, p. 423.) Utilizing a basic criterion of a structure, namely, simplicity, these three knowledge areas are accepted as the foundation upon which to base further analysis and to derive a structure and content for the industrial arts (16, p. 3). These fields of knowledge contain discipline areas which meet the criteria set forth by Phenix as being an identifiable organized tradition of men of knowledge and evidence fields of inquiry in which learning has been achieved in an usually productive way (14, p. 316-17). The present analysis is a macro-technology analysis identifying a universe of content and is in keeping with the principles of structure and general education. Other examples, of a more definitive classification, are of the micro-technology analysis and are concerned with areas or divisions of the content universe which can be subsumed under one of the three knowledge areas described. Both efforts must be pursued.

Technology has been described as man's special power, and Arnold Toynbee, (22, p. 650) the great historian, considers it one of the major areas of human endeavor on a plane equal to economics, politics, art and religion. Therefore, if we accept as valid the assumption that education is integrally related to the culture of each period, we must assume that a society whose base is technological and scientific will reflect the technology in some measure, in the curriculum of its schools. When one examines the areas of human endeavor, he is amazed at their variety and realizes that all activities cannot become a part of the school curriculum or that any one activity can serve as a master activity. However, many of the major activities are so interrelated that to omit the study of certain key activities is to limit perspective and deprive the student of true understanding. Certainly this is true of the study of technology, an area of endeavor common to all mankind. Whereas only a few in a society are directly involved in the pure sciences, all are involved, to some degree, in the creation and utilization of technology. One would assume, then, that technology will be afforded increasing importance in determining the goals and content of general education.

In recent years man has become aware of the force exerted by technology in the development of civilization. The understanding and comprehension of technology is important in fulfilling a fundamental objective of education, namely, understanding the culture. This is clearly indicated by Kranzberg:

"Anyone who is at all interested in understanding the past, in learning how the present got to be the way it is, or in speculation about the future - and this would include every thinking man - must be concerned with the development of technology and its relation with society and culture." (9, p. 56.)

What is meant by the term "technology"? First, we recognize that technology is an area of human knowledge, as are the sciences and the humanities, and is an endeavor common to all mankind at some level of sophistication. By emphasizing the relationship of man and technology, we are concerned with the human elements in the body of knowledge and with man as the creator of this knowledge. The concern is with the modes of thinking, the problem-solving and the solution of technical problems together with the socio-cultural relationships involved.

It is important to recognize that technology is not science, nor is it applied science. The nature and statement of the problems, the methodology and the goals are different. Progress in the technologies, according to Jarvie (8, p. 388), depends upon the increasing clarity with which technological problems are posed and upon our improved ability to think ahead. The structure and character of technology are complex and interrelated and require analysis on the level of generalization rather than on the level of the skill-faculty of individuals. The complexity of technology results from the fact that the problems are environmentally centered and involve socio-cultural components. Jarvie (8, p. 388) illustrates this point as follows:

"For example, much of our technology must be changed when we enter weightless or low gravity environments, just as big Tokyo buildings are different from big New York buildings on account of earthquakes."

Technology is concerned with the possible within given environments. Where science is concerned with the investigation of the whole universe and the discovery of the structure and laws that govern nature, technology is concerned with the creation of structures for specific, delimited purposes. The goal of pure science is the discovery of new knowledge. The goal of applied science is in understanding and extending this knowledge. Both deal with a reality that is given. Technology sometimes utilizes the knowledge and information of science and applied science in creating. At other times problems are solved without the benefit of science or applied science. As Skolimowski notes, (19, p. 374), "In science we investigate the reality that is given; in technology we create a reality according to our own designs."

The problems of science are dictated by the scientific field of investigation; whereas, those of technology are dictated not only by the environment but by the social setting as well (8 p. 388). In our society, we cannot discuss economics intelligently without a knowledge of technical innovation, invention and the function of these elements in producing goods and services. The body of knowledge created by technology is vast, and interrelated to all fields of knowledge.

In today's world, when there is a greater need than ever before for technological literacy, we discover the contemporary status of the industrial arts to be one of confusion and perhaps indecision, with a few notable exceptions. Teachers in the profession, however, are becoming increasingly aware that the confusion is the result of our heritage, and that the indecision is the result of inadequate perspective.

Contemporary scholars have provided new insights into the heritage. Because of these efforts, our history is less perplexing and our perspective more adequate. Three rather distinct philosophies have emerged and are supported in various degrees by members of the profession. These philosophies range on a continuum from (1) courses based on a craft or trade approach devoted to vocational or occupational goals with emphasis on skill development, through (2) programs concentrating on the study of the production elements of industry indigenous to the United States, to (3) programs evolved from the concept of man as the creator of technology, incorporating the foundational technical and cultural elements of the several areas of technology.

It is proposed that an industrial arts curriculum based upon the study of man and technology is the most valid of the three content approaches for the following reasons. A study of man and technology:

1. provides a better base from which to implement the purposes and objectives of general education;
2. is not limited or isolated by geographical boundaries, thereby evidencing the true nature of disciplined inquiry;
3. is concerned with man, regardless of national origin, as the creator of technology
4. provides a meaningful relation between technology and man's culture (Historical, anthropological, social and economic elements of the culture are important to the understanding of man's technology, and a knowledge of man's technology is vital to the understanding of any culture.); and
5. identifies a knowledge area meeting the criteria of a discipline in the truest sense of the term.

The three fields of knowledge comprising the framework for general education have between the elements, patterns or structures and interrelationships essential to teaching and learning. The task, then, is one of selecting principles and procedures to serve as criteria for determining a pattern of curriculum organization.

The tremendous volume of knowledge available to be learned forces the search for criteria which can be justifiably utilized to reduce the mass to suitable and manageable proportions.

Essential to the determination of any curriculum structure is a basic philosophy. The present analysis is based on a sociological concept of defining curriculum structure in terms of the universal institutions created by man or of the universal endeavors engaged in by man. These universal institutions and endeavors make up the fabric of all progressive societies.

An historical and social analysis of man's progress in various cultures, for instance, establishes a number of man's universal technological endeavors. We discover in our analysis that man in all stages of his technical development has been a builder, a communicator, a producer, a developer, a transporter, a craftsman and an organizer. All progressive societies evidence these areas of technology, namely, construction, communication, production, research and development, transportation, craft industries and a hierarchical division of labor. These are universal technological endeavors that have developed and progressed, establishing bodies of knowledge which have survived. Each has a specific structure, raises certain questions, has definite lines of progression and has been productive in an unusual way.

The importance of approaching curriculum development for the industrial arts and general education from this point of view is supported by Smith:

"Finally, the civilized person is one who has mastered the art of living with others in harmony and cooperation. But since the universal institutions are, in every progressive society, the means of cooperative life, the civili ed person is one 'who is in possession of the universal institutions of his time'." (20, p. 229.)

One of the reasons for the confusion and lack of consistent direction in industrial arts has been the failure to establish the area or to think of it as a discipline. Why is the concept of a discipline a necessary consideration? For one thing the term has distinct meanings, and, as in all concepts, it is a convenient way of conveying, by the use of one term, a broad complex idea.

Discipline, as a term, can be used to define a minute segment of knowledge which meets certain criteria or it can be used to describe a body of knowledge which meets certain criteria. The use of the term depends on the hierarchical level at which one is discussing the knowledge concept. In this discussion the latter is assumed, together with the elements which make up the discipline.

When we use the term "discipline", we are actually indicating that a body of established knowledge exists, a body of knowledge which has been determined and agreed upon by specialists in the identified field. To understand the term more fully, we should realize that a discipline is:

1. "Dynamic in nature. Disciplines and the knowledge fields comprising them are dynamic, not static. They are constantly evolving. New disciplines are established, old disciplines eliminated or changed." (14, p. 10 and 18, p. 86).

2. "Cumulative in Nature. The body of knowledge comprising a discipline is cumulative and has been established by its own unique pattern of investigation utilizing proven techniques, methods and procedures. Validation of new knowledge by others is possible." (18, p. 84-85.)

3. "Theoretical in Nature. The body of knowledge of a discipline consists of key ideas, principles and concepts unique to the field and evidencing the true essence of the discipline. The basic concepts range in difficulty from elemental to complex. Understanding the basic concepts provides means to comprehend a vast knowledge field and serves as a foundation from which to increase knowledge and simplify learning." (See Brady, <u>Organization, Automation and Society</u>) (14, p. 11-12 and 18, p. 84.)

4. "Structural in Nature. A discipline evidences a system or structure, the body of knowledge, composed of ideas, principles and concepts, is patterned in an hierarchical order." (12, p. 47 and 14, p. 324.)

5. "Integrative in Nature. Disciplines, although unique and separate in their own right, are interrelated and utilize findings from allied fields. Some are more dependent on other areas." (14, p. 320; 4, p. 18 and 26, p. 50.)

A discipline, therefore, is essentially a body of knowledge which meets certain criteria. Whether the subject matter of a course meets these criteria depends upon how the course is taught. The methods of inquiry, the concepts, basic ideas and the application of principles must all be consistent with the discipline. This, according to Ten Hoor (20, p. 424), determines its claim to being a contribution to the discipline. And this internal consistency is extremely significant when one is concerned with curriculum development and the structure of a knowledge area. (4, p. 14.)

Much effort has been directed by the profession in preparing definitions of the industrial arts with little attention to the identification of the body of knowledge, determination of a valid philosophical base or selection of curriculum principles or guides. Even these are inadequate if a classification of knowledge in the technologies does not exist. Machlup (11, p. 15) believes that attempts to classify and order knowledge (in the sense of what is known) are more often enlightening than attempts to define it. He states that an exhaustive classification may suggest a definition. This would indicate one reason for our failure to implement a fruitful and productive educational program in the industrial arts: preoccupation with definitions and the almost total lack of concern with knowledge classification, content, and the methods of thinking in the discipline.

Attempts at curriculum analysis and development are less than rewarding without a taxonomy of the body of knowledge identifying the structure and its elements. Technology can be verbally defined, but to understand the elements and their functional relationships one requires a knowledge of the total structure.

"The questing mind is naturally given to analysis; and whatever else it may also mean, analysis always seems to imply a search for component 'parts'. Without relations between the parts they would remain isolated, meaningless and unintelligible. If we can speak of analysis, we can also speak of the structure which we hope will emerge as a result of our analysis." (23, p. 28.)

There are a number of reasons to engage in efforts in taxonomy or classification of knowledge areas, not the least of which is to obtain an accurate perspective of the content reservoir. Without a full perspective of the content reservoir, a valid curriculum cannot be developed. In addition, a taxonomy of the area of technology would:

1. "Eliminate confusion and simplify the task of curriculum planning by providing a perspective of the relationships among the elements and the structure and order the knowledge area into specific categories, thereby assuring a balanced allocation of content." (14, p. 250.)

2. "Facilitate communication among the membership of the field of knowledge, together with others such as administrators, curriculum specialists and scholars in related fields." (4, p. 10.)

3. "Simplify understanding and economize intellectual effort by treating large numbers of different things as though they were identical regarding the aspects by which the categories are defined." (12, p. 47-4, p. 36 and 42-43, p. 45.)

4. "Provide a base for a long-term research and inquiry into the nature of the discipline area by ordering the area of knowledge in such a way as to reveal significant relationships and properties as well as the interrelationships among the elements of the structure." (4, p. 17.)

5. "Provide a base for developing valid evaluation instruments by identifying elements of content to be evaluated."

6. "Aid in identifying the difficulty levels of content areas for establishing instructional sequences at different learning levels."

A review of taxonomies established by other knowledge areas reveals certain guiding principles which have been developed to serve as selection criteria. These taxonomies evidence the following characteristics:

1. "Mutually exclusive groups. Categories or clusters are established, wherein each larger unit is a combination of subgroups. The groups or categories are established in a hierarchical order." (25, p. iii.)

2. "Each category is identified by a word or phrase which delimits the category but is non-transient and permits additions to the structure as discoveries of new knowledge warrant."

Example: "The remaining categories form the basic taxonometric hierarchy of animals, any given species belonging thus to seven obligatory categories as follows: (12, p. 47.)

Figure 1

Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Carnivora (Wolf)
Family	Canidae
Genus	Canis
Species	Lupis"

3. "There are a relatively small number of mutually exclusive groups or categories." (16, p. 3.)

4. "The distinction between groups or categories is established by a universal concept inherent in the knowledge area itself."

5. "Taxonomies are logically developed and internally consistent. There is evidence of external stability with internal flexibility and adaptability to evolving new knowledge within the discipline." (4, p. 14.)

6. "Taxonomies are not limited to local or national knowledge areas but are international in scope. The mutually exclusive categories are of the external world and not simply categories of the contents of first-person experience." (26, p. 120.)

7. "Taxonomies have structure because there are internal relations existing between the elements. The structure is dependent upon this interrelationship." (23, p. 12.)

8. "The structures of taxonomies vary from extremely logical and homogeneous classifications of the elements to vague, ambiguous, heterogeneous and difficult-to-define relationships of the elements." (23, p. 20-24.)

Figure 2

Math	Art
Logic	Aesthetics
Homogeneous Structure	Heterogeneous Structure

Many knowledge structures exist and for various purposes. The Dewey Decimal System, Department of Commerce Bureau of Census Classification System, Society for the History of Technology Bibliography Committee Outline, Domestic and Foreign Government Economic Export Classifications and the United States and International Patent Classification System are several examples. Each of the systems contain both macro- and micro-analysis. The United States Patent Office Classification System, for instance, is divided into five major groups, three hundred classes and fifty-seven thousand subclasses. All of the above classification systems deal with technology in one way or another.

An analysis of the several systems, however, discloses support for Tranoy's conclusion:

"There are also certain important cases where the same whole can be analyzed in different ways, giving totally different structures that do not bear any simple relation to each other although they give equivalent explanations for the whole. A case in point are the two different 'models' that can be given for any atomic phenomenon, the particle model and the wave model." (23, p. 21-22.)

Continual evaluation is in progress pertaining to classification systems in the technologies. There is evidence that more and more of what was once divided into separate categories, with separate functions and purposes, is now being incorporated into total systems, such as communication systems, transportation systems or production systems. Concern is with the "whole" and not only with the component parts. For instance, the function of the knowledge area of communication concerns information dissemination, storage, retrieval and use. The methods of accomplishing this, whether in a man-to-man, man-to-machine or machine-to-machine system, vary with the task. Elements of radiant energy, printing, photography or graphic representation, by man or machine, are utilized to achieve the most valid solution to a given communication problem.

One test of an adequate taxonometric structure for the study of man and technology, in addition to the principles of taxonomy listed previously, is universalism. The structure must be applicable to technology in general, and not indigenous to any one country or civilization. This is true, since no one country or civilization can claim credit as the sole creator or utilizer of technology.

The purpose of a taxonomy is not to limit a field of knowledge arbitrarily but to ascertain its totality, together with the component elements and their interrelationships. Curriculum development thus follows the determination of the structure and its elements.

"...The nature and function of the 'elements' is determined by the position which the 'elements' occupy in the 'structure', while the 'structure' is what it is because of the 'elements' which constitute it. That is to say, 'structure' and 'element' occur only in indissoluble fusion. There exists no 'structure' without constituent 'elements' and there exists no 'elements' without functional relations of some sort to a 'structure'."(26,p.120)

Using the information provided in the analysis of disciplines, knowledge areas and taxonometric principles, an approach can be determined which may provide a base for establishing a definitive curriculum structure for the study of the industrial arts and technology.

It should be recognized and made very clear that a structure is not a curriculum, nor is it something to be "given" or taught to a student. A structure is a tool to be used in curriculum development and is "arrived at" by the student through the learning process. A discipline structure does not classify instructional methods, materials or behavior changes expected in students. Each of these areas requires separate analysis and structure. (4, p. 12) It does classify elements of knowledge and indicates relationships. Also, the previous discussion implies that the nature of the content, in large measure, determines the method of instruction required. (See Ten Hoor).

It has been posited that all of man's knowledge can be subsumed under three broad headings. These, created by man, are the sciences, the technologies and the humanities.

Each knowledge area seeks to answer a basic question:

1. What is there to be known about man and his physical universe?

2. What use can be made of the information furnished by the sciences for the benefit of man?

3. What use ought to be made of the information furnished by the sciences for the benefit of man?

The knowledge area of technology furnishes the base for the derivation of the content reservoir for the industrial arts. Following this approach, the function of the industrial arts in a formal educational program is delimited to:

"The study of man and technology (including the technical and cultural-social elements) as a creative endeavor in meeting the needs of individuals and cultures in the areas of products, transportation and communication, through the utilization of the properties of matter and energy."

The industrial arts are closely related to man's endeavors in meeting his biological-physiological needs. The main responsibility for meeting these needs, however, rests with the agricultural and medical technologies and is not a part of the present consideration. In terms of products, communication and transportation, it is evident that definite interrelationships do exist between these bodies of knowledge.

Man's development of his technology in the area of the industrial arts is directly related to his culture and is social in nature. Drucker notes this in his discussion of the production area:

"The mass-production principle is not a mechanical principle. If it were, it could never have been applied beyond manufacturing, and independently of assembly line, conveyor belt and interchangeable parts. It is a social principle – a principle of human organization." (6, p. 6.)

Therefore, throughout the development of the following example of a taxonomy, a social orientation is implied if not specifically indicated. A taxonomy of technology incorporates both cultural-social and technical elements. The present example is limited to one series of hierarchical elements.

Figure 3

Discipline — Technology

Technical Elements — Cultural-Social Elements

A taxonometric structure for the study of man and technology, based on the foregoing definition and delimitation and from an historical and social analysis, identifies three major areas of technological endeavor. These areas represent the essence of the discipline, are consistent with major components in other technological classifications and provide for internal adaptability to change through the use of non-transient terms. The technical areas are:

Area	Functions
1. Production	Providing goods and services of economic value for man's needs and wants.
2. Communication	Providing information dissemination, storage, retrieval and use.
3. Transportation	Providing movement of man, materials, products and services.

The technological areas of production, communication and transportation are found in all cultures regardless of their stage of development. Hence, they meet the criterion of universalism.

A study of each of these physical areas indicates that they vary in their primary function, being unique discipline areas in their own right, and, as with other discipline areas, such as zoology and botany, they require their own taxonometric classification scheme. However, a close interrelationship exists between the areas of production, communication and transportation and their elements, thereby meeting a requirement of structure. Analysis of one technical area, production, provides an example of the procedures in taxonomy.

The area title is Production. Production is composed of two divisions, namely, manufacturing and construction. Manufacturing, to take one division in the structure, is composed of two categories, fabrication[1] and processing.[2]

[1]Fabrication is the making of a product from pieces, such as parts, components or assemblies. It also includes the making of the individual products or parts. Items of a discrete nature, such as tires, nails, spoons, screws, refrigerators or hinges, are fabricated. (1, p. 32) [2]Processing consists of manufacture by continuous means, or by a continuous series of operations, for a specific purpose. Items of a continuous nature, such as strip steel, beverages, breakfast foods, tubing, chemicals and petroleum, are processed. (1, p. 32)

Figure 4

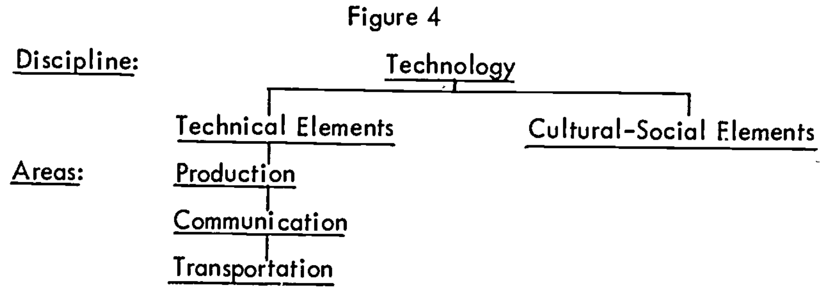
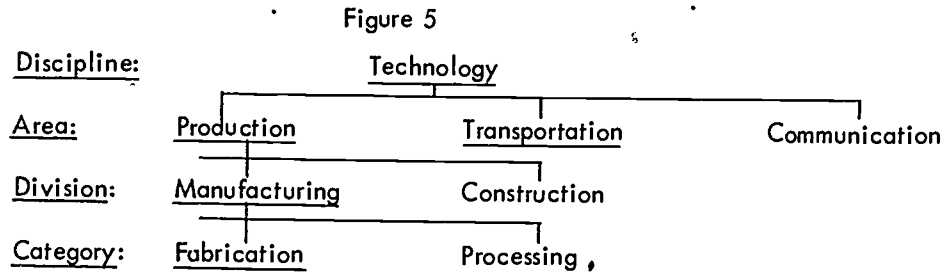


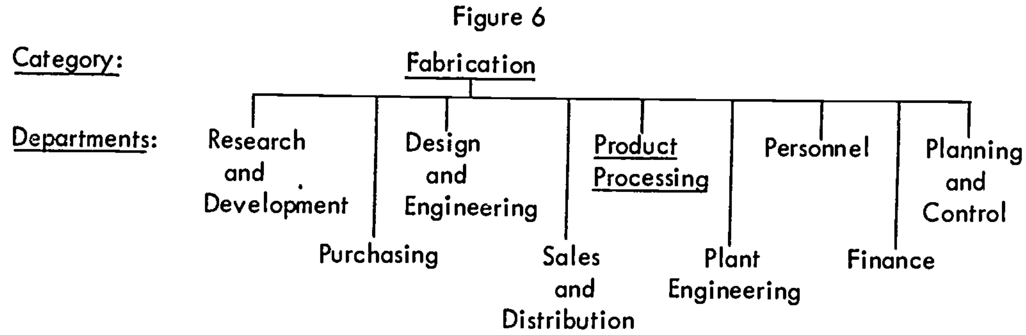
Figure 5



The next level in the structural hierarchy provides for the departments in the fabrication category. The departmental level also exists in the processing category. However, for purposes of this discussion only one line of development is illustrated.*

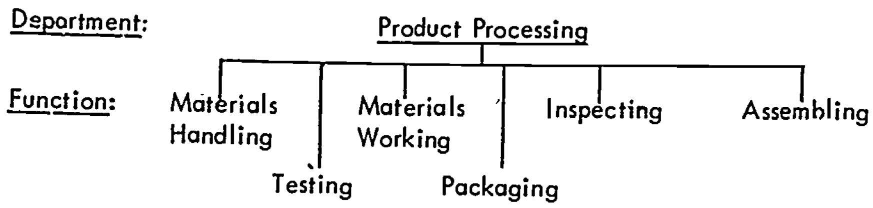
*Note: Anatomy of Automation by Amber and Amber was used as a resource for classification terms.

Figure 6



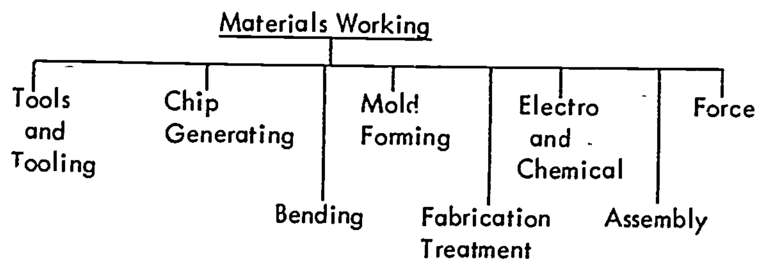
Various functions are assigned to each department. Focusing on one department, Product Processing, one observes the following functions:

Figure 7



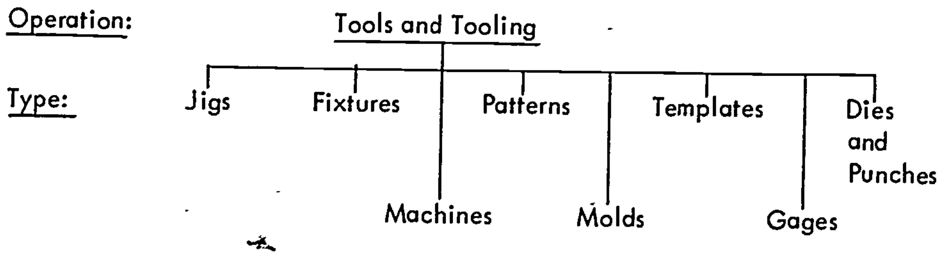
Each function, such as materials working, is composed of operational levels. The operational levels relating to materials working are identified in Figure 8.

Figure 8



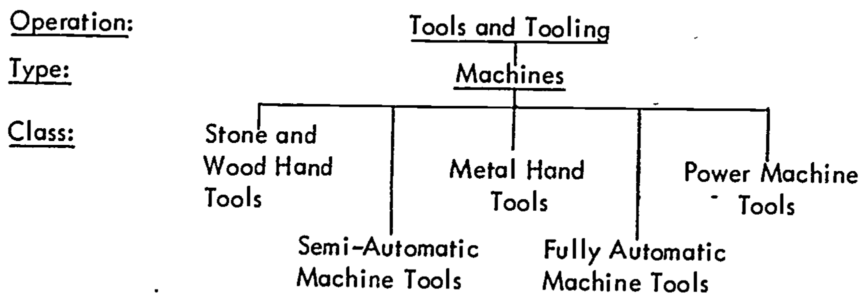
Each operation is composed of basic structural elements which can be sub-divided and classified as to type. Selecting one element from the operation classification, Tools and Tooling, an illustration of type level in the hierarchy is shown in Figure 9.

Figure 9



The next to last classification heading denotes to some degree the evolutionary stages of the operational type. The element Machines, as an example, is composed of Classes as shown in Figure 10.

Figure 10



The final hierarchical level further delimits the evolutionary aspects by denoting the order of complexity. See Figure 11, next page.

Figure 11

Class: Fully Automatic Machine Tools

Order:
- Repeat Cycle
- Relating Cause & Effect
- Self Correcting
- Creation and Originality
- Equation Solving
- Command
- Limited Self Programming

An example of a classification for one series of elements is shown in Figure 12.

Figure 12

A Taxonomy of Technology

Discipline: Technology
- Technical Elements
- Cultural-Social Elements

Areas: Transportation — Production — Communication

Division: Manufacturing — Construction

Category: Fabrication — Processing

Department: Product Processing

Function: Materials Working

Operation: Tools and Tooling

Type: Machines

Class: Fully Automatic Machine Tools

Order: Repeat Cycle

The basic premise of the foregoing discussion rests on the assumption that the development of general education programs for the public schools involves three bodies of knowledge created by man, namely, the sciences, the technologies and the humanities. As defined previously, the body of knowledge called technology contains the content reservoir from which public school programs in the industrial arts derive instructional content.

Derivation of the content is attained through the establishment of a taxonomy. With properly developed structures from which to derive content, it is possible to proceed with curriculum development for the public schools. Here, too, some form of structure is required. Basing the program on the study of man, his technology and his three foundational technical endeavors, namely, production, communication and transportation, it is possible to provide flexible solutions and a logical program of general education courses for schools of various student population levels. Programming for various ability levels, interests, intelligence levels and time requirements can be designed. Integration of discipline areas and opportunity for concentration in a knowledge area accrue in this approach.

The taxonomy and resulting structure does not rule out ipso facto certain already-established subject areas or courses. It does provide a basis for valid content selection. In many instances present content is retained and given new meaning through the establishment of interrelations between areas as they exist in actuality in the technological environment.

A diagrammatic example of the utilization of a taxonomy in curriculum development is shown in Figure 13. The knowledge area is transportation, which deals essentially with different environments and the problems of providing movement of man, materials, products and services. There are essentially four major steps to curriculum development utilizing the taxonomy as the content reservoir.

I. Establishment of the content reservoir – taxonomy
II. Establishment of the basic concepts and principles of the content area from the content reservoir.
III. Establishment of units of content instruction based upon an analysis of the basic concepts and principles.
IV. Establishment of courses of study through the grouping of logical combinations of units of instruction.

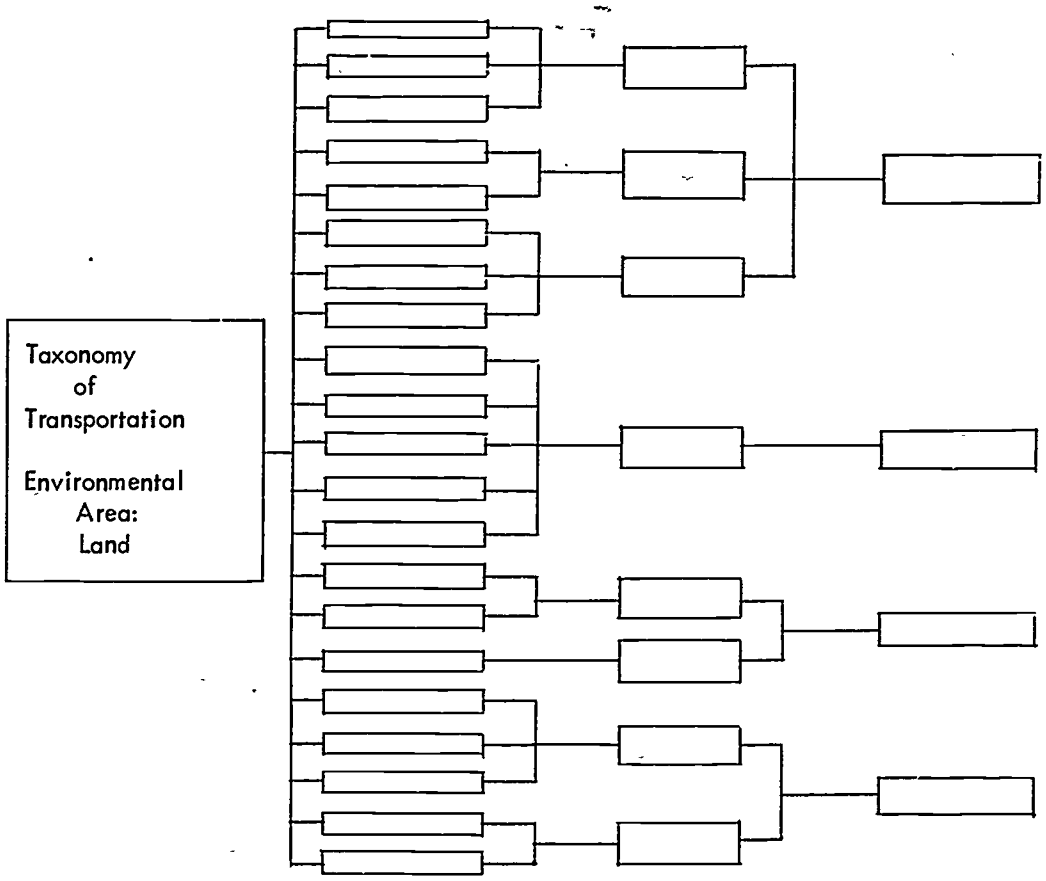
Figure 13

A. Taxonomy

B. Basic Concepts and Principles
Technical/Social Cultural

C. Units of Instruction
Technical/Social Cultural

D. Courses of Study
Technical Social/ Cultural



An intermediate step by curriculum developers can be taken based upon present knowledge of content areas. For example, an evolutionary step can be pursued as shown in the skeletal outline for the secondary level in Figure 14. Content areas already available have been utilized. The example relates to the knowledge area of communication and is primarily concerned with the technical means man has created to solve his problems in information dissemination, storage, retrieval and use. Each subject area noted in the diagram relates to some aspect of the information dissemination, storage, retrieval and use problem and contributes to the total through the concepts taught.

Communications Program*
Secondary School

12	Electronics Communications	Elective
	Photography	Communications Res. and Devel.
11	Graphic Arts	Graphic Arts
	Advanced Electronics	Drawing and Design
10	Intro. to Communications	Drawing and Design
	Intro. to Communications	Basic Electronics
9	Manufacturing	Manufacturing
	Manufacturing	Manufacturing
8	Manufacturing	Manufacturing
	Manufacturing	Manufacturing
7	Introduction to Technology	Introduction to Technology

*Note: Taxonometric classification may be developed for the communication area based upon three types of communications: Man-to-man, man-to-machine or machine-to-man and machine-to-machine. Systems include: sensing, encoding, transmission, signaling, receiving, decoding, storage, retrieval and use. Sub-elements may be considered in the areas of: (1) information dissemination including: radiant energy, mechanical-chemical, and electromechanical methods Sub-elements are derived from applications such as: radio (including radar, sonar, loran and radio-photo), television, graphic arts (including printing, stenciling and drawing) and photography. (2) information storage and retrieval, including: dynamic and static systems utilizing mechanical, magnetic, photographic, thermoplastic, chemical, stylus and composition record, electrostatic, magnetic cores, superconductors, capacitors and relays, to name a few.

The components (elements) of the structure vary according to man's selection of elements meeting the criteria of adequacy, efficiency and economy in solving communication problems.

Several levels of content for each course can be developed, thereby establishing a program meeting the ability levels of all students.

Attention is called to the junior high school program based upon the knowledge area of production with the manufacturing division as the content field. This follows current proposals in present operation. The senior high school program would consist of the knowledge areas of construction, communication and transportation.

Senior high school programs should be flexible so a student not concentrating in one of the divisions or areas would be able to elect one or more courses of his own choosing in keeping with his avocational or vocational interests. Other patterns of curricular organization, courses of study, units, and methods of instruction are possible once the taxonomy of the knowledge area has been structured and the content defined.

An attempt has been made to present an approach to curriculum development for the industrial arts which is logical, consistent and attainable. The function of the industrial arts as a part of formal education has been reviewed. A technological base for the study of the industrial arts was discussed, together with the philosophy of cultural universals and general education. The purpose of a discipline and knowledge base was established and the principles of taxonomy outlined.

An example of a structure was shown and an outline of a curriculum program for both junior and senior high school diagrammed.

It should be noted that the structuring of knowledge is not the complete basis for the organization of the curriculum. Instructional methods, psychological principles and cultural and social factors are essential considerations. The structure and system of knowledge serves only as the foundation upon which to build. But it is a most essential foundation; without it we have nothing.

In evaluating the concept presented, there are several advantages which accrue from such an approach:

1. Criteria for content selection are established and curriculum development ordered and simplified. Optimum learning sequences can be planned by identifying complexity levels of contents;
2. Flexibility and adaptability to change and internal consistency are intrinsic through the use of technological universals as a base. The overall structure is stable;
3. Rather than isolated and repetitive courses, programs of study are inherent;
4. Teacher competency is increased through the media of a specialization in a field of knowledge, such as communication, transportation or production;
5. Teacher education programs at both the undergraduate and graduate levels would be improved, both from the point of view of the student and the faculty;
6. Utilizing the discipline and knowledge base would permit and require theoretical and laboratory study of technical programs through both the master's and doctoral levels. Advanced study programs, based on the content area in which one is expected to perform and not on peripheral or available content areas, would become meaningful. The structure provides for a life-time of learning and professional contribution through legitimate, recognizable specialization;
7. A closer liaison in curriculum efforts would be possible within the profession. Communication would be improved;
8. New and more profitable research problems would become evident; and
9. Both program and student evaluation would be enhanced and improved.

From a structure based on cultural universals, the curriculum problem can be delimited and a specific content reservoir identified. From the content reservoir, the several objectives of the industrial arts and general education can be determined and implemented.

Through knowledge and understanding of the nature of the content, together with the stated and agreed-upon objectives, the basic concepts, units of instruction, programs of study and methods of implementation can be determimed. Without a definitive content base, however, the goals of general education, to which we should contribute, cannot be attained.

FOOTNOTES

*Taxonomy: From the Greek Taxis, arrangements, plus nomis, law.

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Dr. DeVore is director of the Division of Industrial Arts & Technology, State University College, Oswego, New York.

W-4.3 ACESIA
Special Panel Session
OUR CULTURAL HERITAGE—A RICH CURRICULUM SOURCE
Gen. Chm., Everhard Thieme; Chm., F. Richard Boller; Rec., Ronald Sorensen; Obsr., D. D. Nothdurft; Panelists, Robert G. Hostetter, Arthur Stunard, Donald R. Meyer; Hosts, James A. Hales, Cal Zuehlke.

THE ADVENTURE PLAYGROUND MOVEMENT IN EUROPE

Robert G. Hostetter

In providing for the needs of child growth and development, the contributions made by all agencies in the world are worthy of our consideration. In America our cultural heritage has had a characteristic pattern of growth which was influenced by teachings in the home, school and a few community agencies. The urbanization of population created many problems for man. The growth and development of his children has become one of great concern, and, to us who help to provide environmental "climate for learning", it becomes a challenge of major concern.

When Danish mothers became aware of conditions depriving their children of normal play activities, they exerted enough influence to secure legal action to improve the situation. Certain institutions in the Scandinavian countries found their young people about to enter training to be deficient in the knowledge of materials and lacking normal aptitude and ability in the practical skills. There was a noticeable lack of coordination and ability to produce with their hands. (1)

These apparent needs led to the establishment of a program that would provide experiences that would correct the deficiencies in Scandinavian children.

The movement called "Adventure or Construction Playgrounds" by Europeans has received national acclaim by students of child development. A summary of the features of this recent movement that hold promise as examples of good educational practice in the utilization of tools and materials follows:

1. Play is important in training the hands of small children, and it has been noted that they will be more skillful in later life if they have had this experience. A well-rounded play experience makes the child more capable to learn.

2. It is desirable to have learning experiences take place outdoors close to the elemental forces of nature. Living things, both plant and animal, are involved directly.

3. Provision to have points of contact with adults, especially of their own families, is utilized. Good play facilities are considered impossible without opportunities for associating with adults.

4. The material used for construction is salvaged from demolition activity.

5. The program involves the concern of parents, town planners, architects, landscape gardeners, health workers, teachers, psychologists and politicians.

6. The visit of Lady Allen of England to America has led to the evaluation of our facilities, and steps are being taken to improve the design of our playgrounds.(2)

7. The heart of the activity is based on the earlier theories of Froebel, Dewey and, more recently, of Bruner, who places great importance on the value of direct experience and learning.(3)

8. The nature of the program is evidenced by looking at the slides which were made by the speaker as he visited the programs in Europe last summer.

FOOTNOTES

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Mr. Hostetter teaches at Millersville State College, Millersville, Pa.

CURRICULUM RESOURCES

E. Arthur Stunard

As an industrial arts consultant, I find the topic of curriculum resources a vital part of my total function within the elementary school. I find myself in a key and important role in helping the classroom teacher do better the things that are already taking place at each grade level, K-6.

Although the role of the consultant is that of providing for industrial arts activities and advancing the values of the discipline, this service becomes more pertinent to the classroom teacher when she is directly involved with all resources available to the school.

The gathering and preparation of curriculum resources must be a total effort on the part of a faculty in order to become an effective educational tool. The mere fact that resources are there does not assure their successful use. The selection of these materials must be done systematically and necessarily would involve all teachers and any other professional personnel that would use these resources.

An excellent starting place might be a booklet put out by the Division of Surveys and Field Services (George Peabody College for Teachers, Nashville, Tennessee 37203), titled: "Free and Inexpensive Learning Materials". This paperback book is the twelfth edition in the series and contains titles of more than 4,000 instructional aids, most of which can be obtained through a simple request made on school or organizational stationery.

The American Council for Elementary School Industrial Arts offers the second most significant booklet in setting up your own curriculum resources. The booklet, titled, "An Annotated Bibliography of Books, Pamphlets and Articles for Industrial Arts in the Elementary School", is available through the Council for $1.50 and contains over seventy articles and more than two-hundred fifty books and pamphlets, all directly related to the elementary school program. This booklet not only contains published material, but also some unpublished literature available through the inter-library loan system.

A third significant approach to developing curriculum resources is that of establishing a "resource file".

The National College of Education Demonstration School faculty initiated a search for "People and Places", from the community surrounding the college. The search continues and already contains a large list of resource people with over 150 places and things to see that help bring life and excitement to the classroom.

The actual 5 x 8 inch file box contains three major divisions: places, people, and audiovisual resources, each providing the classroom teacher with easy access to vital information for more effective teaching.

Three cards and a letter were developed by a committee to help collect and catalogue information, and they are included here for your consideration, as the type of information teachers need.

In closing, I would like to suggest once again that the role of the consultant, regardless of what area—be it science, mathematics, music or industrial arts—must be extended out of the narrow discipline; he must help to provide the many needed services the classroom teacher must have in order to do the most effective job of teaching.

Mr. Stunard teaches at National College of Education, Evanston, Illinois.

ENRICHMENT THROUGH INDUSTRIAL ARTS FOR GRADES FIVE AND SIX

Donald R. Meyer

We have, in Kansas City, an elementary industrial arts program centered around the 5th and 6th grade curriculum. We do consider and include the objectives of regular industrial arts, but our main reasons for having Enrichment Through Industrial Arts are to motivate further study, clarify thinking and create new interest in regular classroom work. There are few better ways to increase retention of learning than the coordination of neuro-muscular and intellectual activities.

Kansas City has a rich heritage of elementary industrial arts, having had a program for 70 years. In 1956 many of the 7th grades were moved from elementary to junior high buildings. The Enrichment Through Industrial Arts program was created, and put on an experimental basis in grades 3 through 6.

We took suggestions from the classroom teachers for the units they felt needed help. It was amazing how much a big teepee in the classroom would inspire third graders to do better in their study of Indians. Other subjects added to the curriculum, and a money shortage caused the program to be dropped from the third and fourth grades. In 1960, Enrichment was officially adopted for grades 5 and 6. This year, 47 of our 82 elementary schools have Enrichment Through Industrial Arts in grades 5 and 6.

Our program is designed to work with both boys and girls. Usually we work with the entire class, about 32 students. It is possible to work with half a class, or with one committee at a time. Each class meets one period a week, 1 hour and 20 minutes; most units take 10 to 14 weeks for completion. With 3 or 4 classes a day, each working on a different unit, much preparation is required of the consultant.

We have five consultants in our program, paralleled by five homemaking consultants. Each year we consult with our 40 teachers and schedule to meet their needs. We actually teach the unit, completing the manipulative activities in the industrial arts shop, with the regular teacher present.

This program can be conducted in a woodworking shop. Most have 24 work stations or vises, and we add C-clamps to create a work station for each child. About $2,648 will furnish a room completely for this program, including all furniture and equipment. We often conduct the program with portable equipment, set in the gymnasium or classroom. By making your own saw horses and using C-clamps, 35 work stations can be set up for about $837. To equip a classroom for work with committees, eight work stations can be set up for $156.

Materials are furnished by the school system, operating with thirty cents per student. To set up a new program, $62 would purchase the supplies needed, such as hardware, lumber, etc. The consultant is responsible for acquiring all supplies.

The basic curriculum content is derived from classroom studies. The selection and use of the unit by the classroom teacher is the heart of the Enrichment Program. We build the equipment, but it is up to the teacher to use it to strengthen her units.

We have developed units in most areas of the curriculum. We endeavor to stay flexible, and constantly search for new ideas. Science is the most often requested area, and we have units on birds, electricity, insects, light, plant propagation, rocks and minerals, simple machines, solar systems, sound, trees and shrubs, and weather. The area of social studies includes units on transportation, the Old World, and pioneers. We have projects for units in mathematics, health, art, and service projects such as Science Fair, puppet stages, and chart racks.

Mr. Meyer is on the Board of Education, Kansas City, Mo.

W-4.4 Ceramics & Plastics
Special Panel Session
THE NEED FOR ARTIST-CRAFTSMEN WHO CAN DESIGN OBJECTS TO BE PRODUCED IN QUANTITY
Gen. Chm., Hugo Fiora; Chm., Gerald L. Steel; Rec., William Guthrie; Obsr., Earl Marihart; Panelists, Ronald Koble, James Runnalls; Hosts, Kenneth Heim, Isabella Lee

HOW CAN COLLEGES AND UNIVERSITIES ASSUME LEADERSHIP IN DEVELOPING PLASTICS PROGRAMS AND CRAFTSMEN?

Ronald L. Koble

The topic "How Can Colleges and Universities Assume Leadership in Developing Plastics Programs and Craftsmen", to which I have consented to speak, contains three implicit assumptions: (1) that programs in plastics need to be initiated, expanded and improved in industrial arts education; (2) that colleges and universities should assume the leadership in providing for the initiation, expansion and improvement of these programs; and (3) that programs in the areas of plastics in industrial arts education should facilitate the development of craftsmanship.

In regard to the first assumption (e.g., that instruction in plastics needs to be initiated, expanded and improved), if industrial arts education is a study of industry, then it seems appropriate to examine some current statistical information pertaining to the plastics industry in this country. According to the Society of the Plastics Industry, about 150,000 are currently employed in the manufacture of plastic resins, the processing of plastics and assembly of common products. The amount of raw plastic materials, e.g., pellets, resins, etc., produced in the United States during 1966 was about 13 billion pounds, and the value of the finished marketable plastic products was slightly over $3.5 billion. In consideration of the fact that during 1962 the amount of raw plastic materials produced was only 7.3 billion pounds, it is readily seen that the growth of the industry has been phenomenal. Although additional information could be cited to document the growth and importance of the industry, I will assume that your presence at this meeting suggests that you are aware that the plastics industry has become increasingly important during the last decade.

In regard to the second assumption, colleges and universities can and should assume their share of the leadership required to initiate and expand experiences with plastics for students. You will note that I said "their share", because it seems reasonable to me that all teachers of industrial arts need to be responsible for curriculum innovation. In my judgment, the entire profession has the potential and responsibility for providing the leadership required to introduce instruction that reflects the technology of today. Additional information documenting the current status of plastics in industrial arts teacher education will be presented later in this program.

The final proposition pertains to industrial arts facilitating the development of craftsmanship. After considerable debate, I am prepared to argue that industrial arts programs should facilitate the development of craftsmanship. While it is beyond the scope of this paper to logically define what a craftsman is, or the exact nature of his work, it appears that there is an essential ingredient required of any individual who would be a craftsman – that is excellence. You will recall a book published several years ago by the same title written by the now-Secretary of Health, Education and Welfare, John Gardner. If it is possible to identify the craftsman as an individual dedicated to the pursuit of excellence, then in my judgment we can assume that industrial arts education in general, and students having experiences with plastics in particular, or any other material, can make a contribution in this area.

The basic question with which we have been concerned is "What Can the Colleges and Universities do to Initiate, Improve and Expand Instruction in Plastics in Industrial Arts Education?" I would like to divide what can be done into two logical steps. The first pertains to providing competent personnel. It will be necessary to "retread" most teachers: experienced teachers, recent graduates, and also teacher educators. While this suggestion may seem critical, it is, in my judgment, necessary. What I am suggesting is that the plastics programs of which I am thinking must involve industrial materials, processes and products to be initiated, expanded or improved. There could be the familiar letter opener but produced by injection molding and not by the sawing-filing-sanding-buffing sequence. Laminating, rotational molding, compression molding, fluidized bed coating and slush casting suggest the type processes to be included in plastics courses. In these same courses, vinyl, epoxy, cellulose, fluorocarbon and polyvinyl chloride would be as common as "Plexiglas" seems to be today. On the basis of my experiences, the majority of in-service industrial arts teachers have not had the experiences that would prepare them to direct student learning experiences in a plastics program that reflects the current state of the technology.

One means of updating in-service teachers would be for industrial arts teacher education institutions to provide institutes and seminars in plastics. It is significant to note that one of the 29 institutes funded under Title XI of the National Defense Education Act for industrial arts is in plastics. This institute will be held at Stout State University. In recent years, the State University College at Buffalo, New York, for example, has offered workshops in cooperation with local industries. Several months ago, the Morris County (New Jersey) Industrial Arts Association held a series of seminars in cooperation with the Boonton Manufacturing Company of Boonton, New Jersey, makers of the well-known "Boonton ware." I have suggested only a few examples of recent efforts to expand instruction in plastics using the combined efforts of plastics industry personnel and members of our profession.

Another example of education-plastics industry cooperation can be shown by citing a recent personal example. During a recent vacation, it was possible for me to work as an employe of a local producer of plastics laminates in their quality control laboratory. One brief telephone call was all that was required to make the necessary arrangements. Admittedly, the college had previous contacts with the firm; the plant manager had been asked to be a member of our Industrial Advisory Committee. The experience was of inestimable value.

Another point I want to make is that to initiate, expand and improve instruction in plastics, all available means must be used. One essential element inherent in any efforts would be public relations. It is necessary to "sell" plastics to many industrial arts teachers, teacher-educators and industrialists. It was surprising to me to find that in many instances individuals representing the industry required the least amount of persuasion. Our most difficult task can be convincing the profession that instruction in this area is needed and important.

The final point that must be considered is the problem that would be created assuming instruction in plastics is to be introduced. Time is perhaps the first obstacle anyone would raise. It can logically be asked, "How can we also add instruction in fluid power, electronics, numerically controlled machining and ceramics?" Perhaps one of the curriculum projects currently under way will provide the answer to this problem.

The question of qualified teachers has been essentially answered by previous comment. To facilitate instruction in plastics, we first need competent teachers. Reference should also be made of the possibility that any alert, perceptive individual can develop his own education program. Extensive reading, self-study and general inquiry would enable an individual to develop the competency required.

Any activity instructional program requires some type of facility. I would like to simply say that a $400.00 injection molder can be justified on the same basis as a $400.00 circular saw. Thus, just as typewriters are required for instruction in business education, or machine lathes in metals, pelletizers, extruders and ultrasonic sealers are required for instruction in plastics. Logically, no difference exists. Incidentally, the need again to call upon industry cannot be ignored. Many local plastics industries are willing to provide various pieces of equipment on a free or loan basis.

The final problem that cannot be ignored is certification. I expect certification requirements for industrial arts in many states will need to be altered to permit only qualified teachers to direct instruction.

In conclusion, it is my impression that although current conditions suggest definite problems that will need to be overcome, the profession has the resources to implement instruction in plastics. All intelligent citizens should be aware of the importance of this material and the industry which it represents.

Mr. Koble teaches at Trenton State College, Trenton, N.J.

USING PLASTICS MATERIALS PAST AND PRESENT IN TODAY'S PROGRAMS

James J. Runnalls

Prior to World War II little was done with plastics in industrial arts programs because of the scarcity and cost of the material. In rare instances some acrylics were used for art work or other related topics of industrial arts. After World War II the use of plastics in industrial arts laboratories became quite widespread. Much of this gain in popularity of use is attributable to the large quantities of scrap acrylics available from government surplus agencies. So came the age of "cut, bend, and buff".

In 1965 I completed a study at the University of Missouri, entitled "Plastics Technology and Its Reflection in Industrial Arts Teacher-Education Programs". Data relative to processes and plastics materials used in industrial production were secured from technical literature. Data relative to instruction in the content areas of plastics were obtained from information forms sent to and received from department chairmen and from plastics instructors in 203 industrial arts teacher-education institutions offering a major in industrial arts. Of the 203 institutions studied, only 61 were offering specific courses in plastics, 73 were offering units of instruction in plastics, and the remaining 69 were offering nothing about plastics. A follow-up study just completed reveals that there are now 75 institutions offering courses in plastics.

Other data provided in the 1965 study indicated that plastics instruction was not keeping pace with the developments or uses of materials in the plastics industry. The acrylics and polyesters were the most widely used materials in industrial arts, while the polyethylenes and polystyrenes were the most widely used in the plastics industry. The industrial arts programs were also failing to use to the proper degree the most common production processes in their laboratories.

There are many up-dated plastics textbooks now available for use in industrial arts programs. However, industrial arts teachers must be willing to search out and make the latest information available to their students. Plastics courses must be given a proper name and should be removed from the ranks of crafts and hobbycraft.

Mr. Runnalls teaches at Stout State University, Menomonie, Wisconsin.

W-4.5 Design & Drafting
Special Panel Session
DESIGN AND DRAFTING CONCEPTS BASED UPON HERITAGES OF THE PAST
Gen. Chm, Jay Helsel; Chm., Russell A. Johnson; Rec., Robert W. Leith; Obsr., James H. Jacobsen; Panelists, William B. Landon, Clifford Yard; Hosts, George Hackett, Stanley Grossman

EXAMPLES OF DRAFTING CONCEPTS BASED UPON OUR CULTURAL HERITAGE AND IMPLEMENTED INTO TODAY'S HIGH SCHOOL PROGRAMS

William B. Landon

When I accepted the invitation to participate in this program, my immediate concern was with being able to present any information or ideas to you, a group of drafting teachers, that would enable you to do a better job of instructing students in your drafting classes. After all, that is our ultimate purpose for attending a convention of this importance.

All of you have been enrolled in several courses of drafting and design in colleges and universities. Many of you have worked as commercial draftsmen. Collectively, you have taught in the area of drafting and design for several hundred years in junior high schools, senior high schools, colleges and universities.

It would be presumptuous to assume that I could tell you anything about drafting that you have not heard many times either in the classroom or in a section of an industrial arts meeting such as this one. Perhaps I can mention a few things that will cause you to reflect and can stimulate a few questions which I probably can't answer.

You will note that I have been assigned a topic dealing with drafting concepts based on our cultural heritage and implemented into our high school programs. When I discussed this topic with a friend he asked me to define "concept". I found that the word concept is defined as an idea or general notion. After doing a little further research, I learned that a notion implies vagueness or a hazy perception. I imagine that when I have finished, you will have just that; a hazy idea of what I've been talking about.

Our industrial culture had its beginning when our ancestors first came to this country. Individuals, out of necessity, began using their imagination and creative ability to produce the essentials of everyday life.

There were houses to be built. There was an immediate need for implements to be used to clear the forests and cultivate the land. Firearms were needed to kill game for food. Roads or trails had to be constructed or hewn out of the forests. People had to use their inventiveness to develop methods for producing food and clothing.

The industrial and technical culture in which we live today had its beginning in our country as an outgrowth of these necessities. Drafting, but probably not as we know technical drafting today, had to be used by these men to plan these necessities.

These people also had freedom of expression in designing and planning the products they were to use. Of course, many of their ideas came from their native countries, but they had to use their own inventive genius to a great degree.

This was the beginning of our industrial cultural heritage. When one researches the history of drafting and design in our country, he finds that our heritage in this area is very interesting indeed, and that it reflects the importance of drafting as the graphic language of our industrial age.

Let us take a few minutes to consider architectural design and drafting. This is an area that can be identified with our cultural heritage.

During my reading in preparation for this presentation, it was noted that creativity is not only creating new ideas but also combining and improving old ones. If we agree with this statement, then we must agree that a student in architectural drafting and design should have, as a part of his background, some knowledge and understanding of the history of architectural styles. This would not only be knowledge of architectural styles developed in this country, but in other countries as well.

In our section of the country, the Spanish style of architecture has had great influence on many of the houses designed and built today. I hope that our students are aware of this.

When an architect designs a house or commercial building, a school or church, he uses ideas and knowledge that have been developed over the centuries, and combines these with his own ideas.

We feel that much of the success in our present drafting program has been achieved in the area of architectural design and drafting. Considerable time is spent with research in the history of architectural design, social and economic aspects of housing, and drawing techniques significant to architectural drawing. After that, the student is allowed complete freedom with regard to design of his structure, room arrangement, choice of materials, landscaping and other factors involved in producing his plans.

Some time ago it was my privilege to attend a conference of high school drafting instructors, engineering graphics instructors, and supervisors of industrial drafting. At this conference it was pointed out that we, the high school drafting instructors, should teach the students to think. I wonder if we are so much as allowing them to think.

It has been my observation that too many drafting instructors are assigning drawings from the textbook with the hope that the students will develop a high degree of skill and accuracy in executing a drawing. There is no disagreeing with the fact that this method will produce the desired results—that is, if the student does not become bored, discouraged and drop out of class.

At our state convention a few years ago, several drafting teachers got together and toured the drafting area of one of our metropolitan high schools. We found one of the rooms literally papered with very well-executed machine drawings. The teacher was asked how many plates a student produced in a school year, and without hesitation he replied, "sixty-nine". Were his students encouraged to think?

May I refer to another example of robbing students of their freedom to think and express themselves? A friend called one evening to relate his new innovation in architectural drafting. He stated that he was outlining the exterior walls of a house on the chalkboard, then requiring the students to arrange the interior of the house. I inquired about his previous program. He said that it had been a program of copying house plans from a drafting textbook or magazine.

Can you sincerely subscribe to this type of practice as implementation of drafting concepts based on our cultural heritage of freedom of expression with the opportunity to create new products?

The majority of secondary school students, after they have acquired the basic drawing techniques and fundamentals, prefer to apply their knowledge and creative skills in the areas of their interest—that is, if they are provided with the opportunity.

To this point there has been nothing said about standards in the drafting room. With the ever-increasing demands of industry and technology, it is extremely important to impress students with the fact that drafting is a graphic language, a language that enables a person to express himself in one part of the world and be accurately interpreted in another.

How often have you had students show indifference to definite rules and practices with regard to lines, symbols, abbreviations, the use of tools and equipment, and the general format of drawing? It is hoped that you countered this indifference by attempting to develop in the student an awareness that standards have been developed in America with an appreciation for drafting as a universal language.

There are many students enrolled in drafting classes who are incapable of meeting either the standards of the drafting room or those set by the instructor. Some of these same students, and many others, may not be able to think creatively or to consider experiences that require much problem solving. These are the students who design the two-room mountain cabins or prefer to copy problems from the textbook.

There has always been a place for these individuals in our American culture. Just today, one of my former students informed me that he is working as a commercial draftsman. He attributes his job to his ability to do reasonably good freehand lettering. He stated that most of his work had involved ink tracing and little else.

We, the drafting instructors, know that drafting is important to everyone. Sometimes I am concerned with our ability to impart this concept to others. All too often the students, parents, other instructors and administrators seem to think of drafting as either pre-vocational or pre-engineering training with little or no value for anyone else.

During the opening week of a recent school year, a student came to me with a request for a schedule change. He was asking to be transferred from drafting to chemistry. He gave as his reason the fact that he didn't intend to become a commercial draftsman. After some questioning, he stated that neither did he expect to become a chemist. As a result of our discussion, he seemed to gain some appreciation of drafting as part of every student's general education.

Perhaps these are a few of the drafting concepts, based on our cultural heritage, that can be implemented into our present programs.

The major concepts are restated here in summary:

Students should have some knowledge of the significance of drafting in our cultural heritage.

They should be aware of the fact that since drawing was used as the first means of communication, it is older than the alphabet.

They should understand that everyone at some time must use a form of drafting to express himself or convey ideas that can not be made clear through writing.

They should understand that industrial designers and architects not only use their own ideas but draw on ideas and knowledge that have been developed through the centuries.

They should understand that a draftsman or designer needs to combine freedom of expression with standard drawing practices through the proper use of lines, symbols, dimensions and lettering.

They should be aware of the fact that there are many levels of attainment in the area of drafting and design, and that in our industrial culture there is a need for each level of attainment.

Mr. Landon teaches at Englewood Senior High School, Englewood, Colo.

WHERE AND HOW CAN WE ENRICH OUR PRESENT DAY DESIGN PROGRAMS USING OUR CULTURAL HERITAGE FOR THE BACKGROUND?

Clifford L. Yard

Having received the assigned topic (I cannot repeat the title without consuming too much time), I am somewhat puzzled as to its intent. "Enrich" means to make rich or richer; it also means to ornament or adorn; finally, it means to fertilize. I wonder which the program committee wishes emphasized? Perhaps the interpretation of this topic might turn out similar to the story of the troupe of girls who had been performing at various army installations all day and were tired and hungry when the commanding officer asked them if they would like to mess with the soldiers. A blonde replied, "Yes, but can we eat first?"

I would like to suggest that we can utilize our cultural heritage of the past in three ways. First, it can be used as a valuable source of information to enhance our general understanding of the significance and extent of our present culture. Much of what we call new now is not new but can be traced far back in history. For example, pop art is claimed to be new but it was practiced by South American Indians over 400 years ago. The significance of an understanding of past cultures is well stated by Lahti, who said, "this does not mean that one should ignore the past; we should know as much about the past as possible, for it provides the foundations for insights into (the present) and future"*

Secondly, availability of the better designs of the past provides an excellent source of examples to attempt to emulate in our present day designing. Though the techniques for producing artifacts of the past have changed, the reasons for their existence and the methods utilized in planning them have changed very little down through the ages.(1) In fact, many designs of the past are formidable challenges for us today, such as Greek vases, Cellini's Goblet (probably cast by the lost wax process), or the fruit carvings of Grinlin Gibbons.

A third value inherent in a study of the design of the past is in the technical knowledge developed that is still unequalled. The ingenious scarf joint of the Egyptians, lost wax casting of the ancient Egyptian and Chinese civilizations, metal enameling, paper making, etc., are a few examples.

The methods of utilizing our cultural heritage are so well known that I will only mention that publications, museums, films, film strips and slides are available for this purpose.(2)

An answer as to how we can enrich our present design programs cannot be arrived at without giving consideration to some persistent issues that the design teacher must face. Since this is a panel program, I'll attempt merely to raise the issues and not to solve them.

Is there a need for a definition of designing capable of operational interpretation in the industrial arts class? We have many definitions, like "designing is creative planning to fulfill a need",(3) which might be compared with "designing as the process of seeing needs, analyzing functions, knowing materials and understanding formative processes, and in all these steps develop a sensitivity to beauty"(4) in terms of capability of student understanding and application.

We might attempt to describe more accurately just what designing really is by examining the prints from Russell Wright's design morgue for an electrically heated Serving Tray.

We have been concentrating on "making things" in industrial arts for the past 60 years to the almost complete exclusion of any attempt to teach design. Only recently have we recognized the need for teaching design and so have added it as a separate entity. Consequently, the two phases have been completely separated for a time.

Actually we should feel a little silly that we should have to resort to such a thing as Mr. Bro's study (5) (no reflection on Mr. Bro's study is intended) to rediscover that integrating the design activity with the making activity is rated high by 94% of the 116 industrial arts teachers involved in his study, that drawing the designed article was rated high by 86%, that making the thing designed was rated high by 88.8% and that evaluating the final design was rated high by 89.7%. A study of primitive man reveals that integrating (doing the whole job of designing and making) the design job was natural and necessary. He gave attention to the material need, to the function need, to construction need and even to the human need. Dr. Olson emphasized this latter need when he said, "good design is good solutions to problems which in industrial arts are both technical and human. It demonstrates excellence in thinking, imagining, creating, selecting and constructing. Good design reflects the human personality; this quality takes the project beyond function, beyond production and economics, and gives it the quality which shows that the designer cared enough to do his very best. The extra attention, the extra concern for details, the hope that someone else will love it, too, all help to show the personality of the designer within the material."(6)

We have examined the simple, direct, functional and crude methods of designing used by primitive man. Now we might go farther back and look at nature as a designer. Nature seems to follow two patterns in its design process. One we might call the revolutionary process. Here nature gets its chromosomes either well mixed up or lost or both and comes up with rapid, radical changes in design called freaks or sports. Occasionally we get an improved design as seems to be the case of the golden delicious apple. Two-headed calves, beetle-capped canaries, mule-hoofed hogs, etc., have proved to be undesirable designs. Man seems to have no control over nature's revolutionary method of designing.

Nature also designs by what might be called the evolutionary process. Here we have a slow gradual change which seems to be somewhat controllable by man. Nearly every domesticated plant and animal has been vastly improved (according to man's standards) over the original species. A good example is the field corn we now grow as compared with the original Indian maize. We must do all our significant designing utilizing the laws of nature.

Man, in applying nature's evolutionary design process, has evolved three procedures in solving most of his design problems. First, he solves some of his problems completely on paper. These problems are those involving pure science – mathematics, physics, chemistry, etc. Such problems as engines, water pumps and the mechanical parts of a typewriter can be solved reliably on paper with no need for a mock-up to determine whether such things as a 20-tooth gear will turn a 10-tooth gear twice as fast as well as reverse the direction of rotation.

Secondly, he solves many problems by starting out with sketches on paper and then turning to materials (mock-ups, etc.). These problems are the coverings and housings for the mechanical parts. Here looks are of most importance and the final design cannot be judged two-dimensionally. The designing that is being more and more frequently called "styling" falls into this category. Probably this type of designing consumes most of our industrial designers' attention.

Finally, a limited amount of designing is done directly in materials. The material clay seems to be the favorite for this, since it is inexpensive, quickly formed and can be reformed quickly without significant loss of material – just labor. Sculpturing in wood and stone might follow this procedure, though many craftsmen in these materials prefer to have at least a rough sketch from which to work.

I believe that experience indicates that many students, in attempting to design, are quite inadequate in the capacity of recording ideas clearly. Some of the values of this capacity are that:

a. Psychologists claim that the human mind is capable of retaining only a limited number of different ideas at a time. Recording ideas reduces the need for so much retention.
b. Recall is often difficult when needed. Recording ideas reduces the need for recall.
c. Recording ideas as they occur relieves the mind so that it might search for more ideas.
d. Recording ideas makes it possible to consider many ideas in the search for a better solution.
e. Recording ideas is the best if not the only feasible way to transmit ideas to others.
f. The final design rendering is of utmost importance in selling the design to the prospective client.

Lahti said, "every designer has difficulty materializing his solutions until he starts putting them on paper. It is for this very reason that his competency in drawing is so vital."(7) The designer uses drawings for self-communication just as we all use words for thinking. This use of drawing as an extension of the mind, a form of external (and reliable) memory can be very important in the design process.

The confusion that might arise from the various concepts of creativity are suggested in the following statements: "Since man is incapable of true creation—making something out of nothing—the design can only be the recombination of known elements into a new or different arrangement. Obviously, the designer can incorporate into his plan only those elements that are known to him, and design is, therefore, primarily a process of synthesis."(8)

A publication, in treating with the question "what is creativity", states that perhaps only 100 Americans are capable of pure, basic research of the Nobel Prize level, while innovation and discovery may be done by 1000 people. Invention can be done by about 10,000, while problem-solving is done by about 100,000 people.(9)

The following suggestive distinctions between four modes of thinking might throw some light on noted differences our students take in solving design problems:

Analytical type tends to approach a problem by defining it broadly, then making logical divisions of alternates, breaking concepts down into component parts. Thus, he is not likely to work quickly or to suggest a great many alternates.

The empirical type tends to operate largely on the basis of past experience. Confronted with a problem, his first move is to leaf through his mental files in search of analogies, problems he has already solved similar to the present one. Then he tries to apply variations of the solutions that worked before, often in the context of the laboratory or shop.

The materials-oriented type gets his suggestions from his materials. He sees materials as making demands, offering resistances, suggesting alternatives. Such a person may display poor conceptual skills and find it difficult to express his ideas in words. But his actual results, which usually take the form of a physical model, may display great ingenuity and originality.

The metaphorical type seems to be the most patently "creative" of the four types. His way of thinking involves speculation, the pursuit of apparently irrelevant approaches and wide-ranging analogies. His solutions are likely to be unexpected and really or apparently impractical. While his verbal fluency, his flexibility, his ability to play with concepts is great, his ability to realize ideas in concrete physical models or technically-expressed solutions may be poor.(10)

We have some who advocate that those who are designing should be isolated from all outside ideas (objects, pictures, etc.) so that they will be compelled to design from their own ideas. There are others who advocate exposure to as many ideas as possible from whatever source.

A company representative engaged an engineering firm to produce 18 new designs of tweezers to be air-brush-rendered on 14 x 17 black cardboard. This representative had gone out and purchased one of every design of tweezers he could find (over 50) and left them with the designer. No doubt what he believed.

Lahti says, "when starting to design, I deliberately avoid libraries, scrapbooks and notes, and I encourage my students to do the same."(11)

Anderson & Ferns say, "having been charged with this design problem (wooden tray or dish), several examples or illustration – photos, drawings or clippings – representing a wide variety of possible solutions to the problem should be flashed or exhibited for a short while so the students may become better acquainted with the scope of possible solutions to the problem."(12)

Another important issue concerning the teaching of design stems from the method of teaching the principles and elements of design. The following statements represent some of the current thinking on this issue. Tinkham wrote . . . "the designing of the project is an entirely natural procedure. It is not dependent on rules or formulas but stems from a logical analysis of function supplemented by an understanding of tools and materials."(13)

Hardin, Wenrich & Wright said, "rules of design, on which we seem so dependent, are perhaps the most inhibiting factors in the learning process. Rules may contribute to learning when their true place in the educational picture is realized but we have been building high fences of these rules, and the results from students' efforts to surmount the fences have been disastrous. By the time the rules have been memorized little desire for creative design remains."(14)

In conclusion, we might reflect on the fact that Leonardi da Vinci was the first Renaissance man (1452-1519) to approach art as a science and science as an art. Likewise we can call upon our rich historical heritage as well as the present to help make decisions in terms of the principal issues facing design teachers. May I reiterate the following issues:

1. Can we clearly indicate what designing really is in terms of student understanding and practical application?
2. What should be done relative to integrating the designing activity with making the object?
3. What should be done relative to developing student capability in idea-expression?
4. What is the proper place of the rules (principles and elements) in design teaching?
5. What is the place of resources (recorded designs, etc.) in teaching design?
6. Should the material need, function need, and production need be expanded to include the human need?

A recent newspaper article really dipped deeply into the historic past when it revealed that some sweatshirts are being decorated with a rabbit sporting sun glasses and a cigarette holder symbolizing "a loosely knit organization of fast-moving fun seekers", other sweatshirts are decorated with a turtle, bespecked and reading a book which symbolizes "a loosely-knit organization of slow-moving fun seekers". These design symbols are based upon Aesop's Fables, dating back to 600 B.C.

FOOTNOTES

* Aarre Lahti. "Speaking of Design", School Shop, September 1963.
1. Lindbeck. Design Textbook, p. 65.
2. Ibid, pp. 56-57.
3. Scott. Design Fundamentals, p. 1.

4. Arnstein, Jacob. "The Nature of Creativity", School Arts, 59:20-22; October, 1959.
5. Bro, Roland. "Ways to Teach I-A Design" Industrial Arts and Vocational Education, 48:291-292; December 1959.
6. Olson, Delmar.- "Design and Industrial Arts," School Shop, June, 1961, pp. 11-12; 38.
7. Aarre Lahti. "Speaking of Design" School Shop, November 1965, p. 44.
8. Wellman. Introd. to Graphical Analysis & Design, pp. 373-374.
9. E. J. Tangerman. "Creativity - The Facts Behind the Fad", Product Engineering, July 1955, p. 158.
10. Schon, Donald A. "Are Creativity Tests Helpful?" Product Engineering, November 17, 1958, p. 28.
11. Aarre Lahti. "Speaking of Design", School Shop, December 1963.
12. Anderson, A. & Fern, G. "Students Can Now Develop Own Designs", School Shop, March 1959, pp. 10-11.
13. Tinkham, Robert A. "Design in Industrial Arts: A Study of Creative Modern Design as It Relates to the Teaching of Ind. Arts", (Unpublished Doctoral Dissertation) U. of Minn., 1952, p. 345.
14. Hardin, R. A., Wenrich, R. C., and Wright, W. E., "Concepts of Design in I-A Teacher Education", Ind. Arts & Voc. Educ. 50: 32; May, 1961.

Mr. Yard teaches at Millersville State College, Millersville, Pa.

W-4.6 Electricity & Electronics
Special Panel Session
ELECTRONICS-MILESTONES OR MILLSTONES?
Gen. Chm., Howard Gerrish; Chm., William Dunlap; Rec., Ronald J. Haines; Obsr., B. John Rose; Panelists, Fred Culpepper, Harry Krane, Kenneth Barton; Hosts, William G. Hoefert, Richard E. Ginther

ELECTRONICS CURRICULUM BASED ON GREAT SCIENTIFIC DISCOVERY

Fred W. Culpepper, Jr.

Science for years has organized its curriculum on deductive reasoning, which is defined as reasoning from a known principle to determine the unknown. This organization in the science curriculum has given emphasis upon the orderly development of principles as they have developed chronologically. As an example, a discussion of the Frog's Leg Experiment of Galvanni and the subsequent development of the Voltaic pile precedes the discussion of the primary cell. Also, the use of the compass and its historical development precedes the discussion of magnetic theory. Our current technological society is a result of the total of all scientific discoveries of the past. The contribution of such discoveries is inescapable.

Industrial arts must recognize these past scientific discoveries if it is to interpret the present level of technology to students. It is indeed a serious omission to allow any student of industrial arts to fail to know and to understand how our current level of technology was developed. Such a discussion of philosophy is indeed a noble thing, but let's see just how a chronological development of scientific discovery could be utilized in formalizing a study of electric illumination:

Ask any student who invented the electric light. The immediate response will be Edison. This, unfortunately, is not a correct answer. The first electric light was the arc light invented by Humphrey Davey, who demonstrated an arc light at the Royal Society of London in the year 1808. Now let's trace this flickering, sputtering ancestor of illumination to its present type of lighting.

In 1843 Delevil demonstrated an arc light at Place de la Concorde in Paris, October 20, 1843. He placed an arc formed from two charcoal electrodes in an evacuated sphere on a statue in the center of the square. For a power source, he used a series of Bunsen primary cells. The development of a practical arc light depended upon a reliable source of current as well as a mechanism to regulate the arc. For the next 30 years the search for practical electric illumination centered on these two problems.

Foucault invented the first electric arc regulator in 1847, and his principle, based upon a clockwork mechanism, was refined by Staite and many others and was the device that produced the first practical electric light. Regulation by means of a series solenoid was many years in coming.

It is interesting to note that the first application of an electric illumination was for stage and street lighting. A ballet "Electro" was produced in the year 1849 to exploit this new source of light. Indeed, electric arc lighting became such a valuable adjunct to stage lighting that an entire room at the Paris Opera House was devoted to the electric mechanisms necessary to produce illumination. It is also interesting to note that an electro-mechanical generator was invented to produce a source of current for this early electric light.

Lighthouses were soon established to use arc lights. These installations had huge generators in the basement to develop sufficient current for the light. It is interesting to note that one of these new generators—the Granne Dynamo—led to the discovery of the electric motor at the Vienna exhibition of 1873.

The next electric light was the Jablochkoff candle of 1876. Incidently, Jablochkoff was headed for the Philadelphia Centennial Exhibition of 1876 when he stopped off in Paris to see the Granne Dynamo. It was here that he became interested in electric illumination and invented his candle.

The principle of the glowing filament in an evacuated glass envelope was well known, and indeed several inventors had built successful electric lamps when Edison began to experiment to discover a practical electric lamp. His experimentation led to the very first economically feasible filament type lamp. He used a carbonized filament in a clear glass bulb. After perfecting the lamp he set himself to the task of inventing all of the rest of the hardware that was necessary for an electric system. He invented the insulators, methods of running the wire into homes, fuses, sockets, etc. In 1879, Edison set up a generating station on Pearl Street in New York City and wired Times Square. On the appointed night in November of 1879 he illuminated the Times building. A newspaper account of the period described this new form of illumination as an odorless, flicker-free device that gave a superior "white" light.

Tungsten metal was first used as a filament of electric lamps in 1906, but, due to the sag of the wire, was not too successful. Dr. William D. Coolage finally, in 1915, with the help of Dr. Langmuir, produced a coil filament lamp which was identical to the lamp that we use today. With the exception of a slight increase in efficiency occasioned by new materials and processes, the lamp of 1915 is similar with that which we use today.

Another form of illumination, the Mercury arc lamp, had its beginnings in 1907 but had to await post-war glass and electrical techniques to become truly practical. Today the Mercury arc lamp is seen on most major highways, parking lots, etc.

The fluorescent lamp, a comparatively modern method of illumination, was introduced in 1939 at the World's Fair, and some of us in this audience attended that Fair as young boys and remember the canopy of fluorescent tubes across many of the streets. It is interesting to note that the World's Fair has always been a method of introducing new inventions to the public. The incandescent lamp was shown at the Chicago World's Fair in 1893.

Recently electroilluminescence has been perfected, and now it is possible to have complete wall panels which glow with a soft highly efficient source of light. The newest technique we have in the production of illumination is the lazer. What else are we going to invent as a method of illumination?

Note how this orderly development of illumination can become a basis for the development of the study of electro-illumination. The same chronological development of great historical discoveries can be used to organize the teaching of electronics in any of the various divisions of the field. Communications can begin with the simple experiments of Morse and be carried down to the present telecommunications used in our satelite program. Each step in the development of communications had been documented, and for the enterprising teacher can be found in the library. Students are fascinated by a discussion of the way in which devices with which they are familiar were developed. Let's see this method occasionally, to help us develop a true and outstanding curriculum of electricity-electronics.

Mr. Culpepper is Chairman of the Industrial Arts Education Dept. of Old Dominion College, Norfolk, Va.

AMATEUR RADIO IN INDUSTRIAL ARTS EDUCATION

Harry Krane

Industrial arts education, in my opinion, is not only a separate academic subject but also an approach to the other academic subjects. Therefore, this could reconstruct our entire educational philosophy.

Occupational requirements demand more mental capability, greater physical skills, higher educational achievements and increased versatility.

Our failures, thus far, have resulted from outmoded facilities, not in keeping with existing technological advances, and from a failure to make changes in content to meet new needs.

Prevailing philosophy indicates that we should not teach today's children for tomorrow's world with yesterday's methods and materials.

We have also learned that today's students are career-oriented and look to us to supply them with the kind of education experience which will enable them to participate in and contribute to our industrial society.

Utilization of the most recent equipment, tools, materials and techniques is a necessity.

If we are to fulfill the aims and objectives of industrial arts general electricity-electronics, amateur radio, as a motivation for learning, should become an integral part of the implementation of the course of study.

Whether or not a teacher has a Federal Communications Commission Amateur Radio Operator's License, he should make every effort to obtain and install an all-bands receiver in the shop. If and when the license is obtained, transmission should be included.

All pupils, including physically handicapped, blind and aphasic, benefit immeasurably from such experiences. In many instances, the success enjoyed in this area initiates an interest in further exploration and education of this and allied areas of instruction.

In New York City, as a result of the efforts of Mr. Herbert Siegel, Director of Industrial Arts, Mr. Howard Sasson, Coordinator of Electricity/Electronics, and myself, many teachers have been motivated to study for and obtain their proper licenses. Receivers and transmitters are being supplied by the Board of Education. Multi-purpose antenna systems are included in the specifications for new school buildings.

As a result of my visits to many schools with a 6-meter transceiver, demonstrating the techniques of operation, establishing contacts as well as displaying the equipment, often seen for the first time by pupils, both the class and the teacher have been motivated to strive for the inclusion of this exciting, educational and exploratory experience.

The goal, a network on the 2- and/or 6-meter band, is slowly but surely being reached.

If industrial arts, as part of general education, is "the study of technology" in which pupils "may create, experiment, design and plan" as well as "prepare for living in an industrial democracy", then it is incumbent upon us to introduce into the scope of the course that which is current, motivational and educational.

Mr. Krane is Supervisor of Industrial Arts, New York City, N.Y.

WHO LEADS THE WAY—URBAN OR RURAL ELECTRONICS PROGRAMS?

Ken Barton

In order to discuss this topic I believe that we must first define a number of terms. First we must define the terms "rural" and "urban". I am sure that these terms carry somewhat different connotations throughout the United States. The term rural as I will use it will designate a school in an area whose major industry is agriculture and whose school enrollment is under 600 students. The term urban will refer to those schools located in primarily a metropolitan area with enrollments in excess of 600 students. I realize that this is somewhat arbitrary and will not be true in all situations, but for the purpose of this paper I feel it will serve a purpose. I will also use the term electrical in its broadest sense and include all phases of electricity and electronics. The material discussed in this paper will be referenced to the Illinois area. However, from articles that I have read in various professional magazines, I do not believe that Illinois is particularly unique in its industrial arts programs and that the same situations occurring there are somewhat universal. As resource material for this presentation I will draw rather heavily from the two recent surveys conducted in the State of Illinois that are listed in the bibliography.

The gentlemen that picked the topic of this presentation felt that there is a distinct difference being given to programs in rural districts as opposed to those in metropolitan areas. I will agree that there are differences in programs offered in these areas, and I will further state that there are many differences from one rural school to another as well as from one urban school to another. Regardless of the size of the community or school, I believe there are a number of factors present which cause differences in the content and emphasis of our industrial arts electricity programs. Having been a member of our State Electrical Teachers' Association for a number of years, I have talked to many teachers throughout the state and have visited many programs. I found many variations in each of the programs. I shall point out several of the major differences and comment on them.

Probably the single factor which causes the greatest variation in our industrial arts electrical courses is the educational and experience background of the teacher. The Harmon survey indicated that the average number of hours of academic preparation earned by those responding was only 16 semester hours. This survey does not include the schools with fewer than 350 students. These schools may have a general shop teacher who is teaching a unit in electricity. If these schools were included in the survey, the average hours of preparation would have been significantly lower, since Illinois has many programs of this type. Another disturbing factor is that the men responding indicated that only 26% of their electrical teaching knowledge was attributed to formal courses in the area of electricity, the remainder coming from military, academic (other than industrial) arts, on-the-job training and vicarious experiences. Many of the men now teaching electricity have literally taught themselves.

A second major difference in programs is due to the amount of time that the instructor can devote to the electrical area. Most of the small schools have a one-instructor general shop. During the four years spent in school, the student will probably not receive more than one year of electrical instruction. This contrasts with the larger systems that have several teachers. Here the student might be able to obtain up to three years in electrical instruction. From information received from a recent survey conducted by the Education Committee of the Illinois State Electrical Teachers' Association, it was discovered that the units covered in the schools of various sizes were basically the same for a similar period of time, the difference simply being in the number of units that could be covered. One area which I had thought might be emphasized in the small rural school would be in the area of house-wiring. According to the survey, the greatest percentage of schools offering instruction in housewiring were those having enrollments of 1200-2400 and above 3000.

A third major factor is the money available for purchasing the equipment necessary to teach a comprehensive course in electricity. The smaller school normally has less money available for each instructional area. Since the shop is usually organized as a general shop, the money that is available must be divided among all of the areas of industrial arts instruction.

A fourth factor which causes some variations in electrical programs is that of geographical locations. Many industrial arts programs will tend to emphasize areas of community interest. If, located nearby, is a major industry interested in graduates with a background in a specific area of electrical work, the program will usually be slanted in this direction. I see nothing wrong with this as long as it is not at a sacrifice of a good solid foundation in basic electrical fundamentals. We have to remember that our population is extremely mobile. The chances of a young person's remaining in his home community to work are becoming more remote. For this reason the student needs knowledge that would be pertinent to industries in all geographic areas. We should leave the specific job training to the vocational programs.

I am sure all of you are familiar with the factors I have mentioned. I feel that I would be remiss if I did not offer some suggestions that could be used to diminish these differences. The acquisition of equipment necessary to teach electricity has been and probably always will be a problem for all school systems. With the availability of federal money, this situation may be helped to some degree. In Illinois the small high school is in about the same situation that the one-room country school was in the late '30's and early '40's. Many of our high school districts are consolidating so that they will have a tax base great enough to provide the students with the type of education necessary to compete in a space age society. As these schools consolidate, the general shop is being replaced by the general unit shop. For the small school that is not consolidating, the answer seems to rest upon the teacher to do a better job of public relations and selling of his program. There seems to be money available if the teacher can show his program is vital to the student, school, and community. The larger school does not seem to have as great a financial problem. We have had a number of administrators come to our campus looking for teachers. They state that equipment is no particular problem if they could find a teacher qualified to set up a program.

The time spent teaching electricity also seems, according to the IAEEE survey, to be proportionate to the size of the school. Here again the only answer seems to be to consolidate. This factor is one that we individually cannot correct.

The area of teacher education is the one area where much can be achieved in eliminating many of the differences occurring in the various programs. First we must provide facilities that are up to date and equipped with the latest equipment available. We cannot expect our graduates to go into teaching and update and upgrade their programs, when the high school program has already advanced beyond that of the college program. Second, we must provide the student with background sufficient for him to gain confidence in his teaching ability. We must instill in this prospective teacher the fact that he is in a fast-changing area of technology and as such he must constantly evaluate his offerings and keep them up to date. Of course, as teacher educators we must set a good example. Third, we must help the student evaluate the many different instructional methods and systems which are now available for school use. Fourth, we must provide facilities and courses for the teacher in the field to upgrade himself through evening or summer offerings.

Another help to electricity teachers is a statewide Electrical Teachers' Association. The exchange of ideas, philosophies and methods has considerable effect on upgrading the entire program throughout the state. All states should inaugurate associations of this type with a national affiliation such as a division of the AIAA.

A question posed by Mr. Ditlow in defining this topic is, "Who should be leading the way: the school in the small rural areas, or the schools in the large metropolitan area?" My personal opinion on this question would be neither. It is my opinion that the teacher training institutions should be taking this responsibility. We should be the ones that are looking to the future and adjusting our programs to meet the ultimate needs in the field of teaching electricity. It would seem that in this area, higher education is a lot like the cart leading the horse. We seem to be following trends instead of developing them ourselves. How can we possibly expect our graduates to go out and teach using the latest materials and methods if they have not been exposed to them in their college training? It amazes me that there are so many outstanding electrical teachers in the field today in spite of their early training. One major area of deficiency discovered by the IAEEE survey indicates that well under 50% of the schools reporting were not offering units of study in the area of transistors. But because of ever-increasing research and application of the integrated circuit, the transistor will probably become obsolete even before the vacuum tube has been completely phased out of use. It would seem as if our programs are not being tuned to space age technology. If you have looked through the latest Allied Radio Industrial Electronics Supplement you have found that there are many circuits now available in complete integrated units. With the integrated circuit, component replacement will be eliminated, and in its place will be the module replacement. If a circuit is defective that entire plug-in module will be removed and a new one inserted. I would think that this concept should begin to be considered on the teacher training level. I notice in the IAEEE survey that a number of our high schools are offering specialized courses. Examples of these are superhet systems, black and white television, color television, troubleshooting, logic and computer circuits and microwave. Of all the schools reporting none indicated that they were offering instruction on integrated circuits.

Another area which is going to require extensive research, and in the immediate future, is that of instruction materials and methods. We are told that knowledge known to man will double approximately every five years. I realize that we are primarily concerned with giving the student a firm foundation of basic knowledge, and this knowledge does not change as rapidly as application. But I feel that applications do determine what basic information must be stressed. The wide variety of commercial trainers currently available has made a tremendous impact on our programs. They accomplished more to alleviate differences in electrical instruction than any other single innovation. Additional training techniques will continue to provide better and more extensive learning in all applications of electricity.

In summary I do not feel differences in our electrical programs can be attributed to the rural vs. urban idea, but to many other factors which are more often than not common to all schools regardless of the size. As I have also stated I firmly believe that the teacher training institutions cannot "pass the buck" but must "pick up the ball" and develop programs which will lead the way to outstanding programs throughout the entire United States.

Mr. Barton teaches at Western Illinois University, Macomb, Illinois.

W-4.7 Graphic Arts & Photography
Special Panel Session
THE CONTRIBUTIONS OF HISTORY TO THE GRAPHIC ARTS
Gen. Chm., Philip D. Wynn; Chm., Edward J. Sikora; Rec., Adrian P. Pollock; Obsr., Roland W. Williams; Part., Francis J. Kafka; Interrog., Wendell L. Swanson, Charles Gennaula; Hosts, Frederick W. Christoffel, Richard P. Burchill

THE CONTRIBUTIONS OF HISTORY TO GRAPHIC ARTS TECHNOLOGY

Dr. Francis J. Kafka

Thank you, Ed Sikora, and good morning, ladies and gentlemen. When Phil Wynn first asked me to make this presentation I had the feeling that my prime qualification for this assignment is that my office is quite near Phil's at Millersville. Seriously though, he knows of my continuing interest in the historic impact of printing on modern practice. This is more of a hobby of mine than it is a professional responsibility.

I do feel strongly, however, that we sometimes conveniently forget that man, throughout history, has struggled against all odds and produced quality products nonetheless. And nowhere is this more true than in the field of printing. I feel honored to make this presentation in Philadelphia, the city which contains the grave of Benjamin Franklin, and the city whose very streets are hallowed by his footsteps. I feel humble in making this presentation in the city which harbors so many of the greatest modern practitioners of the ancient art of printing.

In making these few introductory remarks, I have merely tried to establish the frame of reference in which I hope to speak. My remarks will be historically oriented. But I speak not as an historian, because this I am not. I speak as a craftsman. And I speak from out of that feeling of excitement which I cannot suppress as I read about and study the accomplishments of printers, who, with cold hands and feet, and using hot type and handmade paper, mass produced hundreds of different titles of books for the trade, as early as the latter part of the 15th century. It is sometimes so easy to forget that such things happened as we stand in front of a web-fed, four-color, offset press.

Arthur Schlesinger, the historian, in stating his views of man in the place of history and as a factor in the economy, said at one time (and I am not quoting directly) that history is a tricky tool for predicting the future. It can answer questions after a fashion, but in the long run "we are all dead".(1)

This is something of a frightening realization but it is, nonetheless, a true one. As social scientists, historians leave us a great wealth in vast quantities of recorded information. The artisans and craftsmen throughout history have left us their artifacts and their formulas and recipes and procedures. (Despite the number as yet undiscovered.) Each generation must build on these or else they will disappear, just as Schlesinger warns that we will disappear. I shall attempt to use this foundation for emphasizing the contributions of history to graphic arts technology. I will try in the next few minutes to underline the importance of this history to our modern practices.

Printing has often been called "mankind's greatest invention". It has also been called "Queen of the industrial arts". I subscribe to both of these epithets, but actually they sound better as the cliches they really are, than they assist in any kind of explanation. Printing, as used or implied in these statements, usually means letterpress printing from movable type, as invented by Gutenberg, and refined and mechanized over the centuries.

There is some truth in all slogans, no matter how hollow of meaning they may be. This is also true of the importance of the invention of printing from movable type. This invention suddenly made possible a dissemination of knowledge heretofore utterly impossible. Within thirty years of Gutenberg's invention, there were European publishing firms with catalogs of hundreds of titles. Printing, whether it was block printing or stencil printing in the Orient, never had such an impact on the spread of knowledge.

"Anton Koberger (and I quote from Steinberg's, Five Hundred Years of Printing)(2) set up shop in 1470 and for a time combined printing, publishing, and bookselling. All these things he did on a grand scale, on the lines of the international cartels and trusts of the era.... At the height of his activities, Koberger ran 24 presses served by over 100 compositors, proof readers, pressmen, illuminators, and binders. The catalog of his firm over the years 1473-1513 enumerates more than 200 titles, most of them large folio volumes".

The Protestant Reformation gave great stimulus to the printing industry, but at the same time the actual effectiveness of the Reformation itself was made possible because of printing. The historic Renaissance in art, artifacts and architecture could only have spread in its total influence because of this new mass-media—the printed book! The first, then, and greatest impact which printing had on future history was that it gave the world its first relatively low cost mass-media.

The printed word, then, became the basis for the spread of knowledge in all fields as scholars and craftsmen alike had their storehouses of information reproduced for the use of all people in all times. This cannot be too greatly emphasized. In the age in which we live we take for granted that if there is any subject in which we are interested, we can find a book on this subject. And we are probably correct in this assumption. In this way if in no other, the graphic arts is the queen of the industrial arts in that it spreads the knowledge in all fields to those in all other fields. But this was not always true. Prior to Gutenberg only the very wealthy could afford to own a hand-lettered Book of Hours, or other devotional or even commonplace book, and the hand-lettered Bibles and missals produced by the monks were chained to their places in the churches.

The true, historically great pinacle on which Gutenberg stands was caused by a unique confluence of historic events in time. He was, in a word, the right man to be at the right place at the right time. The world was savagely athirst for written information.

As early as AD 645 a Chinese, Hsuan-Tsang, returning from India, headed a commission which translated 75 books in 1,335 volumes.... In AD 950 (circa) Feng Tao "printed nine classics from wood blocks as cheap substitutes for stone engraving." (3) Paper had already made its appearance in Europe and stood ready to replace parchment and vellum. The problem of casting movable metallic type, perfect in width, height and depth, so that it could be locked into lines and forms, was a dream to anyone other than a skilled artisan. And Gutenberg was either a goldsmith himself, or he worked for years with goldsmiths and had long before learned the skills of perfect casting from very small patterns. He was also skilled in polishing gems and silvering mirrors. He understood the metallurgist's knowledge of shrinkage and durability in metals. His skills were the fine and delicate ones which were called for at this point in history. And he was there.

Historically, when we examine a modern book, there are virtually no features in it that were not in books produced centuries ago. Actually, except for the process, or the means, little has changed in the manufacture of books over the centuries. We find that early books were printed in signatures and signature sewn for binding, color work was included, profuse illustration was used, and the sewn signatures were cased in durable, hinged bindings. All of the work was done by hand, but it was done. Books were printed and bound, people bought them and owned them, and in so doing gave rise to the tradition of using books to spread knowledge. On this foundation our modern book publishing industry rests. A cooperative book club was even founded in the year 1736 in England.(4)

Block printing from carved or engraved wooden slabs, practiced early in the Orient and later in Europe, where the technique gave rise to the block printed book, is the earliest known form of relief printing. It ultimately developed into highly refined and sophisticated engravings, on metal as well as on wood, and undoubtedly influenced the inquisitive craftsman who discovered he could print from the depressed areas as well as from the raised areas. The Chinese probably invented block printing as an outcome of stone rubbings and thus have given us the historic base for modern photo-engravings, electro-plates, stereotypes, flexographic plates, and, most recently, photo-sensitive plastic and glass plates for letterpress printing. The esthetic influence of the characteristics of the true block print can be seen in advertising and illustration all around us today. Frequently this is produced from a slab of plaster of Paris, crudely carved, proofed, photographed and converted into a photo-offset plate. But its historic background is in that flourishing period of the hand-cut block print. The 1493 Koberger edition of Schedel's Liber Chronicarum contains 1800 wood block illustrations.(5)

Intaglio, or the printing from depressed or incised areas, reached its great heights for illustrative purposes just prior to the invention of photographically produced images. So accurate in tonal value are some of the old mezzotints and aquatints that they are hardly distinguishable from photographs upon cursory examination. The intaglio technique ultimately gave rise to gravure and then photogravure as practiced today. Man had long sought a way to give tonal values—halftones—to his illustrations. The wood block engraver, and later the metallic engraver, had developed some techniques for graining his plate mechanically. However, to the average viewer the result was still a two-toned value—pure black and pure white. Cross hatching was used, tiny burred wheels were used, but these still fell short of the creation of gray tones, or halftones, actually created by the eye in the blending of minute spots of blacks and whites. To the early etchers of copper plates we owe the base for modern gravure printing. The early etchers discovered that acid could be made to bite a fine dotted ground on the plate, and later by using a fine-burred tool or even abrasive powder, produced similar results. Out of these techniques, grew the concept of tonal values—gray tones or halftones—later to be produced by photographic half-tone screening.

It is important from an historic point of view that the principle of lithographic printing, accidentally discovered by Senefelder in writing a grocery list, has given us modern photo-offset printing. Even the practice of offsetting from the stone to a blanket and then to paper was developed by the stone lithographers to eliminate the tediousness of imposing images on the stones in reverse. And as tedious and time consuming a process as this may seem, it was used to add hundreds of illustrations to books, it was the mainstay process of map printing and tne printing of sheet music, as well as the backbone of that doubtfully glorious flowering of calendar art in the United States. Lithographic printing from stones was done in the early days on sheet metal containers using the offset process, and was undoubtedly used for decorating wooden toys and the pseudo-realistic expressions on the faces of rag dolls.

Screen printing, or stencil printing, was developed in the Orient at probably about the same time that block printing was developing. It is interesting to note that the design members were obviously adhered to mesh because no evidence of bridges or ties is found. The lacquer film invention of Joe Ulano, then, was developed in principle some hundreds of years earlier in the Orient.

It is important, particularly in education today, when our storehouse of technical knowledge grows so rapidly that none of us can keep abreast of it, that today's students realize that the vast graphic arts industry did not come suddenly into being at about the time they were born! Today's marvels of photographic and electronic imagery, and automated photographic typesetting and printing, are merely the present pattern or result, of a history which began when an ancient cave dweller drew some pictures on the wall of his cave to tell a story in a visual form.

As early as the end of the 18th century, European scientists began to experiment with the photosensitive characteristics of certain chemicals. This led inventors to the earliest picture-taking and creation of photographic images toward the beginning of the 19th century.

Out of this experimentation there developed, on historic foundations, new and different ways of producing photographic emulsions for relief and offset printing plates, the etching of gravure plates, and the creation of silk screen printing stencils. Today, photography and pneumatics and electronics and chemistry do the jobs that the graphic arts industry must accomplish. And the newer processes do these jobs faster, more accurately, and with less manual labor. But the students of today must know that out of the historic past comes evidence that all of these jobs were done before and that today we have merely discovered improved and refined ways of doing them.

As man stood and viewed the graphic arts industry in approximately the year 1820 (at just about the time that the first Fourdrinier machine was put in operation on the Brandywine here near Philadelphia),(6) just prior to the creation of the first successful photograph, and after Senefelder had invented the lithographic process, and before modern man had rediscovered stencil or screen printing, he did not have to communicate in the archaic media of stone tablets and parchment scrolls! Instead, what he saw in the industry was:

(1) Excellent letterpress printing in multicolor with perfect hairline register (without benefit of air and humidity conditioning);

(2) wood engraved illustrations with manually cut halftone patterns that are nothing short of unbelievable;

(3) aquatint and mezzotint renderings, particularly portraits, which still compare very favorably with photographic portraiture, and still confound the viewer;

(4) handmade and machine-made paper of controlled thickness and not subject to parching and foxing in over a hundred years;

(5) hand colored illustrations, particularly maps, colored by artists in an assembly line fashion, after printing by stone lithography.

(6) hand sewn, signature bound books, covered with linen or leather which are still sound and without broken spines or loose pages, to this day; and,

(7) daily newspapers, completely hand composed, illustrated with wood and metal engravings, produced overnight, printed in sheet fed presses, hitting the streets for sale every evening.

As man stood at the summit and looked at the complex world of printing, toward the beginning of the last century, when political fomentation was still at its height, he saw craftsmen working at a labor of love, using the most time-consuming and tedious of processes, to give the hungry public all that it wanted and needed: to read.

Arthur Young, a British traveler in Paris in June of 1789, writes: "I went to the Palais Royal to see what new things were published, and to procure a catalog of all. Every hour produces something new. Thirteen came out today, sixteen yesterday and ninety-two last week." In making reference to the crowded publishing shops in London, he goes on to say, "... they are mere deserts compared to Desein's and some others here, in which one can scarcely squeeze from the door to the counter."(7)

Thus, we can see that the historic impact on modern printing is that of an ever-growing appetite on the part of the reader, pushing the printer to more and more impossible problems to be solved. Gutenberg gave man a foretaste of what it can mean to acquire knowledge from the printed word. Today, scientists are developing electro-optical printing systems with potential speeds for setting over 100,000 characters per second.(8)

The history of printing is a history of man's efforts to communicate in writing. There is little purpose in discussing the uses of knowledge with such an erudite audience as this. I think that all will agree, however, that man has always wanted to know. When he ceased to have this desire he stopped moving from darkness to light. And our present generations have grim evidence of this. When man no longer wants to know, he ceases to be a man. History will bear me out in this respect.

And the history of printing, whether it meant casting one's own type, setting it, character by character, and printing it on wet, handmade paper, or whether it means sitting in an air conditioned room before an electronic console, is the story of how the printing industry has always satisfied man's unrelenting quest for knowledge.

FOOTNOTES

1. "Disarming Candor" Book review of The Bitter Heritage: Viet Nam and American Democracy. New York: Houghton Mifflin Co. Reviewed in Time Magazine, February 3, 1967, p. 77.
2. S. H. Steinberg, Five Hundred Years of Printing. Baltimore: Penguin Books Inc., 1955. p. 58 ff.

3. William L. Langer (Edit.) An Encyclopedia of World History. Cambridge, Mass.: Houghton Mifflin Co., 1948, pp. 340-41.
4. Steinberg, op. cit., p. 232.
5. Steinberg, op. cit., p. 232.
6. Anthony Marinaccio, Exploring the Graphic Arts. Princeton, New Jersey: D. Van Nostrand Co., Inc., 1959, p. 221.
7. Reay Tannahill (Edit.), Paris in the Revolution. London: The Folio Society, 1966, p. 23 ff.
8. Ford Park, "The Printed Word". International Science & Technology, January, 1967, No. 61, p. 24.

Mr. Kafka teaches at Millersville State College Millersville, Pa.

W-4.8 Mechanics & Power
Special Panel Session
POWER AND MECHANICS —OLD OR NEW?
Gen. Chm., Paul Wighaman; Chm., Harvey E. Morgan; Rec., Joseph P. Flinn; Obsr., Richard W. Barrow; Panelists, Terence J. Trudeau, William G. Turner, James Keegal; Hosts, Patrick R. Doherty, Jr., J. Philip Young

EXPERIENCE-CENTERED APPROACH TO THE STUDY OF POWER

Terence J. Trudeau

While there are many interpretations of industrial arts, one finds equally as many in the area of power mechanics. The most common ones are: (1) automotive courses using the title power mechanics; (2) small piston engine repair and maintenance; (3) fluid mechanics taught under the title of power mechanics; (4) a study of all phases of power as utilized in our industrial society.

For this discussion we will select the last interpretation and shall further define power mechanics as "that discipline which concerns itself with various energy forms, the matter from which they are derived, the conversion of these energy forms into useful power, and the means, methods, and efficiency of such conversion". (1)

Many people will ask why automotive mechanics is denied a prominent place in this scheme, since traditionally it has been the focal point in this area. The answer is quite simple: as such, the automotive industry is now relatively small when compared to all the other functions of power devices in this country. For example, the aerospace industry employs approximately twice as many people as does the automobile industry, with most of these jobs having emerged within the past ten years as a direct result of our space program. Yet, we are presently giving little or no classroom time to space power systems, while at the same time claiming to operate modern and well-rounded industrial arts programs in this country. General education today is broadening, and the area of power mechanics must do likewise.

In the book, Reorganizing the High School Curriculum, Alberty states that "the curriculum maker must also give attention to developing a program of general education to meet the common needs, problems, and interests of students".(2) To some degree industrial arts programs have been successful in achieving this. However, as our technical society becomes more complex, it becomes increasingly difficult to provide the facility to achieve this. For example, at the present time it appears to be impossible to study realistically the phenomena associated with rocket propulsion. The reason for this is that propulsion equipment used by industry is not generally adaptable to classroom use. At most, films, mock-ups, charts, etc. are obtainable to assist the teacher in providing education for students about our space age. Unfortunately, education of this type becomes subject-matter centered, and the students do not get the actual experiences necessary for complete understanding.

When the teacher uses this traditional method in teaching rocketry, the students learn about how a rocket engine is operated, but never actually operate these engines. It is apparent that the vital "experience" aspect is lacking. There is a great deal of difference between the ability to answer questions on an examination paper and the ability to apply knowledge of principles to a realistic situation. John Dewey is critical of obtaining knowledge without specific application when he says: "Pure knowing is beholding, viewing, noting. It is complete in itself. It looks for nothing beyond itself; it lacks nothing and hence has no aim or purpose." (3)

The basis for an experience-type educational program was projected by Dewey when he wrote: "Hence the central problem of an education based upon experience is to select the kind of present experience that lives fruitfully and creatively in subsequent experiences."(4) Industrial arts laboratory work should provide the student with these practical and meaningful experiences as well as theoretical lectures. In this area of power mechanics, new equipment is being developed to provide meaningful experiences with power devices. This hardware, by definition, consists of miniaturized versions of those used by industry and is so designed to be functional within the confines of a classroom or laboratory. Through the use of such apparatus, the students' knowledge of power mechanics is more complete. In addition, it becomes aligned with present-day society rather than the past.

Admittedly, our heritage is important. It gives us an appreciation of man's accomplishments throughout the years. However, to maintain a link with the past, to the extent that we sometimes do in industrial arts, is to refuse to face the present and future. Many programs in industrial arts are closely related to the cottage industries of years ago and in no way reflect contemporary industry. Also, we tend to teach the traditional and completely ignore the newly arising aspects of our industrial society. The most common example of the latter is in the area of power, where we continue to teach automotive mechanics exclusively, with complete disregard for equally important aspects, such as the aero space industry, marine industry, stationary industrial uses of power, etc. It is time we broke the link with the past and linked-up with the present and the future. Our future depends on it.

FOOTNOTES

1. Terence J. Trudeau, "Planning Contemporary Power Mechanics," Industrial Arts Vocational Education, March, 1966, p. 46.
2. Alberty, Harold, Reorganizing The High School Curriculum. p. 48.
3. John Dewey, Reconstruction in Philosophy. p. 109.
4. John Dewey, Experience and Education. pp. 16-17.

Mr. Trudeau teaches at Buffalo State College, Buffalo, N.Y.

IT IS NOT NEW THAT AFTERMARKET SERVICE IS THE KEY TO SUCCESS

William G. Turner

Recent trends at Indiana State University have led to the formulation, proposal and limited implementation of four major curriculum areas for industrial arts. These areas as set forth are manufacturing, construction, communication and service.

The purpose of my presentation is to discuss some of the ramifications of service or service arts instruction as we are attempting to develop them at Indiana State University.

How does service fit into the life purposes of mankind? As educators and philosophists deal with ideals of life purposes and goals, let's look at the one ideal that lends itself to a basic purpose or goal. Man's purpose in life to those of us who profess Christianity is service to our Creator, to our fellow man and to ourselves. Others might include service to a government, religion and so on. In a final analysis we live to serve in some capacity.

The man who mines or logs serves his employer, his family and the whole of mankind by gathering the products of the world about him for the use and convenience of others. The minister serves both God and man. The politician serves government and its people and in some instances self, we are led to believe. The plant manager or superintendent serves the stockholders, the board of directors, the workers and all others who are affected by his actions and decisions. The factory worker serves the company with his efforts, and himself and his family with the pecuniary rewards of his labor.

The area of aftermarket service as it applies to industry involves the service of products after they have been marketed. Prior to marketing, the concerns of design, routing, production, control, distribution, marketing, etc. have been a few parts of the total of industrial society.

There are vastly more people involved with most products after they are marketed than in their production. Automation is increasing the number of products and reducing the number of people involved in the manufacture of a product.

The responsibility of service is manifold. The user should be able to realize his responsibility in regard to maintenance requirements, limitations and capabilities of equipment. He should be able to recognize situations and warnings indicative of forthcoming trouble and malfunctions. Exposed to certain brief experiences and practices the user will be a better consumer and more practical purchaser. The number of mechanisms available to the average consumer today is incredible. We are living in an age of materialism and machines. While manufacturers are, for the most part, doing their best to keep these mechanical marvels as dependable as possible, they still malfunction on occasion. If most of you aren't aware of this, you must live beyond REA or are unmarried.

A recent news release by one of the major household appliance manufacturers indicates that they are designing do-it-yourself repair kits for their appliances. This is another justification for providing industrial arts students with some ability to diagnose and understand their mechanical surroundings.

The matter of purpose for industrial arts education comes into focus as we consider service arts. Is our motive a part of general education and development of general concepts, or is it that of training in specifics, which thereby trends toward the realm of vocational training?

Up to this point in the discussion a plea has been made for acquainting the user with his product in terms of general concepts. The same broad approach is suggested and is now being developed by many institutions involved in the various new approaches to industrial arts instruction in manufacturing. If we include the word "technology" in our curriculum and pursue training into special areas, we then approach the vocational training areas. It is my contention that in any case where a student enrolls in a specific industrial arts subject matter area beyond the second semester, it has ceased to be industrial arts. Be that as it may, this is not a matter for us to decide here.

Up to the present, a great deal has been done in the areas of power and auto mechanics toward the understanding of construction, function and service of small engines, the automobile and the sources of power. Where these types of programs have had competent instructors and adequate facilities, they have been well accepted by all concerned and are adequately serving the needs for which they are designed.

The service arts area offers a challenge to teachers of industrial arts in all areas. Need a thermal couple to control the heat process in manufacturing? How does it work? What is it? What are the limits of its use? How about a warp switch? How does absorption refrigeration differ from conventional types? On second thought how do conventional types work? How do you identify a bad bearing? What is a servo-mechanism? How can you check a diode? How does it work? Why does the auto manufacturer use it? Why does our closed circuit TV give us problems in monitoring a manufacturing process? How much can we spend for its repair? How do you diagnose and correct a malfunction in hydraulic circuits? Certainly service arts doesn't have the answer for all these questions, but it does allow a chance for students to gain insight and experience into how things work and how they are made. The pure joy of learning and observing how things work is one of the highlights for students of all ages and mentalities.

What better way to understand the principles of cycles, solenoids, glow coils, microswitches, and timers, etc. than to work with an automatic washer or dryer? Will they learn how to repair them? Probably not, at least not in a few days or weeks but they'll get the general idea of the thing. "Concept", I believe it's called now. In many cases students will be able to make minor repairs to appliances and may pursue the major problems to a satisfactory solution.

Integrated areas of comprehensive instruction would include hydraulics, pneumatics, refrigeration, servo-mechanisms, heating systems, etc. Supporting areas of instruction would include electricity, welding, etc.

Service arts exploratory experiences for a beginning course would be in the area of household appliances, household equipment and electrical circuitry. These would be taught after or in conjunction with power mechanics courses.

Technical training and advanced experiences would constitute a program designed to provide the learner with limited skills, experience and basic information that should be salable in the employment market. This latter type of program, it seems, would provide worthwhile experiences for the 50 to 60 per cent of our high school students who are not college-bound.

Mr.Turner is coordinator of power and auto and service arts area at Indiana State University, Terre Haute Indiana.

DEVELOPMENT OF HYDRAULICS AND SERVO-MECHANISMS

James J. Keegal

There are, basically, only three methods of transmitting power which have definite commercial importance. One is by gears, pulleys, shafts, chains, belts, cams, clutches, levers, wheels, springs and links. This is called mechanical transmission of power. The use of motors, magnets, wires and electronic apparatus of various types will transmit power also and is called electrical power. Use of compressed air, oil, water or a vacuum is called fluid power. Of the three, electrical and fluid power are the most flexible, but, unfortunately, the least studied in the comprehensive high school.

Fluid power, or hydraulics or fluidics, as you may call it, is not new. The ancients had knowledge of hydraulics. To pump water, the Greek scientist Archimedes invented a coiled tube which is still used in Egypt today. The Romans had a very elaborate system of water distribution for their fountains and public baths. They had water meters which worked on a quantity of water going through a specific sized orifice. The water wheels of various types were a crude use of hydraulics, but relied mainly on mechanical transmission of power.

Not until the process of boring a cylinder was developed could much be done to develop a workable hydraulic system. Various types of pumps had been developed, and these were driven by the water wheel, wind or steam.

In the latter part of the 19th century, a few industries in England did have an hydraulic system. It consisted of water pumped into an accumulator tank with a heavy pistion supplying added pressure. The pressurized fluid was distributed to presses by cast iron pipe. Needless to say, it had many drawbacks: leaky packings, rust, dirt and poorly fitting parts needing constant adjustment. In America today, there are still elevators that use water as their hydraulic fluid.

With the development of better machining methods and fitting of parts, there was further development to produce hydraulic equipment as we know it today. First was developed the hydraulic brakes in automobiles, hydraulic shock absorbers and basic hydraulic systems. None of these systems were dependable until World War II. At this time were developed synthetic packings, which were self adjusting, better and more accurate machining techniques, smoother finishes, stronger but lighter metals, electroplating methods, and fluid development. From there, we have ventured into systems used in aircraft and machine control of extreme accuracy and from large systems controlling missile launchings to miniature fluidic systems used to control ordinance materials.

Many of these systems are very common to us today: the hydraulic brakes on our cars, automatic transmissions and power steering, not to mention the water we drink and the machines that provide goods and services.

With hydraulics as a prime mover or force in industry today, why has so little been done in a comprehensive high school? One reason has been cost, and the second, availability of equipment and instructional material.

To develop an area in fluid power, several of the ideas I am presenting may help.

One of the first things should be instructor preparation. In past years, this has been rather a hard course to get. With the added emphasis on fluid power, many colleges are offering workshops and suppliers of equipment are doing the same. One place to obtain more information is from the Fluid Power Society.

Second, determine whether the geographical area warrants a working force requiring a knowledge of fluid power. If it does, find out what the local industries are. Any of the following industries would require such a labor force with this knowledge: industries using or manufacturing air or hydraulic components, aircraft, heavy equipment, machinery, packaging, elevators, and various service and maintenance industries.

Third, develop a course of study suitable to your philosophy of education and the area needs. It should contain the following basic information:

1. Physical laws, formulae and practical application of the laws.
2. Measurement of changes in the system (pressure, volume, vacuum, etc.,), definition of terms and standard drawing symbols.
3. Types of cylinders and their function.
4. Types of valves and controls.
5. Various pumps and pressure developing mechanisms.
6. Accessories needed to control the system, such as accumulators, pressure relief, types of lines, connections, etc.,
7. Safety of operation concerning fluids, air and vacuum.
8. Plenty of good, practical experience.

The order in which you set this up can best be decided by you with the help of textbooks and qualified personnel in the field.

The fourth phase is to develop facilities. This may mean, if the need is great enough, a separate course in fluid power with its individual lab or a part of an existing course such as power mechanics, metal working, or electronics.

The fifth step is to procure equipment. There are on the market many good fluid power instructional units that cover hydraulic, vacuum and air. Their cost is not unreasonable, and all parts are interconnectable. Securing individual components from local industries may be done through purchase or donation. It is fair to warn you, components are not cheap. Surplus equipment is fine if you can get enough of it, and it is interconnectable. I mention this because there are very few complete surplus systems around, and if you are not careful, the connections of individual components may or may not match. The pressure on these systems is quite high. The acquisition of commercial unit systems, or removal of systems from a piece of equipment, works well. An example of this would be a power steering system from an automobile or, if you are lucky, a system from some machine or other equipment.

Fluid power is flexible in that you can transmit your power through flexible tubes or lines to almost any location. The same may be said of electrical power in the form of servo-mechanisms. Here again, power may be transmitted through all types of environment through the use of wires or cables.

The word "servo-mechanism" may be new to many not acquainted with the electronics field. Actually, many every-day objects are servo-mechanisms. To better understand servo-mechanisms, I can compare an every-day device with the definition of servo-mechanisms. The thermostat in your home is a good example. A servo-mechanism must be able to accept an order which defines the result that is desired. This is done when you set the oil burner thermostat to the certain temperature that you want. The servo-mechanism must evaluate the existing conditions. Should the temperature around the thermostat be higher than you set it, the furnace does not go on; if the temperature is lower than your setting, the furnace goes on. The servo-mechanism must be able to compare the desired result with the existing conditions, obtaining a difference or error signal. The bi-metallic strip in the thermostat, being heat-cold sensitive, does this for you by expanding or contracting according to temperature and either opens or closes contacts. A servo-mechanism must issue a correcting order based on the error signal which will properly change existing conditions to the desired result. The thermostat, if it closes and starts the furnace, must and does turn the furnace off when the air around it warms up to your setting. If it did not have ability to shut off (which it does, due to the bi-metallic spring), most of us would be very overheated. Finally, the servo-mechanism must have the means of carrying out the correcting order. The thermostat must be connected to the furnace controls so that when the heat is up to our setting, it can shut the furnace off until either the temperature drops or we make a new setting.

Here is a device which controls our home and industrial heating, giving constant temperature, with little or no attention. This is but one type of servo-mechanism.

There are basically three types. One is the positioning servo-mechanism. These would be used in gun control on ships, steel mill rolling lines, automatic pilot, missile guidance systems and anywhere an object must be positioned or rotated.

The second servo-mechanism is a rate servo-mechanism. This type moves a load at an exact speed and direction as selected by a machine operator or other servo-mechanism. These are units which control valves, hydraulic systems, assembly lines and machinery.

The third type is the calculating servo-mechanism which makes a desired mathematical computation from information put into it. The answer is delivered in the form of mechanical motion or electrical signal or a combination of both of these. This type includes such items as computers, guidance systems, automatic pilots and sections of automated equipment and machines.

One point I do want to make clear is that the area of servo-mechanisms is not a study of automation. Servo-mechanisms only supply a control factor to automation.

The difficult part of developing an instructional area is instructor teacher training. Servo-mechanisms have been around since the invention of the fly ball governor on the steam engine. Not until World War II, and use of electronic devices, were servo-mechanisms small and dependable enough to do their intended jobs.

The U.S. Navy has done much to push the instructional field of servo-mechanisms, and to develop courses. Technical schools and colleges soon followed the lead, as well as teacher training institutions. Recently, the growth of automation and its impact has caused a greater number of institutions of higher learning to include servo-mechanisms. Recent graduates are more likely to be acquainted with the servo-mechanism field than those teaching for many years. So, where do we learn? It's back to school to those colleges or universities offering the courses or to correspondence courses.

In developing a course on the high school level in servo-mechanisms, it is the same as developing a course in fluid power. First, instructor training, second, geographical needs, third, developing of a course of study that fits your philosophy of education. A typical course may contain the following:

1. A pre-requisite of electronics or a basic electricity course containing instruction in circuitry, relays, motors, wiring, transformers, and amplifiers.
2. Types of motors and motor controls.
3. Gearing and mechanisms.
4. Synchro, selsyns and transducers.
5. Mechanical servo-mechanisms.
6. Servo and motor control amplifiers.
7. Servo motors.
8. Vacuum tube and solid state controls.
9. Practical experience to fully explain all of the theoretical problems.

For most high schools, depending upon types of student, the more practical, realistic, and simple the job to be learned is, the more meaningful the course. For some, understanding and wiring a small motor to a latching relay to make the motor run forward, reverse, or stop, would be a great goal. Others may be able to make up automated adaptations to shop equipment.

To do any of these things, equipment is a necessity. There are some kits on the market for basic instruction. More school suppliers are developing these each year. Many precision component manufacturing companies have developed kits for use by engineers and prototype designers. These are not cheap, even with a basic kit running about \$1200.

The cost of obtaining parts through commercial sales is extremely high. There is great precision in all of these components. Local industries may be of some help in securing complete, obsolete units taken from equipment or prototypes. Be sure you get all of the parts. The cost of one part may be more than a new instruction kit. Beware of government surplus, as it is often so specialized in its application that it is not practical as an instructional aid. Much of it runs on 400-cycle alternating current. Unless you are able to make up such a power source or find one, the equipment may best be used as cutaways or left alone. A good 400-cycle power supply can be made from some of the surplus dynamotors and an electric motor. Purchasing of kits is cheaper and easier.

To sum up the development of fluid power and servo-mechanisms, six (6) points should be remembered:

1. Both are completely flexible in application.
2. The more sophisticated our industries become, the more we will need flexible power sources.
3. Young people and teachers must have training and be prepared for these fields.
4. The equipment used is available through various channels.
5. Development of a course will be new and challenging, but not so complicated that it would be impossible.
6. The devices today will be obsolete in years to come. Their usage and operational theory will change little, and be in ever-increasing demand.

Mr. Keegal teaches at Wayne Hills High School, Wayne, N.J.

W-4.9 Metals
Special Panel Session
METALS TECHNOLOGY OF THE PAST
Gen. Chm., Kenneth R. Clay; Chm., Wayne D. Coleman; Rec., Virgil L. Carter; Obsr., Olin Singer; Panelists, John Ottiano, Ralph Miller; Hosts, Frank O. Gaylord, Keith C. Birks

LOST-WAX INVESTMENT CASTING— PAST AND PRESENT

John W. Ottiano

In the past few years there has been a significant increase of interest and cooperation on the part of commercial foundries, industry, sculptors and institutions of higher education, in pooling foundry knowledge, research and expanding modern technology. Great steps have been made toward the adaptation of this knowledge to the needs of contemporary fine arts and the burgeoning wants of industry.

Nearly 50 centuries ago, man discovered that he could cast practical and artistic objects from molten metals. His needs were simple, and his time without limit. Today this is no longer true. The objects he requires are more complex, and time is money to industry. As a result new methods must be developed which will allow both the artist and the industrial designer to create without the limitations imposed by the ancient, time-consuming process.

Probably the Neolithic man watched crude ore trickle from his campfire into cavities in rocks and sand, where it cooled and solidified, creating an immediate tool. Or perhaps the ancient magician, who formed idols with beeswax, imbedded them in clay and sacrificed them by fire, found that he had created a ceramic mold. Filling it with molten metal, he reproduced in metal the image which had originally been formed in wax.

The origin of the casting process is partially obscure or lost in the far reaches of ancient time, but we do have knowledge that early man did use wax, clay and molten metals. In the use of these he developed the technique of the lost-wax or cire perdue process of casting.

Some archeologists believe that each early culture that came to use metals invented its own techniques. There are others who declare the knowledge was discovered once, then passed on from one part of the world to another. Our knowledge of the techniques of the lost-wax process as practiced in ancient times is vague. Until the Italian Renaissance, in which the sculptor Cellini gave a detailed description of his casting process, we know little. The process he described is still used today in Italy, the United States and European countries, very similar to the techniques we know were used in ancient Egypt.

Although the conventional founder uses a greater variety of investment materials and waxes with some new techniques, the ancient problems of casting are still the same. Foundries in the United States for the past several years have found it difficult to keep pace with the rapid industrial growth, mass production, high wages and the replacement of aging skilled foundry workers. The entire process of lost-wax casting became so expensive and time-consuming that it was almost extinct among United States commercial foundries a few years ago.

Today, because man's research in science and fine arts has united modern technology and contemporary imagery, the ancient process of casting metals by the lost-wax process, only slightly changed, has been re-established.

The Ford Foundation project, which was conducted at the Massachusetts Institute of Technology, under the direction of Professor Merton Flemings and sculptor Alfred Duca, developed a simple and inexpensive method of casting. The sculptor worked directly with a large complex structure of expanded polystyrene, which was invested or surrounded with sand, having proper venting for gases to escape. Bronze was poured into the mold, vaporizing the polystyrene and producing a 400-pound structure in 38 seconds, by the "Full Mold Process".

Another significant development is the adaptation to art casting of the industry-oriented Shaw Precision Casting Process by Joel Meisner, sculptor and now director of the Art Casting Division of the Avnet-Shaw foundry in Plainview, Long Island. This is a method of producing extremely precise, finely-detailed castings in ceramic molds, which are used primarily in the automotive, appliance and aircraft industries in the United States.

The present-day conventional lost-wax process involves many complex preparational procedures, time-consuming stages and high labor costs in the total executional mechanics. In using the conventional process, it would take approximately four days to the time of the wax bakeout, while the Shaw Process duplicates this stage in six hours.

The Shaw Process uses high temperature refractories and bonds, allowing for an extremely stable permeable ceramic mold, having microscopic cracks which permit the mold to vent off gases without vents and canceling out the back pressure of gas when hot metal is poured. The extensive conventional gating is eliminated, and only a single ingate is necessary.

The mold does not dilate when receiving hot metal, which eliminates the dangers of cracking, seepage of metal into the mold, cracking of the metal in complex shapes and shrink areas. The ceramic mold is chemically inert, tough and shock-resistant. There is no impregnation of mold particles into the molten metal, which would disfigure the desired surface of the finished casting.

The Shaw Process allows the sculptor/designer to have a broader range in the selection of his modeling media. The bakeout at 2000°F plus permits the use of materials or combinations of materials which are combustible at this temperature, but would not be at the lower temperature used in the conventional method.

New synthetic waxes, having more fluid and stable properties, help to produce finer textures and details when poured against the rubber-like molds. These molds, made from a variety of rubber-like materials developed by modern technology, allow the Shaw Process flexibility in the production of patterns to adjust to the simple and complex areas of a single piece of work.

Metals having a melting point in excess of 4000° can be used in the Shaw mold, which allows designers to explore a wide variety of metals.

All of these developments constitute a revolutionary break-through in the lost-wax process. The sculptor, the educator in fine and industrial arts and the industrial designer are finding a new challenge in this age-old process because modern science and technology have joined in an exploration to adapt an ancient process to the modern world.

Mr. Ottiano is professor of Art at Glassboro State College, Glassboro, N.J.

FORGING—STRENGTH FROM THE PAST—ENDURES IN THE FUTURE

Ralph W. Miller, Jr.

From the dawn of civilization, man has devised methods of extending his physical limitations by using the materials he has found in nature. Perhaps one of the first tools he devised was the fist axe or hammer, upon which he later fixed a handle, thus providing more effective blows. The handle was made more secure when Neolithic man learned to make shaft holes.

Much later in time, man found special "rocks" (meteorites) which he formed under blows of the hammer rather than by cracking. By his crude methods he was able to form these metals into more effective tools or weapons. Thus, the forming of metals by hammering is considered the very first metalworking technique. It is almost as old as man himself, and certainly as old as written records.

Several Old Testament accounts, early Egyptian inscriptions, and writings of Greek, Phoenician, Chinese, Japanese, Persian and Indian historians trace the crude hammering of iron ore into bars and the further working of metal into weapons, jewelry and implements. It is claimed that steel was forged in China and India as early as 2000 BC. Discovery of wrought iron plate in the Great Pyramid and an iron falchion blade under a sphinx at Karnak suggest the extensive use of forged iron in ancient Egypt.

During this early period the art of forging was regarded with uncommon esteem—an indication of its critical importance. Greek, Roman, German and Norse mythology contain their respective Gods of the Forge.

A second lineage may be traced back through the technology of stamping jewelry and coins. The earliest predecessor of our present-day impression dies are the ancient engraved stone platens used in the stamping of gold and silver sheet for jewelry in Mycenae and Crete about 1600 BC. Later (about 800 BC) coins were known to have been produced in a similar manner. About 600 BC the first bronze dies were developed. In Rome, in about 200 AD, more complicated impression dies, permitting greater precision, were in use. Simple flat dies and crude roll dies augmented the traditional blacksmith's hammer in the forging of armor during the Middle Ages.

The early iron furnaces also had an effect on the development of forging. Since the Catalan Forge and its predecessors were ineffective at melting iron out of its matrix, the pasty mass of metal had to be repeatedly hammered and heated to drive the unburned ore and refuse out and bring the metal to a condition of refinement and strength. This early iron was the ideal medium for the smith to use in fabricating objects, for it was tough, malleable, ductile and very resistant to rust. The fuel of the forge-charcoal-contributed to these characteristics, since sulphur was not introduced in smelting.

Charcoal iron, which is characteristically low in sulphur, corrodes in a way that leaves a black coating of magnetic oxide which protects it indefinitely. This accounts for the preserved objects of the charcoal iron era which have long outlived their successors.

The process of refining the early iron by hammering it into blooms and then painstakingly forging it into desirable products by the blacksmith was all quite necessary to develop a "quality" iron. It was necessary that the fibers should be interwoven in all directions to obtain perfect evenness in texture, and thus to insure against the metal breaking or tearing when being molded into shape.

The blacksmith was, without a doubt, one of the first and most important craftsmen in the embryo industry of America. Henry Kauffman, in his book Early American Ironware—Cast and Wrought, points out this fact by citing some examples taken from colonial directories. These examples indicate that anywhere from an equal number to more than twice as many blacksmiths practiced their trade than the sum of all other metalworking occupations at that time.

The forging trade during this era was, surprisingly, quite diversified and thus specialized. The blacksmith forged metal into both useful as well as highly decorative forms. His work included objects for the hearth, hardware items, candle stands of many types, cooking utensils, gates, and balusters. Mostly rough hammering was done by the blacksmith. File and die work was limited.

The whitesmith on the other hand was a more refined craftsman and concentrated his work on refining details such as engraving, filing, and making die impressions. He often worked in conjunction with the blacksmith, refining his work.

The farrier was the true shoer of horses. Although he used essentially the same tools as the other trades, his horse-shoe making was a less skilled trade. This trace was a "custom" fitting operation, and many unusually shaped shoes are found with specific uses.

Edge toolmaking was first carried on in the regular duties of the blacksmith, but in the latter part of the 18th century some craftsmen specialized in this trade. This was a highly skilled occupation which dealt with the difficult problems of forge-welding iron to steel for edge tools.

Another area of specialization was that of the cutlery business. The cutler produced table knives, butcher knives, swords, sickles, scythes, lancets, buttons and buckles, cork-screws, seals, forks, tailors' shears, thimbles, pinking irons, hatters' knives, etc.

Still another area of specialization was that of lockmaking. The early locksmith was able to earn his living on this art alone and the disciplines of this trade covered a broad range of forging, filing and fitting skills. The mechanical ingenuity and exactness required by this trade created an area of specialization which isolated the locksmith from other craftsmen in metals.

The gunsmith had to be skilled in brass casting, woodworking, engraving and machining, as well as forging, in order to produce the finished object himself. Many guns were produced through the cooperation of many craftsmen, but it was the smith himself who was the key figure in making the parts function.

Still another special field in smithing was that of nail making. Although this trade lacked refined skill and creativity, it was an extremely important trade. The making of nails was easily adapted to the machine and thus one of the first production items.

The last smithing specialty was that of producing the iron work for the most highly important vehicle in the development of America—the wagon. Wheelwrights, as they were called were many times both wood and metal craftsmen. The banding of wood with iron to both strengthen and improve wear was extremely important during the early days. The wheelwright also forged all the hardware for the wagon's body—braces, axle bearings and hub inserts (called "boxes").

We might say, then, that forging was the very backbone of our existence during the 17th, 18th and 19th centuries. When iron was formed, it was for the most part forged into useful products. However, as the demand for more and more metal objects grew, the time involved to produce these objects by means of the hammer gave rise to other forming methods—castings being the largest. We must also consider that the smelting of iron had been perfected to the stage that sand molds could be filled with molten iron and thus directly produce the object desired. Early castings resembled the forgings but were far inferior to their counterparts in the qualities of strength and shock resistance. Only those cast objects which did not depend on these characteristics were successful.

Modern impression die forging, in barely recognizable form, began to appear toward the end of the 18th century, after the development of a specific type of equipment—the gravity hammer with a guided ram—had taken place.

All these influences—the crude hand forging of iron, the use of dies or stamps with impressions, and the forging equipment which permitted precise control of the dies during the application of energy—merged during the course of the 19th century to establish the fundamental process from which our modern impression die forging technology has grown.

Let us look at the characteristics inherent in forged objects. The forging process is the shaping of metal under pressure or impact to produce a desired shape. This controlled deformation of material (usually performed at elevated temperatures) results in greater metallurgical soundness and improvement of mechanical properties. The primary advantage of forging is the directional alignment of the grain to achieve the characteristics of strength, ductility and resistance to impact and fatigue. Through the successive stages of hot working, the grain flow follows the contours of the object, thus providing the maximum strength characteristics. This working also refines the grain to produce uniform characteristics throughout the object. This phenomenon makes machining, welding and heat treatment easier because irregularities such as grain size, segregation, surface inclusions and sub-surface voids are eliminated.

The production of forgings in closed dies has additional advantages in the area of uniformity of shape and size as well as in these internal characteristics. Objects which are produced consistently to a determined size can be machined, removing a minimum of stock. With the development of a finish forging operation called coining, even closer tolerances can be held and a better surface finish obtained through this cold working process, thus reducing or even eliminating machining altogether.

Since forgings have such a high strength-to-weight ratio, many sections or portions of the object can be reduced to save material and cut weight. Many times, less expensive materials can be substituted in the forging process because the maximum advantages can be obtained from these materials.

Forgings are normally used where strength, reliability, economy and resistance to shock and fatigue are vital considerations; and they can be produced from materials offering the desired degree of high or low temperature performance, ductility, hardness and machinability. In recent years the number of different metals and alloys specified for.

impression die forgings has grown at a rapid rate. Through advances in forging technology, some materials considered unforgeable just a few years ago are now processed by routine. Those alloys which respond to forging most easily are aluminum, magnesium, copper, carbon and alloy steels. Those offering the most resistance to forging are alloys of molybdenum, nickel, tungsten and beryllium.

The broad diversity of properties, sizes and design opportunities available in forgings is exhibited in virtually every branch of industry. By far the greatest market for forgings is found in the aerospace and automotive and truck industries. Together these two use over one-half of all the forgings produced. You have probably surmised that where speed, reliability (safety) and weight are important—you will find forgings.

The modern techniques of forging range in degree of perfection from the smith forging of tongs, for holding forging multiples, to the high-energy one-blow methods where kinetic energy amounts of 105,000 ft.lbs. are imparted to the forging. Some of these forging methods are smooth die, roll, impression die, extrusion, press, high-energy, upset and rotary swaging.

We in the field of industrial arts have a responsibility to provide experiences which impart an understanding of the technologies of the past, present and future. Our job today is to look at our present programs to see where they could be redesigned or implemented to meet the advances in technology. More specifically, let us scrutinize our forging program. I'm afraid that many who have retained their forging programs have not changed this area in the past ten to twenty years. Some have eliminated it altogether. Are we only forging ferrous metals? Are we only using smith forging techniques? Are we limiting our fuel to coal and thus hindering student interest in this area?

We have for years been using our forging area only to teach past technology. I would be the first to admit that all machine processes are but extensions of the hand. The question I ask is how far removed from the machine process are we? If we are too distant I question the correlation which can be made by the student.

I am sure that we have thought about the dangerous and expensive equipment employed in the industry and given expansion the "cold shoulder". What about press forging? Hydraulic presses are available to exert 50-75 tons per square inch—this being suitable size to be used in the industrial arts laboratory. The movement is slow, can be controlled easily and reversed with a turn of the switch. A press of this type could be justified in conjunction with other processes like draw forming, powder metallurgy, extrusion, weld testing, as well as arbor pressing and punching operations. Obsolete sets of dies could be purchased, and students could learn these operations by doing rather than just by talking about them. We in industrial arts have grown lax on activity, and as technology advances, we have tended to withdraw into the classroom and to limit our experiences to the verbal. We can no longer just adopt those experiences which can smartly be incorporated in a project of some type. Our technology is becoming too refined. If we limit our experiences to those only done by hand we have moved to far from the present and the future. What is wrong with having a boy take metal powder, put it in a die, and press it to 35 tons/sq.inch? Then have him remove the green compact, sinter it in an oven and possibly infiltrate another lower melting alloy into the mass. How much more he could benefit from this experience than by talking or reading about it.

Our heating methods also must be updated. Gas forges are employed extensively in newer industrial arts facilities. Unfortunately, most of the types I have seen are not designed, as is the coal forge, to concentrate the heat. This is very necessary for smith forging techniques. When we move in the area of impression die forging, this overall heating technique will prove very satisfactory. For localized heating, 60-cycle induction heating seems the most desirable to me. To my knowledge, equipment suitable for the industrial arts laboratory is not available.

Forging is an area which is easily saleable to a student if we emphasize the superior characteristics of the finished product and the direct control the student has on the finished product. All forged objects today are of utilitarian design, and the early decorative uses have been replaced by other forming methods. Our forging projects should reflect this change. All types of forged tools would be more reflective than "doggy forks" and candelabra.

A forged project can be a very challenging design problem. The student must decide which cross-sectional area of stock will be most desirable to upset to produce the maximum thickness desired, to be drawn out and swaged to produce the thin areas. He must consider his material, grain flow, plan the type of hammer blow to drive his metal the proper direction and thus produce an object which will obtain the properties of strength and reliability desired in the part.

Just as the forging industry has advanced beyond the drop board hammer and the coal forge, we must forge ahead to update our forging programs. Let us scrutinize the modern methods of metalworking and provide those experiences which are safe and within our expense limits. Our programs should not drift too far from the present, but must be constantly updated. Let us then get background from technologies of the past, keep our programs in line with technologies of the present, and be looking to the future for methods our programs can incorporate.

Mr. Miller teaches at Millersville State College, Millersville, Pa.

W-4.10 Woods
Special Panel Session
WOOD AND OUR EARLIEST HERITAGE
Gen. Chm., David A. Rigsby; Chm., Claude R. Edwards; Rec., Paul R. Meosky; Obsr., Joseph L. English; Panelists, Alfred F. Newton, John Carl Long, Paul W. Eshelman; Hosts, Joel L. Lamke, Arthur M. Bagley

WOODWORKING IS A LOST ART?

Dr. Alfred F. Newton

Frequently we hear industrial arts teachers, educators and supervisors say "woodworking ought to be de-emphasized in industrial arts programs". "We are fifty years behind times in most of our industrial arts programs because of too much emphasis on woodworking." "We need to replace woodworking as a subject area in industrial arts." With comments like these coming from the industrial arts leaders, it is very easy to jump to the conclusion that woodworking is on its way to becoming a lost art.

A nationwide study of industrial arts in 1962-63 revealed that the general woods subject area had the second largest enrollment. The largest enrollment was in a subject area called general industrial arts, which also contained woodworking. Thus one can assume that woodworking is still a very popular subject area in industrial arts and quite a long way from becoming a lost art.

Enrollment figures and course titles will not give the answer, however, to whether woodworking is a lost art. We need to take a very close look at woodworking in the industrial arts program as well as in industry. In so doing we are brought to the realization that woodworking is not a lost art but a changing art in terms of technique.

Throughout the remainder of this paper, support is given to the notion that woodworking, a changing art, is an essential part of industrial arts.

Most industrial arts leaders agree that one of the major objectives of industrial arts is to provide the proper experiences for all students to learn to control their industrial-technological environment. To accomplish this objective we must take the subject content from industry and adapt it to the school laboratory environment. In taking our content from industry, we must include the wood products industry, since it is one of the largest and most important in our country.

Among the occupational areas of the wood products industry are carpentry, cabinet-making, paper making, chemical products, pattern-making, boat building, furniture design, sales and the like. An analysis of these occupational areas in terms of skills, tools, machines, processes, materials, economics and human relations will give insight into what content is to be included in the woodworking area of industrial arts. The content will not be the same today as it was in the past. Industry is changing in terms of products, processes, machines, economics, human relations and the like.

The manual training programs of the nineteenth century developed into the present-day industrial arts programs and brought along woodworking as the major subject area. The Russian system of manual training can be found in present-day industrial arts programs much too frequently.

A recent visit to a new junior high school was shocking when the principal said, "Let me show you our modern manual arts shop". He had a traditional woodshop with twenty four sets of hand tools and the usual woodworking machines. A sign on the door read "Manual Arts". The new teacher in this program was very apologetic and explained that changes would be made during the year to convert manual arts into industrial arts.

Woodworking in industrial arts must consist of more than a series of graded exercises in which students develop the basic skills of using woodworking tools. An interpretation of the present-day woodworking industry must be given and supported with the proper learning experiences. Basic skills are an essential by-product of the program and are not to be considered as an "end" but rather as a "means to an end".

In giving consideration to the avocational and recreational purposes of industrial arts, we must recognize the importance of basic skills. In this respect wood becomes extremely important as a material suitable for these purposes. We get no real rebuttal to the claim that wood is the best material to use in teaching basic hand tool skills.

Most industrial arts leaders agree that consumer knowledge is one of the major functions of industrial arts. As one phase of consumer education, the study of wood products can give insight into the quality of many items all students will someday purchase. This purpose can be served in the woodworking laboratory.

In what way can we better develop the appreciation of good design and workmanship than in a unit of woodworking study? It is easy to underestimate the value of developing in each student the ability to design, create, plan, select proper materials, properly care for tools and orderly carry out the construction of a useful wood project. Much too often we evaluate the program in terms of completed projects and not in terms of abilities, attitudes and appreciations developed in the student during the process of building a project.

In years past the emphasis seemed to be on the art of hand woodworking. Today the art has been modified to utilize power tools, machines and processes to give the desired shape and form to wood. It would be unjustifiable criticism to say that the teacher of the past was wrong to teach only hand woodworking. Teachers today ought to be very careful to limit the instruction in hand woodworking to a small segment of the total course. They should use up-to-date tools, machines, materials and processes. This would not eliminate the art of woodworking; it would change only the techniques by which we practice the art.

Dr. Newton is head of the department of industrial education, Clemson University, Clemson, SC.

THE REED ORGAN—FINISHED OR REFINISHED

John Carl Long

The study of this instrument is intended only as a pilot study. Other studies of instruments, skills, processes or any treasures of the past can be explored by students involved in the project method, research and experimentation method or the history of technology approach to the teaching of the industrial arts.

Studies such as this should be designed to add to the enrichment and cultural expansion of the individual in whatever area of endeavor he explores. Again, the following study is offered only as an example.

Preliminary review reveals that the American cabinet organ, commonly called reed organ, pump organ, parlor organ and various other terms, played an important part in bringing music into the American home.

This study has shown that the cabinet organ was basically a reed instrument, played by means of a keyboard, with bellows providing the apparatus for propelling the air against the reeds. The free reed employed in these instruments beat through an opening in the reed frame. This reed was similar to those in the mouth organ or harmonica.

The word "organ" dates back to the Greeks of the second century BC. The word "organon", means instrument - more particularly, musical instruments.

The first type of organ was probably the fabled Pipes of Pan, called a "syrinx". This instrument was made up of a number of pipes or reeds tied in a row and was played by blowing across the ends of the pipes. Later, pipes were set in a wind chest and a bellows added to supply the wind. By the 11th century, slides or valves, operated by a keyboard, were introduced, to control the sounding of the pipes. This pipe instrument evolved into what is today called a pipe organ.

The first reed organ dates to the 17th century. It had a small keyboard and two bellows which had to be pumped by hand. It was called a Bible-Regal because it was carried from place to place by folding it like a book.

The next instrument of importance was the harmonium, invented by a Frenchman, Alexandre Debain, in 1842. This instrument employed two registers or sets of reeds, played from one keyboard. The bellows was pumped by foot pedals. The American version of this instrument was the "melodeon", invented by Jeremiah Carhart of Poughkeepsie, New York. The main difference between the melodeon and harmonium was that the melodeon operated on a suction or vacuum principle; whereas, the harmonium had the force system. The reeds of the melodeon sounding into the case had a much more pleasing, mellow sound than that of the harmonium.

Emmons Hamlin, in 1850, discovered the art of "voicing" or "coloring" the tone of the reeds. Hamlin found that by very slightly filing, bending and twisting the tongue of the reed it could be made to imitate the sound of other musical instruments. In 1865 Hamlin, with his partner Henry Mason, formed a company and began manufacturing a cabinet organ. With the works of the organ enclosed in a cabinet, mechanical devices such as double exhausters could be added to the organ. The double exhauster added to the bellows was pumped by two pedals in alternation; by this means an evenness of tone was achieved. During the Victorian Period thousands of these instruments were sold throughout this and other countries.

The organs, once tuned, very seldom changed in pitch and so needed only to be cleaned occasionally and kept in a dry place. Leaks in the bellows were repaired by replacing the rubberized bellows cloth or patching the old cloth with tape or tire patches. Cracks in the sound boards were filled with cotton saturated with glue. Sheepskin was glued over the small cracks.

Having completed this study, I would be hard-pressed to explain just how it has benefited my teaching or how it has changed my culture. But I have gained some knowledge of the inventive genius of those who contributed to the evolution of the organ. This study has increased my appreciation of musical instruments, especially keyboard instruments. Having reconstructed this organ, I have empathy for the early American craftsman and his work.

George Santayana said that "those who cannot learn history are condemned to repeat it". Some time ago I was reading about an educator who had some remarkable ideas on teaching. In elementary work he discussed reading by first learning syllables which would pass to words, and then the student would learn to make phrases from words. In spelling he advocated the phonetic method. He felt that it was a common fault to teach the student names and order of letters of the alphabet before they became acquainted with their forms. He provided ivory forms of letters for the beginning students to play with. He proposed that sick children stay home so as not to infect others at school. These are just a few of the contemporary ideas as expressed by Marcus Fabius Quintilianus, a tutor of oratory in Rome (circa AD 35-95). Educators might profit from a review of such history. If engineers of the Industrial Revolution had studied with a more critical eye the theories of the great mechanical genius, Leonardo da Vinci, it might not have remained to the 20th century for the development of ball-bearings, automatic transmissions and helicopters.

Today, we are caught up in a great technological explosion. Most of our efforts in industrial arts should be to explain and have students understand this changing world of industry around them. However, how can the student fully understand the modern technology without first learning the major technological achievements which had occurred in the past and so influenced the future?

My thesis is built on this premise—that we cannot exclude history of technology from our curriculum. We should not de-emphasize wood in our studies simply because it has been the chief material of industrial arts. As Dr. Ralph Ressler stated in the Journal of Industrial Arts Education, Jan-Feb. 1967, "Let us give the new approaches a real fair shake; after all, wood may still be a good medium to use as a means of teaching concepts, principles, or whatever. . . ." Whether Dr. Ressler is being facetious or not, we cannot forget that materials, wood included, have been the basis of our heritage.

Mr. Long teaches at McCaskey High School, Lancaster, Pa.

WHICH WAY TO TURN—WOOD AND OUR EARLIEST HERITAGE

Paul W. Eshelman

The Colonial wood turner was one of the many craftsmen who supplied various articles needed for daily family living. The wood turner made a profound contribution to the development of wooden utensils used for serving food and drink, as well as furniture and those products used in other trades and professions. He turned trenchers, bowls, plates, noggins, tubs, etc. Woodenware producers became numerous during the early nineteenth century, especially in New England. In many cases, father and son worked together, one turning the lathe while the other cut with the tools. After a supply was produced, they traveled throughout the countryside until the supply was sold.

There are several styles of wood lathes to be found among the artifacts of the early turner. During the early part of the Colonial period, the pole lathe was most frequently used. Several examples of the bow lathe, which was Oriental in type, have also been found. During the middle and later part of the period, the pole lathe was replaced by the great wheel lathe and the treadle lathe.

The use of the pole lathe probably originated in the practice of turning objects in the forest where the timber was being cut. After the branches were removed from a standing sapling, a rope was fastened to its top end. Tension on the rope, which was wound around the work and fastened to the raised foot treadle, caused the sapling to bend and return to its natural position when foot pressure was released on the treadle.

The motion given to the wood being turned was alternately toward and away from the operator. This is the essential difference between the operation of a pole lathe and our modern mechanical lathe. The tool cuts intermittently as the wood is turned toward the operator and is idle as the wood is turning in the opposite direction.

Even though the pole lathe is primitive in principle, excellent work can be accomplished on it. In reality the pole lathe has several advantages over the modern lathe. The operator may so adjust his work that only a portion of the entire surface circumference is cut and a projection on the surface can remain uncut. This projection may later be carved in the form of a handle. The early Colonial noggin is a good example of this work.

The great wheel lathe was another turning lathe which was common during the Colonial period. A driving belt, which was placed around the great wheel and around the pulley on the lathe, transferred the motion from the wheel to the lathe. It revolved the work in a constant forward motion similar to our modern lathe. One person operated the wheel and the other person cut with the tools.

The treadle lathe also revolves the work in a constant forward motion. The motion is accomplished by means of the treadle which the turner operates with his foot as he stands at the machine. The flywheel is put into motion by means of the treadle as the operator's foot pushes the treadle downward to its lowest point. The force of the treadle must be sufficient to turn the flywheel a complete cycle and be ready to receive the next pressure from the treadle.

The Colonial wood turners were excellent craftsmen on the treadle lathe. A study of the furniture in the Wallace Nutting Collection in the Hartford Athenium, Hartford, Connecticut attests this fact. The clean, smooth shoulders and beads produced by the paring action of the tools; the fine, intricate lines between the major and minor portions; and the quality of the design are such which speak for themselves and are practically impossible to reproduce on our modern automatic lathes.

There are two approaches in using the turning tools, namely, the cutting or paring method and the scraping method. The paring method is the very scientific one which was used by the early turners until the Industrial Revolution, when turning became a mechanical machine process. After this event, hand wood turning became a lost art. The cutting method is not a difficult one to learn. A study of the principle involved in this cutting method and a comparison of it with the principle involved in the scraping method will help the student to understand the approach.

The cutting method lends itself to a paring of the wood fibers as compared with the tearing of the fibers in the scraping method. The top of the tool rest, which should be on a horizontal with the spindle axis, becomes the fulcrum for the tool. The tool bevel should rest on a 30-degree angle on the surface of the wood. The handle of the tool should be kept in a rather low position. By raising the handle slowly, the angle of the tool bevel will be changed on the surface of the wood so that it will extend under the tangent to the work. The tool will be compelled to pare the wood as the work revolves toward the chisel. The depth of the cut will be determined by raising and lowering the handle. The paring action is smooth and will cause long ribbons of wood to be removed from the wood surface.

The idea of placing wood between centers and revolving it toward a cutting tool is used in our modern lathes. If the art of the Colonial wood turner would be applied on our modern power-driven lathes, our modern wood turners would be masterful craftsmen.

Mr. Eshelman teaches at Millersville State College, Millersville, Pa.

W-4.11 Special Interest
Special Interest Panel A
FEDERAL, STATE, AND LOCAL FORCES STRIVE TOWARD RETAINING OUR AMERICAN HERITAGE—NATURAL BEAUTY

Chm., James E. Seitz; Rec., Richard M. Birch; Obsr., Robert E. Buxton; Panelists, Robert M. Gidez, James E. Seitz, Thomas J. Brennan; Hosts, Warren Fitzgerald, Lynn P. Barrier

MAINTAINING OUR NATURAL RESOURCES

Robert M. Gidez

There is little question that one of the major domestic problems facing the nation today is the quality of this country's natural and physical environment. It is a problem of how in the future we will use and control our land, water and air. It is at once a metropolitan, regional, urban and rural problem. How successful we are in grappling with the quality of our environment will undoubtedly dictate the future quality of life for each individual.

Resources for the future suggest that there are five major problem areas concerned with the quality of our environment. These are:
1) Water pollution
2) Air pollution
3) Pesticide pollution
4) Physical urban development
5) Development of the rural countryside

While much has been said and written about the social and economic problems of the Appalachian region, of equal importance are the problems ahead in restoring and improving the quality of Appalachia's environment. It is obvious that the Appalachian program must necessarily address itself to the priority social problems, such as education and health, and to priority economic problems, such as expanding the region's economic base and providing for additional employment opportunities. There is little question, nonetheless, that unless the more serious environmental problems in the region are resolved, whatever success may be achieved in improving the social and economic climate of the region will be for naught if we fail to mitigate the region's critical environmental problems.

I can only mention a few of those problems in the brief time today. For instance, hundreds of miles of the streams in Appalachia are polluted with acid drainage from abandoned mines. Appalachian industry, not unlike industry throughout the country, creates other serious water pollution problems. The extraction of one of Appalachia's major natural resources—coal—has resulted in an Appalachian landscape being scarred by strip, surface and underground mining. These contribute to the problem of acid mine drainage as well. While Appalachia is blessed with an abundant rainfall, which is an obvious asset for any region, the topography of Appalachia, with its narrow and steep valleys at the same time, creates serious flood problems. But as the recent drought in the northeast amply demonstrates, abundant rainfall, if not properly controlled and utilized, can and does create serious water supply problems and attendant water pollution problems.

We read much in the newspapers today about the increasing menace of air pollution in our metropolitan areas. Many of you I am sure would be quite surprised to learn that because of Appalachia's topography and atmospheric conditions, many of the industrialized valleys of the region may well face serious air pollution problems in the future. Indeed, this has happened in the past. Donora, Pennsylvania is a case in point.

While one of the root causes of Appalachia's social and economic problems has been a much slower development of its urban areas, there are many parts of Appalachia that are now beginning to urbanize at increasingly faster rates. If the over-all Appalachian program is successful, urban development in Appalachia may accelerate. The physical development of these urban areas, if not properly planned and executed, may also result in an unattractive and displeasing environment—an environment we are familiar with when we visit areas of our large metropolitan complexes.

Any of you who have travelled throughout the Appalachian region are undoubtedly taken by the variety of its natural beauty. This has translated itself into some major recreation and tourist development within Appalachia which for many communities provides a sole economic base. But unless we are more careful in the future, we stand to further degrade the natural beauty of the area with recreation and tourist developments that may not fully recognize the importance of maintaining the quality of the natural environment within which these developments may occur. On a much more business-like basis, we are keenly aware of the fact that the businessman who makes the decision to locate his plant in one of several communities may well make his final decision on that location in that community which to his eye and to his sense of attractiveness has the most pleasant environment within which to work and live.

In hindsight, we may look with pride upon our achievements in improving the quality of environment in this country. As has been pointed out by others, the rivers of our country have been cleaned of the grossest flowing materials; many cities have significantly reduced the particulate matter in their atmospheres; some of our worst slums have been eliminated; from the public health standpoint, we have controlled major infectious diseases; much of the land area of the country has been returned to and preserved as natural "wild" areas. But we continue to face in the Appalachian region as well as in other areas of the country the problem of maintaining the quality of our environment.

Time does not permit me to explore with you all of the problems raised in improving the quality of our environment. I would, however, like to discuss with you one aspect in the development and maintenance of Appalachia's natural resources that is quite crucial to restoring and improving the over-all quality of the environment in this large region. Of particular concern is the approach to maintaining the natural resources of Appalachia, not necessarily in the context of these resources as an economic asset but, more importantly, within the framework of utilization of these natural resources and how that utilization affects the region's environment.

I would like to suggest that as we seek to develop new tools to maintain our natural resources, we may have to reconsider some of our older concepts with regard to conservation. Older conservation concepts may have appropriately been concerned with the scarcity of our natural resource base as evidenced by the rate at which those resources were being exploited. We have often wondered whether we would deplete our coal seams, whether our oil wells might stop producing, whether we might harvest all the timber at a rate that would not permit new stands to be developed in time, etc. I would suggest, however, that despite the importance of our natural resource base, that our "real" natural resource consists not of coal seams, oil wells, flowing rivers or forests, but of science, knowledge and technology in using these resources. These have tended to make our natural resource base more and more homogeneous, erasing the restrictions once thought to reside in the lack of homogeneity. There may be peculiar scarcities, but we are not faced with an inescapable scarcity of our resource base. We are talking here of resource substitution and adaptability. Historically our social heritage consists far more of knowledge, equipment and institutions than our natural resource base. This is not to deny some of the uniqueness of our natural resources, but as we tackle the problems of our natural environment, we must be extremely careful not to find ourselves in the trap of categorizing all natural resource uses as being so unique and special that we fail to recognize and fully evaluate, in developing tools to control our environment, the many alternatives that may be available to us.

In general, we know the magnitude of our problem. We also know that the cost of an optimum control and management of our environment, in the engineering sense, probably far outstrips available financial resources to do that job. This then calls for an approach to conserve our natural resources, and, consequently, our environment, in which we can combine conservation objectives, in which we can realistically look at alternatives and the consequences of applying various alternatives to determine the best use of the available resources we may have to control and manage our environment. We must also look not only to the engineering and physical alternatives to conserve our resources appropriately, but we have available to us a number of human institutions and other techniques which with only minimal dollar expenditures may make material contributions to improving the quality of our environment in the use of our natural resources.

Aside from the technical aspects of control techniques, our first task is to develop a special point of view towards maintaining our natural resources. Just as the maxim of our "a penny saved is a penny earned" if carried to its ultimate would have disastrous effects on our economy, so would a program that is simply designed to conserve and preserve our natural resources. The point of view I would like to leave with you is drawn from a basic law of physics. It goes like this: "for every action, there is a reaction." In general we know this to be true, but all too often we fail to see all the reactions. We must set objectives, understand all the consequences of programs designed to achieve those objectives and then carefully choose a course of action in full knowledge of those consequences.

To do this requires that we first look at the total problem before us. The approach towards natural resources development and use in the Appalachian program illustrates how this can work. The maintenance of natural resources in Appalachia, as I have indicated previously, must be viewed in terms of economic consequences and its relationship to the region's environment. This is another way of saying that the economic exploitation of the region's natural resource base, while providing monetary returns to those who develop that base, at the same time may result in an expensive social cost to the people of the region as a whole. Examples of this have been given earlier in this paper. Because this has been true in the past, the Appalachian program provides tools to the Appalachian states to cope with the problems of improving and correcting the problems caused by the use of natural resources of the region so that they may contribute to the region's over-all environment. For instance, the Appalachian program provides funds for the reclamation of stripped areas and the correction of other problems that have resulted from mining operations in the region. Funds are also available under the Appalachian program to supplement Federal grant-in-aid programs, some of which are designed to improve the over-all environment of the areas within Appalachia.

A great deal is now being talked about in terms of developing new tools at the federal, state or local level to better maintain our natural resource base. Indeed, there is room to apply our technological capabilities to come to grips with these problems. But while we are developing the new tools, we should also take a hard look at what we already have available to us. I would like to use as an illustration some of the tools that we already have and how they may be combined to achieve the objectives of at least one aspect of maintaining our natural resource base. I would like to use highway beautification in Pennsylvania as an illustration of this point.

Scenic parkways aside, many federal tools exist to help the state beautify the highways it has already built or is planning.

The Pennsylvania Department of Highways has already demonstrated its capacity to build some of the most scenic expressways in the country. Some have earned national awards. Yet much remains to be done along existing highways and those scheduled for construction.

Pennsylvania is eligible for a federal grant of up to 3 per cent of its annual apportionment of federal highway funds for landscape and roadside development within the rights-of-way of federally-aided highways. It can use these funds to acquire interest in and improve strips of land necessary for the restoration, preservation and enhancement of scenic beauty along federally-aided highways. It can, with the same funds, provide rest and recreation areas along the same highways.

The state is also eligible for an extra one-half of one per cent of its regular federal highway trust funds for planning highway beautification. To date, the state has not used that extra money which would amount to approximately $211,000 in Fiscal Year 1967.

The new Federal Highway Beautification Act provides minimum standards to be followed by the states along federally-aided interstate and primary highways. There is nothing to prevent a state from enacting more stringent provisions on its own. Under the new act, states must make provisions by January 1, 1968 for the control of outdoor advertising within 660 feet of the right-of-way. Advertising is permitted in certain locations in order to inform the public of nearby facilities. Standardized highway information signs can be funded for the same purpose. Billboards in existence on September 1, 1965 will be permitted until July 1, 1970.

The new law provides federal funds for 75 per cent of the cost of removal of billboards with a ceiling equal to 3 per cent of the state's annual allocation from the Federal Highway Trust Fund.

A similar federal grant is available to help defray the cost of screening or removing junkyards within 1,000 feet of interstate or primary rights-of-way. For Fiscal Year 1967, Congress has authorized $20,000,000 each for advertising and junkyard controls and $120,000,000 for landscaping and scenic enhancement.

These are not the only funds that can be used for roadside enhancement. It is perfectly possible, for example, to use certain authorized practices under the agricultural conservation program of the Department of Agriculture with federal grants financing half the cost of such treatment. Under the Appalachian Program, additional funds have been made available to the state for this purpose in the 52 Appalachian counties.

While I have outlined a number of tools available for this particular program, what is most important is how the planner can combine the tools available to achieve a specific objective. As I have reviewed your program during your convention here this week, I can well understand your concerns with the over-all problems of industrial arts education. Undoubtedly, many of the students that you will be teaching may well find themselves dealing with questions of natural resources development and use. While your first obligation is to provide them with the skills, I would only like to add that, to the extent possible, we instill within our future generations and especially to those who will be charged with developing our natural resources a broadened horizon of how to use their skills. Their obligation should go beyond that of merely applying a specific technology to a specific problem. Our problem has been that we have been eminently successful at this, but have in many cases failed to recognize that when we appear to solve one problem we all too often create others.

Mr. Gidez is director of the Planning Appalachian Regional Committee, Washington, D.C.

NEEDED: INNOVATIVE SOLUTIONS TO RECURRENT PROBLEMS

James E. Seitz

Progress without adversity, unfortunately, can seldom be achieved. The impact of technology is driving this fact to the point with a force never before realized.

While industrial development and scientific improvement are bringing unequalled prosperity to our society, the concomitant developments are such that the resultant problems sometimes seem insoluble, the obstacles insurmountable and the solutions unattainable. Air pollution, water contamination and mineral depletion are but a few of the side-effects of technological growth which continue to mushroom unabated.

It is a painful paradox that the very technology which contributes so much to our daily progress is at the same time leaving so much to be desired. Our technology creates countless new opportunities for those who avail themselves of the necessary education, but it also contributes to the rapid depletion of some basic resources and to the adverse condition of our rivers, highways and landscape which become evermore polluted, cluttered and pock-marked.

The problems require our immediate attention. America is sure to become more industrialized and largely urbanized in the years ahead. Is the average citizen to live captively in fear for his life—afraid for his own safety on the crowded highways—afraid that depleting fresh water supplies will cause us to draw from waste-laden bodies of water which, as yet, cannot be totally rid of disease-carrying viruses—and afraid that the phenomenon of thermal inversion may contribute catastrophically to choking thousands with poison-filled smog? Even with temporary solutions, equally serious problems are likely to arise in the future. Is it possible that, in time, the oxygen-consuming devices and animals and the oxygen-producing plants will reach a dangerous imbalance? Such is the serious nature of the thinking of some of our most prognosticative scientific researchers. You and I, the literate creatures that we are, know how important it is to increase the efforts toward finding practical solutions.

The factors involved in preserving natural beauty and utilizing natural resources are interrelated—sometimes inherently so. In mining areas, for example, how generally is the land stripped of minerals and the terrain left in a disappointing upheaval? An effective solution being applied in some places is to develop the area into a recreation center by filling the pits with water, stocking them with game-fish, and planting nut-bearing trees about the banks. This works fine in some strip or surface mining areas, but it is not at all applicable to hiding the dusty chert (chat) piles which stand like immense mountains above and about some communities.

Problems of the sort suggested here are in need of innovative solutions. One thing that seems to be needed most is a re-direction of some of the creative effort and research which goes into expanding our industrial complex toward seeking more and better ways to utilize manufacturing wastes and the raw materials in scrap heaps. A dual benefit is possible. While making more efficient use of our resources, the landscape is returned more toward its original beauty.

In recent months, some favorable developments have occurred. Industry and, in particular, the federal government have been active. More must be done in those fields, but scarcely anything at all has been achieved in the fields of education. What are the possibilities?

--in industry. Increased self-discipline and awareness to the public welfare is needed. Also, there must be more concentration on developing new devices, such as those now being put into operation in several large cities for disposing of tons of garbage while using it as a fuel to generate heat or electricity.

-- in government. Significant action has recently been taken at the federal level. The President, on January 30, asked Congress for a new law to control air pollution, promised to use existing laws to push a clean-up of polluted waters, and recommended programs of research to develop rapid and low-cost methods of excavation for burying power and communication lines.

Throughout the states, 2,200 highway-beautification projects have been launched, and some municipalities have passed ordinances or otherwise encouraged full-scale civic and community clean-up campaigns. More must be done in these areas, also.

-- in education. Something can be achieved at various levels of schooling. Dean Kimball Wiles of the University of Florida, speaking at the 27th Annual AIAA Convention in Tulsa, said, "If we achieve the Great Society, it will be through the use of the system of public education." Not all of us will subscribe completely to the idea of the Great Society, but most of us will probably agree with its basic objectives. In any case, Dean Wiles' observation has been proved correct for the past two years, and it will probably remain valid for years to come. It is essentially through education that the future conduct of industry, government and society is determined.

Industrial arts and technical educators can exert a powerful and positive influence in educating our future citizens with respect to preserving natural resources and scenic beauty. There are two basic ways: (1) through molding or shaping attitudes, and (2) through developing the pertinent skills. The first of these, of course, can be achieved in some measure in the classroom at all levels of education. Methods of achieving the latter may be less readily apparent.

An example of how the Mineral Area College is working toward a direct solution of the second point follows. The imaginative educator can think of things applicable in his particular community.

Our civil technology students are given a sequence of laboratory experiences to develop what might be termed creative problem-solving abilities. Near the end of the two-year period of training, the students are given broad problems to solve experimentally and on their own. An example of a problem under consideration is the development of an economic sub-grade material for the highways of the area. Various combinations of materials might work better than compacted soil and crushed rock. We are particularly optimistic about developing a combination of soil, lead-mine tailings and cement.

What are the objectives of this approach? Primarily, we are concerned about acquainting the civil technology student with the materials available, methods of highway construction and the improvement of his problem-solving abilities. Secondly, we hope the student will acquire an understanding of the advantages to be realized in finding uses for the wastes from the lead mines and the need for improved road construction. If someone is also lucky enough to discover a practical, material solution, then he will have accomplished more than we really expect him to in an educational program.

Mr. Seitz teaches at Mineral Area College, Flat River, Mo.

TECHNOLOGY—ITS EFFECT ON INDUSTRIAL ARTS PROGRAMS IN APPALACHIA

Dr. Thomas J. Brennan

This is the third paper I have prepared for this program and even now I am still in in doubt that I am addressing myself to the topic which the convention planners intended to have discussed at this session. After listening to Mr. Widner's remarks, I am even more convinced that this is true.

When I was first asked if I would accept the responsibility for talking on this topic I readily agreed. I have spent twenty-five years in teacher education in Appalachia. In that time, I have absorbed some of the industrial arts philosophy in the region and have observed a little of what is going on in the schools under the title of industrial arts education. I immediately got to work and came up with what I thought was a reasonably good paper on the topic. About the same time, I received my copy of the January-February issue of the Journal of Industrial Arts Education. I looked at the program for this convention which was outlined in that issue and learned that I was to talk at the session to be devoted to the topic "Federal, State, and Local Forces Strive Toward Retaining Our American Heritage—Natural Beauty."

The paper I had prepared on the topic "Technology—Its Effect on the Industrial Arts Programs in Appalachia" was just that. It did not touch on our American heritage at all. There was only a very remote connection between it and any form of conservation. I started over again to prepare another paper which was more to the point. I had gotten about half-way finished when I decided I didn't know what I was talking about. I realize that this is not entirely unusual where speakers are concerned, but I did feel that I owed it to whatever few brave souls attended this session to learn definitely what my responsibility was. I wrote to Dr. Seitz, our session chairman, with a copy to George Ditlow, program director of the convention, explaining that I felt my topic was a bit incongruous for the topic of this session. I received my answer in short order. Dr. Seitz agreed that the topic did not really belong in this session and suggested I contact the convention planners. Almost in the same mail I received a letter from George, giving his reasons for including it under this topic. He said that the purpose of this session was to direct some thinking to the thoughts which President Johnson has had on improving the living standards in the Appalachian region. He felt that I could say something on how industrial arts and other areas of technology are helping to achieve the President's desire. This is still not in the exact context of the topic for this session, or at least I did not think so. At this juncture I decided to select my own topic. If it does not coincide with the theme of this session, if it does not touch on technology and if it does not carry out our President's idea of improving the living standards in Appalachia, I absolve myself of all responsibility in the matter.

In an attempt to satisfy all three of these ideas, I suppose I should comment a little on the effect of technology on industrial arts programs in Appalachia. To put it bluntly, I think I can truthfully state that technology has had little if any effect on industrial arts programs in the region. Here at West Virginia University, we have just completed a small study of industrial arts in the southern Appalachian region. This study was copied from Marshall Schmitt's study and was designed either to supplement his findings or to point out significant differences. Dr. Schmitt's study was a ten percent sampling of all the schools in the country and concerned itself about such things as the extent of the offerings in industrial arts, the number of students involved, the kinds of programs, the types of offerings and similar topics. In our study, we used Dr. Schmitt's survey instrument and we gave it approximately the same statistical treatment. The chief difference between the two studies is that ours is a universe study and Dr. Schmitt's was a ten percent sampling. In addition, we validated in person and the Schmitt study was validated by a mail follow-up. I quote from Dr. Schmitt's report: "The current industrial arts curriculum does not even measure up to the program recommended by the profession 10 to 20 years ago." If this is true for industrial arts across the nation, it is more than true for programs in Appalachia. Charlie Collins, who completed our study at West Virginia University, remarked to me that it was his opinion that industrial arts in Appalachia was at least ten years behind the program as Dr. Schmitt found it in his study. Gentlemen, I submit that if these two reports are accurate, and I have every reason to believe that they are, then technology, in spite of everything we say about it and its effect on our industrial arts programs, has really had very little effect upon them. Certainly I can attest to the fact that this has been the case in the southern Appalachian region.

In the first paper I prepared for this meeting, I talked at some length on the reasons for this, pointing to the nature of the typical Appalachian resident, his unwillingness to accept change, his distrust for "outsiders" and their ideas, and above all the appalling lack of a suitable base for the support of all education. I commented at some length on the part of our study which bears out these ideas. In fact, I was debating with myself if I dared to make the report since it was so discouraging. When I received the Journal and attempted to rewrite my remarks in terms of the framework for this session, I must confess I had no success at all. George Ditlow's letter came as a distinct relief, and I shall try to confine my remaining remarks on his idea of how industrial arts can assist in improving living standards in Appalachia.

The chief reason why it is so difficult to aid the Appalachian region is because only a relatively few of the residents of the region really want to be helped. It is certainly true that there are thousands of people in the area who are involved in hundreds of programs designed to ameliorate the problem. It is on these people that we must hang our hopes for a solution. However, when you are dealing with a once-proud people who somehow have been able to accept the dole as a way of life and still preserve a semblance of the dignity which is one of their chief assets, the problem assumes astounding proportions. An educational program is the chief hope, but how can you hope to succeed if the educational level is as low as it is in the region? I did a small study on the drop-out problem in West Virginia a few years ago in which I reported that forty-five percent of our children drop out of school. They do so with either the consent of their parents or at the urging of their parents. If education is the answer, then our educational programs will have to be revised from top to bottom. It is here that I think industrial arts has its greatest challenge. If we can somehow upgrade our industrial arts programs to a place where they are attractive to the students, where more students are involved in them, and where, by a clever combination of technology and good basic education we can develop a feeling of need for an education and a desire to stay in school, then we have gotten over the first giant milestone on the way back.

I should like to report on one project which is under way at the present time which may have promise and on some of the ideas which are under consideration at this time for implementation in the near future.

Last year the federal government set in motion the machinery for developing a series of regional research laboratories, designed to supplement research in education, particularly at the local level. The Appalachian Regional Research Laboratory, which has its headquarters in Charleston, West Virginia and which serves all of the states in the Appalachian region, has taken its first major thrust as the easing of the transition from school to work. It is attempting to do this with a program of five projects. One of these problems involves industrial arts specifically. Two others might eventually involve industrial arts teachers.

In an attempt to utilize the industrial arts programs of the region as a place where actual guidance for the world of work can be given, the laboratory is conducting two summer workshops for industrial arts teachers. The work of these workshops will center around the making of easily administered occupational information units based on the latest industrial knowledge. Part of the summer will be spent in visiting industries. The teachers will learn at first hand what industry is looking for in prospective employees. They will incorporate this information in the occupational information units they will devise. During the next year this material will be offered by these teachers as an integral part of their industrial arts programs. Tests will be administered and research will be designed to determine the effectiveness of the program. It is anticipated that there will be a measurable improvement in the educational outlook of the students who are exposed to this occupational information.

A second project which might possibly involve industrial arts teachers is one in which groups of students from remote areas will be brought to centers of industry for summer employment. They will work in industrial jobs for pay. They will be exposed to a series of educational situations designed to acquaint them with the need for an education if they wish to continue in jobs of this kind. It is hoped that they will return to school during the following year with a renewed intention to remain in school to obtain this education. They should also be an influence on those students who are considering dropping out and who have not had the benefit of the summer activity. Industrial arts teachers of the region have been suggested as the coordinators of these summer programs. They will be responsible for the on-the-job occupational information training. The reason for having an industrial arts teacher assume this responsibility is two-fold. An industrial arts teacher has the background for such an activity and his choice is a logical one. In addition, this will be an opportunity for him to be employed for the summer months. His annual take-home pay will approach the earnings he might have had if he migrated from the region. This might also serve as a needed incentive to get new industrial arts teachers to elect to teach in Appalachia, since their yearly earnings might be equal or above that of their contemporaries who are teaching in the more affluent areas of the country.

The third project of the laboratory which might involve industrial arts teachers is similar to the first one already commented upon. A series of summer institutes will be set up for the development of self-administering or easily-administered occupational information units. Such technological advances as the single concept film, the coordinated slide-tape film and other audio-visual advances will be utilized for the easy dissemination of occupational information materials. These materials will be constructed in such a way that the student can use them himself in attempting to learn about the world of work. It is assumed that industrial arts teachers of the region will be vitally involved in the construction of these materials. They could become practical guidance counsellors in the schools, assisting the regular guidance counsellor. In small schools where there is no guidance counsellor they could become the only guidance person on the staff, thereby providing vitally needed information about the world of work in school situations where it has never been available before.

I have mentioned these programs to point out how industrial arts can be utilized in raising the educational expectancy level in the schools of Appalachia, particularly as it involves the world of work. In this, we are consistent with the objectives of industrial arts education. At the same time we are aiding in the conservation of our really most important resource, our children.

Mr. Brennan teaches at West Virginia University, Morgantown, W. Va.

W-4.12 Special Interest
Special Interest Panel B
ILLUSTRATIONS OF CURRICULUM INNOVATIONS PAST AND PRESENT
Chm., Morris J. Ruley; Rec., Robert Ryan; Obsr., Robert D. Ryan, Panelists, Norman G. Laws, James Yadon, George Delpit, John Degler; Hosts, R. B. Parnell, Leonard J. Poleszak

ILLUSTRATIONS OF CURRICULUM INNOVATIONS: MATHEMATICAL EXPECTATIONS FOR STUDENTS IN INDUSTRIAL ARTS

Dr. Norman G. Laws

Less than a decade ago, Sputnik was a dramatic symbol of the technological advancements of our generation. We have experienced a bolstering of science, language, mathematics and engineering opportunities for the academically talented. But the need for technical personnel has not been so clearly understood.

We had one technician for every two engineers in 1960 or about seventy-seven thousand technicians. By 1970, just to keep the same ratio, we will need a yearly increase of 803 thousand. Where will we find persons qualified to enter these occupations? Mostly, they are likely to be spotted in the junior and senior high school shops. And it is at this level we should first be concerned with mathematical background. Success in science and technology is dependent on mathematical ability. Mathematics is basic to any technological program. At a college level 40 per cent of the students drop-out (Labor Secretary Willard Wirtz calls them "pushouts"), and these students, together with those who did not enter college, seek their vocational opportunities on the basis of what they learned in their junior and senior high school shops. Those who do continue in post-high-school programs need the mathematical skills for continued study and those who enter the labor market directly need mathematical skills to perform their jobs.

Thus, it seemed important to determine what kinds of mathematics and how much mathematics is needed by technicians. Such a study was undertaken by myself under the joint sponsorship of the Henry Ford Community College (where I have taught mathematics to technicians for the past eleven years) and Wayne State University (under the directorship of Dr. G. Harold Silvius) for the Michigan Department of Education. Since we were interested in future trends, we selected participants from our larger industries. A task force of business, industrial, labor; governmental and educational leaders helped to select those firms that had showed evidence of "most promise" and "best practice" in their use of technicians. The firms were selected from the Standard Statistical Metropolitan Districts of Michigan as designated by the US Bureau of the Budget, and from lists of companies furnished by local Chambers of Commerce.

The 1960 US Census was used to determine the types of industry and technicians to be found in Michigan, and we sought to include a representative number in our sampling.

Adminstrative personnel in each company were interviewed to determine their mathematical requirements for technicians. It was thought that regardless of actual needs, a technician could not obtain a position unless he could meet the standards imposed by the employer.

Seventy-five percent of the administrators interviewed had been with their companies for more than ten years and 50 percent in their present position that long. Sixty-six percent were chief administrative officers. Over half had earned their bachelor's degree and, while 11 percent had graduated from liberal arts schools, 59 percent had graduated from engineering schools. It was not surprising to find that 86 percent had studied trigonometry, and 67 percent had studied calculus. But this made me wonder if the mathematical needs for technicians would be stated in terms of their individual backgrounds. Such was not the case!

The interviewees indicated that 59.2 percent of their technicians now have sufficient mathematical background, and that 46.5 percent came directly from high school. (In Michigan we found an industrial rather than an engineering type of technician.) There was an indication that employers would give first consideration to post-high-school graduates and then would select only the best qualified high school graduates.

Eighty percent of the employers felt that trigonometry was the mathematical attainment level necessary for technicians. Ninety-five percent indicated that the technician would work under the supervision of an engineer, and sixty-two percent indicated that the technician would be expected to improve his mathematical skill while on the job. It was interesting to note that 87 percent of the companies contacted have tuition subsidy plans for employees. Additional factors were emphasized. Seventy-nine percent indicated that mathematics for the technician should be very practical, not like the abstractness found in "modern mathematics". Also, 97.2 percent felt that a technician should be able to use a slide rule and that future technicians should be able to use calculators and understand computer theory.

There was agreement from all types of industry that the technician must know some trigonometry, that the technician should understand how to make practical use of mathematics and have an ability to estimate and approximate to determine the reasonableness of his calculations.

To obtain a comparison and a more detailed response, a mathematical checklist was furnished to each type of technician found in the companies where supervisors had been interviewed. These then were processed by the computing center at Wayne State University.

As would be expected, the fundamental operations of arithmetic were declared essential, except for the machine shop fundamentals. There was a major emphasis on skill in arithmetic, which seems to be lacking in many students—especially fractions and decimal numbers.

The basic operations of algebra are essential for most technical occupations (but not all), and the more advanced topics of algebra seem to have little application at the technician level.

It was somewhat surprising to note that geometry was rated low, until individual returns were re-examined. It was found that in some technologies geometry is used very little and in other technologies it has high usage. The responses tended to balance. The chart does show that the use of right angle trigonometry is significant.

Looking at the charts on advanced trigonometry and calculus, it is evident that our industrial type of technician has little need in these areas. The responses noted were from the few engineering-type technicians found in our state and hints that for engineering technicians there is a need for practical calculus.

Most technicians use calculating machines, but this is a skill usually acquired on the job. In the future, more use may be made of statistics, probability and computers.

I believe the implication of this study points up the continual need to emphasize a practical and fundamental mathematical approach to the industrial arts student. Their knowledge should extend to right angle trigonometry, but emphasis should be placed on the "bread-and-butter" mathematics of arithmetic, including the slide rule, the use of literal numbers and equations, with a concentration on accuracy and "feel" for the reasonableness of solutions.

Dr. Laws teaches at Henry Ford Community College, Dearborn, Mich.

MATERIALS FABRICATION

James N. Yadon

Education is fast becoming, if it is not already, the most important aspect of modern man.

Technology is the basis of our socio-economic society and has every right to occupy the central place in our educational structure.

If technology is to be taught on a level which will benefit the youth of today and to prepare them to live in the on-rushing space age with its predicted scientific and technological advances, then we must be prepared to try innovations which will more clearly reflect the present.

Materials fabrication is an innovation in the field of industrial arts and technical science. The program was first conceived some four years ago by Mr. B. Stephen Johnson, Supervisor of Industrial Arts and Technical Science of Broward County, Fort Lauderdale, Florida. Materials fabrication at Plantation High School is the culmination of this concept.

The Materials Fabrication Laboratory, and it is a laboratory rather than a shop, was planned specifically for this program. The equipment was carefully selected to fulfill all of the criteria established over the three years planning period.

Facilities are available for a comprehensive study of technology. The heart of the program is the materials testing laboratory which enables the student to achieve a thorough understanding of the materials which are the building blocks of today's world. Investigation of strength, hardness, elasticity, stress, deformation, temperature effects and optical investigations are conducted by students as the need arises.

The syllabus for the first year course was written in 1966 and is presently being evaluated and revised. The content of the first year course is divided into three phases: (1) Materials, which provide the student a point of beginning by studying such things as fundamental concepts, measurements, problem solving, and testing; (2) Processes, which cover chemical, electrical, thermal, mechanical and combinations processes; and (3) Fabrication, which covers forming, machining, joining and finishing.

The syllabus is written on a three-level structure and thereby provides for a wide range of ability and interest levels. This also provides for girls an opportunity to receive the much needed experiences in the field of technology. Individualized instruction is a necessity due to the nature of the facility and to fulfill the potential of the program.

The program is in its infancy, this being the first year of operation, but already the benefits can be seen in that it is well received by students, parents and fellow educators.

Mr. Yadon teaches at Plantation High School, Ft. Lauderdale, Fla.

THE INDIVIDUAL AND LEARNING

George H. Delpit

All teachers believe that all students are individuals and that they have many differences. All teachers likewise believe that these differences must be taken into consideration and so have developed a philosophy to allow for them. This philosophy states that: "Education should meet the interests, needs, and abilities of the individual." It is at this point, however, that this philosophy and classroom practices have a parting of the ways. Certainly the philosophy is sound, but how about the actual classroom procedures? Is what goes on in the classroom really meeting the needs, interests and abilities of the individual? Does having all students listen to the same lecture on the same material at the same time and responding to the same degree fulfill this philosophy?

Because the actual classroom activities that could fulfill this philosophy are so diverse, complicated and difficult to achieve, most teachers fall short of attaining their goals.

It is the purpose of this paper to present just one of the many ways that a program can be organized so that the age-old dream of meeting the interests, needs and abilities of the individual can be realized.

The only possible way that this can be accomplished is to free the teacher from all interferences that handicap the relationship of the teacher to the student as an individual.

First: Teachers must get off of the "Messiah's" throne. This is the biggest handicap to meeting individual needs. Too many teachers have assumed command of all learning and decide what is best for all students. They become the keepers of knowledge, the determiners of destiny and the dispensers of learning. We must realize that learning is a personal thing, and that it is determined by the individual. He must be the one to decide what is to be learned. Learning is as sacred to the mind as religion is to the soul.

The originator of most of the interference between the teacher and the attainment of these goals of philosophy is the ego. Whenever educators stop thinking about themselves and start really considering the student's needs, the emphasis will be on learning and not on teaching. Understanding that there is no such thing as teaching—only learning—is to make the first move toward removing the ego obstacle. As long as we are teacher-centered in our thinking, we allow the importance of our subject to become exaggerated beyond recognition, which leads us to teach it as if each student were going to make it his career. The teachers with the captive audiences (history, math, science, etc.) are the worst offenders, and although they would deny it vehemently, they are teaching vocational education.

The conventional vocational courses are enjoying an upswing in high school that will soon reach the intensity of competitive sports. This spiraling growth of vocational education is a product of the same force that produced the over-emphasis on sports.

It is because the regular school program is so dull, boring, wasteful and unfair that the students literally flock into any escape they can find. Many a poor high school program hides behind a good football team. This is not to deny sports its wholesome place in the curriculum, but rather to put the total school program in balance.

American high school education is supposed to be general education and exploratory in nature. The biggest single problem facing a youth today is deciding his future. Learning the material isn't the problem, but rather discovering the material he wants to learn. He must have varied and numerous learning experiences in order to do this. Every student should be able to explore various fields of learning in order to find himself, and he should be able to do this without fear of marks of failure that follow him the rest of his life. Because school is exactly opposite to this, students are forced out with no alternative and nothing to do. Vocational education has rushed in and has helped fill the gap, but the fact remains, the student has been denied twelve years of general education that is so vital for maturity and a wise career choice. This is why we have so many occupational misfits today. This is why there are thousands of doctors who wear white smocks, carry a stethoscope around their necks, can mumble Latin but do not understand healing. There are likewise thousands of lawyers and judges who can quote the law, but who do not understand justice; and an unforgivable number of teachers who rattle off facts, but who do not understand learning.

If high school were truly effective, most students could enjoy twelve full years of profitable general education, and then vocational education, along with college, could serve its appropriate function as a post-high school program.

Second: Get that schizophrenic monkey off your back. Most teachers, whether they realize it or not, are playing dual roles that are as contradictory and in conflict with each other as Dr. Jekyll and Mr. Hyde.

One cannot be both prosecutor and defender, helper and hindered, promoter and demoter. One cannot wield the whip and then expect the student to allow him to apply the ointment. Yet this is precisely what we try to do. As long as we are on the throne, we insist we know what's best and try to motivate all the students our way. When they rebel, we devise every conceivable type of threat, punishment, bait and coercion that can be assembled. A student cannot learn effectively under these conditions.

It is not the teacher's responsibility to create hostile conditions and pressures to motivate the student to seek education. Society has plenty of built-in pressures (economic survival, parental aims) that could easily provide all kinds of motivation, but we won't let them operate.

Our job is to help students, not to hinder them. If we are to be involved in motivation, it must be by positive means. There is nothing more exhilarating than the excitement a student experiences when he is learning something that interests him.

Third: Lecturing must go. This is the most ineffective and therefore the most inefficient method of learning ever devised by man. Lecturing is transferring information from the teacher's notes to the students' pads without touching either of their brains. It is a form of egotistical gratification that satisfies the teacher but does little or nothing for the student. But worst of all, it denies the opportunity for the teacher to work with the individual student because it demands all of his time and chains him to the blackboard.

Fourth: Learning must be at the student's own rate. If the teacher does free himself to work individually with each student, then there is nothing to prevent the student from truly learning at his own rate. It needs to be clearly understood here that learning at his own rate does not mean ability rate exclusively. There is such a thing as interest rate. A student's interest teams up with his ability to produce motivation. If the teacher ignores the interest factor and starts squeezing the student to produce certain teacher-conceived goals because the student has ability, then the results can be disastrous. Under these conditions, the better student will develop a phony set of values that handicap him in making mature decisions. The less fortunate student becomes frustrated and simply drops out.

Fifth: Programmed learning is a must. Teaching each student at his own rate without some help is an impossibility. If your course is programmed, however, it does become possible, even though it is still difficult, time-consuming and requires a lot of work. Once it begins to operate, the burden lightens and the results are so rewarding you will want to take to the soap box.

Any course can be programmed, and it can be done to a greater or lesser degree. Here are the essentials that are necessary before a course can be considered to be programmed:

A. Material must be available to the student at his convenience, to be used by him to learn alone. It can consist of films, written material, tapes, etc. You may have to write your own material so that the student can understand it without constant help from the teacher. The core of the program should be presented in terms of concepts with supporting facts limited to understanding the concept. Factual information in depth should also be available to those who are interested, but should not be crammed down everyone's throat. The teacher can then spend his time with individual students as the need arises.

B. Fifty percent of class time should be all that is needed for the average student to learn the main concepts of any program. The other half of classroom time should be available for the student to explore and research his own ideas. All required work should be done in the classroom, leaving after-school time free to learn the many things outside of school that are often more important. Compulsory homework should be eliminated. It is just another coercive tactic designed to cover up an inadequate program and to show the ego that the bees are bringing in the honey. The effect that compulsory homework really has is to destroy the students' opportunity for independent study.

C. There must be free movement between students and the learning situations. Students need to be able to move in and out of classrooms as the need arises and not be locked in a particular subject for an hour. Imagine, if you will, how it would be if the hospitals were organized in as unnatural a structure as schools. Kidney troubles will be treated from nine until ten, liver from ten until eleven and heart trouble until noon. You had better not get a gall bladder attack in Dr. Cardiac's office. All deliveries must be before three PM, and all patients must have a pass to the delivery room. Labor pains after three o'clock will be treated with severe disciplinary action. All convalescent patients who visit the schools must have, upon return, a note signed by the teacher.

Things like tardiness, absences and passes have no significance in a good program. (A pass is a pink testimonial to an idiot institution signed by one of the inmates.) Moving in and out of classrooms will not disrupt lectures because there aren't many. When a student is absent, there is no such thing as make-up. He simply picks up where he left off when he returns. If he continues in the same subject the following year, he likewise begins where he left off the previous year, regardless of what part of any book he may have been in.

D. Evaluation must be for the student. The widespread and almost complete acceptance of grades as a means of promotion is nothing short of criminal. All students who take a course should receive an acknowledgement of having taken it. There is nothing wrong, of course, in giving the student a mark to show how well he is doing, but this should be for his benefit and not to pass or fail him. There is no such thing as failure anyway, there is only delayed success. Even death is a transfer.

Passing and failing concepts that are held by American educators are responsible for producing a continuous stream of forbidding beliefs and defeatist attitudes. An example of this is the old saying, "Opportunity knocks only once". In real life, opportunity is perpetual.

If evaluation is truly for the students' benefit, then the students should be allowed to choose the time of evaluation. When written tests are used, the students should be permitted to ask for the test when they feel prepared and should be evaluated immediately. If their performance on the test does not measure up to their expectations, then they should be allowed to be evaluated again and again on the same material until they are satisfied.

Here then are some of the major obstacles that are preventing quality education from becoming a reality today. The task to overcome these obstacles is not an easy one, but it is a necessity.

It should be pointed out that if you do organize a program along these lines and it is the only one in the school, it will take almost a year to undo the harm that has been done to most of the students previously. During this time their response is almost nil and even disappointing.

If the classroom practices outlined here or other similar ones were a significant part of the American school scene, we would be able to hold our heads high when we say, "Meeting the interests, needs, and abilities of the individual."

Mr. Delpit teaches at Plantation High School, Ft. Lauderdale, Fla.

TEACHING OF THE HEARING HANDICAPPED— WHAT'S THE PROBLEM?

John Degler

Because of their limitations in communication, skills and an acknowledged academic retardation, the great majority of our deaf children will earn their livelihood with their hands. Schools for the deaf must offer a vocational program that develops a salable skill within the capabilities of the student. This means that a variety of vocational trades must be available to meet the diversified talents and skills that we find in our students in schools for the deaf.

The Pennsylvania School for the Deaf has always prided itself upon the fact that it has prepared its pupils so well for the duties of life that few are unemployed and most are self-supporting.

The school has a history, going back to the early eighteen hundreds as a school dedicated to the proposition that hearing-handicapped children, who are academically talented, be given every opportunity to prepare for a college education. It also, from the very establishment of the school, felt that industrial training constituted an important part of its educational training.

In the first Board of Directors' report of the school (1823) there appears this statement: "Provisions were made for teaching the pupils cabinetmaking, shoemaking, coopering and weaving."

Our Industrial Education Department is housed in the Nevil Vocational School, which was officially opened in September 1964. We feel it is one of the finest vocational schools for the deaf in America. This handsome million-dollar-plus structure provides 54,000 square feet of instructional and administrative spaces. Each shop and laboratory is a self-contained unit with lockers, washroom facilities and drinking fountain.

All pupils come to the Industrial Education Department at the age of 12 or 13 according to their readiness level of ability, and participate in the exploratory program for 3 or 4 years as a part of general education.

For the girls we call the program homemaking, which includes units of work in foods, clothing, home nursing, household management, child care, proper grooming, consumer education and home decorating.

For the boys the industrial arts program includes graphic arts; metal-working—sheet metal, art metal and wrought iron; woodworking—benchwork, wood finishing, home mechanics and electricity.

These programs are flexible in that they range from six 45-minute periods per week to two periods (double period) per day for a total of ten periods per week.

At the age of 15 or 16, an evaluation of each pupil is made, in terms of intelligence, achievement, aptitude and other factors. Following this, recommendations are made for placement in the academic tract with 6/8 time in the classroom and 2/8 time in industrial arts work; or in the vocational tract with 6/8 time in shop and 2/8 time devoted to academic work.

We offer the following vocational trades or areas:

For girls, professional sewing, power sewing machine operation, business education (where all makes of electric as well as manual typewriters are furnished). In addition, there are adding and calculating, accounting and bookkeeping machines, duplicating and copying devices including a 914 Xerox machine, addressograph equipment, a graphotype machine, and an IBM card punch area equipped with 6 card-punch machines, 402 accounting machine and a sorter.

For the boys, we offer the following trades or areas: finishing and upholstering, auto mechanics, cabinetmaking, machine shop (which has a welding area equipped with an A-C/D-C Rectifier Welder as well as other industrial type welding equipment), shoe rebuilding, barbering, commercial foods, and a graphic arts program which includes lithography, printing, bindery and typography areas.

Over the years we have tried to keep our vocational trades current and up-to-date and are constantly on the alert for new trades to replace trades that have become obsolete.

Because we are aware that the aptitudes, skills and education of our graduates must match a changing world of work if they are to successfully compete in the labor market, we have made the following changes in our vocational program in the past school year.

To upgrade our typography program, we have introduced a cold type course as a cooperative program between business education course and printing course. In the past our graphic arts facilities were bound to the traditional methods of type-setting, the hot type method. With the addition of 3 Varitypers, a Headliner, Typro Phototype composer, 2 Justowriter Reproducers, 3 Justowriter Recorders, and a motorized Tape Punch, our offerings now include both hot and cold type composition. We also modernized our instructional techniques in the hot type composition area with the purchase of a Friden LCC-VF Tape Perforator for line casting control of variable fonts.

Two new darkrooms equipped with all the supplies and equipment needed to add direct color separation to our existing photo-lithography instruction program were constructed in the graphic arts area this past year.

To meet the challenge brought about by data processing in the business world, we have introduced into our business education program a course in data processing. By adding a verifier, interpreter, and collator to our existing equipment, 6 key-punch machines, a sorter and accounting machine, and the services of an experienced data process instructor, we are now able to offer a comprehensive course in this field.

All vocational students are required to complete a three-year program of instruction, which includes at least 2500 to 3000 work experience hours of instruction.

A job training program is conducted in cooperation with industry during the last semester of the vocational course prior to graduation to provide the student with an opportunity to gain firsthand practical experience in industry.

In conclusion, schools for the deaf are obligated to provide the finest type of program conceivable. We do not have a choice as to whether we want industrial or vocational education or not. The real choice is whether we want the best vocational program or not. We owe our young people the best, for vocational education is truly the salvation for the deaf. We need strong courses designed to meet tomorrow's needs.

Mr. Degler teaches at the Pennsylvania School for the Deaf, Philadelphia, Pa.

W-4.13 College Students
Special Panel Session
OUR AMERICAN HERITAGE—DOES TIME CHANGE INDUSTRIAL ARTS
Gen. Chm., Rex Miller; Chm., William S. Scarborough; Rec., Gary Allen; Obsr., Lee LaBute; Panelists, Robert Nichols, William Strausner

THE ELI TERRY CLOCK AND THE IA PROGRAM

Robert A. Nichols

This presentation is the result of an investigation of the life of Eli Terry and his clockmaking activities, an investigation completed as a research report to fulfill the requirements of a master's degree in industrial arts from Millersville State College.

Eli Terry is an excellent example of one of the men who created an industry in America, and his clocks are likewise an example of charm and beauty combined with a most practical device.

This presentation is made up of two major parts. One part is a study of the man Eli Terry, some of his personal life, and mainly his clockmaking activities. The other part of this presentation is an explanation and description of the making of the various parts of a typical Eli Terry Pillar and Scroll Clock, including both the mechanical movement and the case.

Born on a Connecticut farm in 1772, Eli Terry had a minimum of schooling but became a clockmaker's apprentice at the age of fourteen. He learned the trade well and demonstrated soon that he was talented in mechanical ability and inventiveness. He had made his first tall-case clock with wooden works by the time he was twenty years of age. He developed some machinery for cutting the teeth in the pinions and gears of wooden clocks and shortly was in business for himself. Eli Terry changed clockmaking from a one-man, one-at-a-time operation to a mass production industry by contracting to make the unheard-of quantity of four thousand clock movements over a period of five years.

Ten years later, Terry had designed and was making vast quantities of a shelf clock which came to be known as the Eli Terry Pillar and Scroll Shelf Clock. These clocks had wooden works and were cased in a beautiful wooden case. The clocks sold complete for fifteen dollars. Terry and Seth Thomas were making up to ten thousand of these clocks each year. This enterprise made Terry a rich man, and after about 1837 when cheap brass movements brought an end to the wooden clock industry, he spent most of the remainder of his life designing improvements for the clocks still being made by his descendants.

Following the summary of the life of Terry, there will be a description and explanation of the main parts of the reproduction of the Terry clock and the manner in which they were made. This explanation will include the making of the pinions and gear wheels, the count wheel, the fly fan, the escapement, the pendulum, face, hands, and lastly the case. (Mr. Nichols used visual aids to complete his presentation.)

Mr. Nichols teaches at Conestoga Valley High School, Lancaster, Pa.

SHELL CASTING OLD AND NEW

William Strausner

There are two generally accepted methods of shell casting; the resin binder and the CO_2 processes. The resin binder process will be the limit of this study.

The process of shell casting or croning was developed in Hamburg, Germany by Johannes Croning with the use of a Bakelite resin binder. This resin was developed and produced by the Bakelite Division of Union Carbide and Carbon Corp. This process was introduced to the industry of the United States after the Second World War.

The shell mold for the production of foundry molds is a radical departure from the conventional method in that only dry sands are used to obtain pattern reproduction. The molds are permeable shells having an overall thickness of 1/8 to 3/8 of an inch. The molds produced by this method are unaffected by atmospheric conditions and can be stored indefinitely.

The shell mold process as originally introduced to the foundry industry has now been expanded not only to include the dry mix of resin and filler for dumping operations, but also a resin-coated sand for blown molds and cores. The shell mold process utilizes dry ingredients—dry sand and powdered thermosetting phenolic resins. The thermosetting phenolic resins provide a bond for the sand grains and fillers.

Sand, being a major constituent of a shell mold, is a very important part in the production of a good casting. The coating deals with the surface area of the sand grain, and, with the increase in the fineness or AFS number, the surface area also increases; therefore, sands that are low in fines and low in clay content are best suited for coating. Round grain sands produce the strongest coated products for a given resin content. The sands which were used in our experimentation had two different finenesses and filler contents. We used with best results a brand name FASKURE SC-3-60w which had no filler in the mixture, thus producing a very strong shell. The other type of sand we used was a 120 fineness with a content of 20% filler which gave us a very smooth finish but broke while removing the shell from the match plate.

The pattern must be made of metal. The selection of the metal to be used for the pattern should be determined by the number of shells you intend to pull or the length of the run. Aluminum is used in industry because of its lightness, with this factor offsetting the cost of replacement due to the wear of the matchplate. In constructing a pattern, it is necessary to have the surface smooth and free of all blemishes with the ejection pins, alignment buttons, gates, risers, spru and pattern positioned correctly.

The temperature of the pattern should not be less than 350 degrees, and the oven temperature should not be less than 500 degrees. Since the pattern is being placed in and out of the oven continually, the oven temperature should be held at approximately 600 degrees or use a quick recovery oven at approximately 500 degrees.

The cycle must be balanced and the times adjusted to allow the sand to cure properly, or the unbalanced cycle will result in a warped shell, overcured or undercured shell, sticking of the shell to the match plate or an improper investment of the pattern. The cycle which we found to be most satisfactory was: preheat the oven to 600 degrees and then heat the pattern for the initial investment for 10 minutes and those thereafter for 2 minutes, investment time 30 to 40 seconds and then replace the match plate with the uncured sand into the oven for 2 minutes. With this cycle we had no warpage of our shells, and the sticking was present only when there happened to be insufficient lubricant on the match plate.

Before a shell mold can be made, the pattern must be properly lubricated; otherwise, the mold will stick and removal is made practically impossible. Of the six commercial releases we tested, the two we found to be most satisfactory were silicone spray and carnuba wax.

We believe the process of shell molding will be a very exciting learning experience for the student in the industrial arts shop. Shell casting can be studied as a unit for small groups or on an individual level. It also is possible to use the process as a mass production project for some salable school item.

As for the advantages of shell molding, there are many, but we found these to be the most outstanding:

Exact detail and accuracy are present in every casting.

The rough casting is very smooth.

Irregular shapes can be molded with additional experimenting.
The process is inexpensive and clean.

Mr. Strausner teaches at Millersville State College, Millersville, Pa.

W-4.14 Student Clubs
Special Panel Session
DIRECTIONS FOR STUDENT CLUBS
Gen. Chm., W. A. Mayfield; Chm., Joseph Carrel; Rec., J. Richard Steinmetz; Obsr., J. B. Morgan; Panelists, John F. Moses, Sister Mary Eligius Shanabarger, RSM.

THE INDUSTRIAL ARTS CLUB—ITS ROLE IN THE IA PROGRAM, THE SCHOOL AND COMMUNITY

John F. Moses

The role of the industrial arts club in the industrial arts program, in the school and in the community can be a very significant one. The extent of significance of this role depends directly upon several factors surrounding the industrial arts club. Objectives of industrial arts clubs can vary from providing extra-curricular activities for students enrolled in industrial arts subjects to meeting for experimentation purposes to keep abreast of the rapid technological changes confronting us today. The tree of objectives for industrial arts clubs is made up of many branches. In addition to the aforementioned objectives, some of these branches might be called: meeting departmental needs, meeting school needs, meeting community needs and last—the one I consider the most important—is meeting individual needs.

Most industrial arts clubs have an open membership. This is not so with our club, which is in its tenth year of operation. We have a restricted membership that has fluctuated between 16 and 19 members. I am going to attempt to show how this has been beneficial to our meeting our objectives, which have been reduced very simply to "being of service to the school and to the community." I am also going to show how this enables us to meet individual needs.

Far too long, industrial arts was the "lost" department of many schools. Students that emphasized industrial arts in their curriculum were thought of as not being high achievers and were placed in a low "social" class by the powers that be. These students had little or no identity with the school. I am sorry to say that the industrial arts instructors themselves were somewhat responsible for permitting the most expensive and valuable department of any high school to be trodden upon. I am happy to report, however, that for the most part this image has changed. I further intend to show how the industrial arts instructor and the industrial arts club have done much to bring about this change.

It is a very difficult task to separate the role of the industrial arts club in the IA program from its role in the school and its role in the community. In my opinion all of these are tied very closely to each other.

If the industrial arts club enjoys an outstanding reputation and has varied and interesting activities, and if membership in the club is restricted only to students enrolled in industrial arts courses, then more students should be attracted to the IA department. The industrial arts club can unify and correlate the department by the need to cooperate with mutual supplies, mass production, exhibits, etc.

Years before our club was organized, I always had a project that involved mass production. After the club was organized, the mass production unit became theirs. This project served at least two main purposes: (1) as a fund raiser and (2) for instructional purposes. Birch log candle holders decorated with live evergreens, holly, etc. became one of our early projects. We have since substituted artificial evergreens, as people continue to ask for the candle holder each Christmas. With the changeover from live evergreen to artificial, we were able to prepare the candle holders in advance and not be forced to spend many hours in the evening just prior to Christmas meeting a deadline. It is the responsibility of the club members to take orders for the project. From other students we require a deposit or downpayment in a sufficient amount to keep us from losing money if they change their minds. Sometimes card tables, etc., are set up in the cafeterias at the school and in supermarkets, manned by different students during their various lunch periods or, in the case of supermarkets, on Saturdays or nights. Our public relations agent is the advisor to the Audio-Visual and Camera clubs. Mr. Trufolo has a real estate and insurance business outside of school. Toward the end of the year, he makes sure that everyone has a new calendar for his room. He undergoes much "ribbing" about his business. He came upon one of the students who had taken an old piece of 2 x 4, drilled three holes in it, and "decorated" it with dead branches and twisted, out-of-shape candles. A sign from Mr. Trufolo's calendar was used with the words "Compliments of" added. He is a good sport but doesn't usually like to have his picture taken.

The industrial arts club members take their places alongside representatives from other school organizations to adopt "welfare" people for Christmas. Our club no longer adopts a single person, but instead we try to satisfy many people. One year we did adopt a boy—Joey, age 11. That Christmas for him, I'm sure, was bigger than any I've ever had. Gifts were collected by the girls of the Future Homemakers of America club for distribution. The officers of the industrial arts club often have the responsibility of planning and testing the project, jigs, etc. Any exhibits and displays concerning the industrial arts department usually are taken care of by the industrial arts club.

There are many ways that the industrial arts club can be of service to the school and, at the same time, become an interesting and valuable link between the school and the community. The club usually works very closely with the PTA group. Club members can handle such things as:

1. Stagecraft and backstage operations for school productions
2. Demonstrations at state conventions
3. Bulletin boards
4. Special parking details—
   Whenever there are any strange groups such as: FHA state meeting, state cheerleader workshop, or the state Supervisors' Roundtable meeting, the club is asked to handle the parking
5. Civilian defense activities
6. Campus beautification programs
   An area just outside of the industrial arts laboratory was taken over by the club and named Club Park. Flowers, shrubs, a tree, bird feeders, bird baths, etc. were added, as were picnic tables to be used by the home economics classes for their "cooking out" unit.
7. Setting up the portable stage and curtain for assemblies
8. Motorcades—
   Motorcades are sometimes used to advertise dramatic productions and to welcome visiting bands when our band conducts an exchange program. These motorcades are arranged and supervised by the club, and—
9. Conferences and exhibits outside of the state
   For quite a few years, I took two students to the IA Spring Conference at Oswego, New York.

The role of the industrial arts club in the community can do much for public relations. Some of the ways this can be done are by:

1. Making display items for merchants in exchange for window space for project displays;
2. Helping merchants by making items they can't purchase
3. Getting club members to do small jobs for residents
4. Cooperating with community agencies such as:
   (a) Parks and Recreation Department
      (1) We make picnic tables for various locations throughout the borough
   (b) Halloween Parade and Carnival Committee
      (1) Early in the fall, the committee notifies me as to the theme, etc. for the official float. If no plans are sent, then the club members must design the entire float. All of the work that can be prepared in the shop is done before the three afternoons that

we are to go either to the National Guard Armory or the Borough garage. During the year 1965, I was elected general chairman of the parade. The young man assigned to drive the car that I was to ride in is now (and was then) an active member of the Junior Chamber of Commerce and a former charter member of our club. Because I was chairman, the boys felt that that parade had to out-do any other parade—and it did! That was the only year the club constructed two floats. One was the official float on the Parks and Recreation truck and the other, a convertible covered with over 80,000 carnation flowers made from Kleenex---it won first prize in its division.

(c) The Welfare Department

(1) This past Christmas the patients at the county home asked for something to feed the birds. The industrial arts club members constructed a bird feeder, went out and cemented the pipe in the ground a week before everyone else went with the gifts. We also supplied them with 100 lbs. of seed and a waterproof can to keep it in. Representatives of various organizations of the school took care of the huge lists and the gifts to match.

(d) Service Clubs of the Community

(1) Various jobs can be done for service clubs.

The Red Bank High School Industrial Arts Club's most recent mass production project was the best yet! We will be making a couple of hundred more since we plan to use them as favors to be used when we celebrate our 10th anniversary with a banquet next month. The Hi IQ, as we call it, will satisfy any age group. It can even be used for therapy.

I have attempted to show how the role of the industrial arts club is of great importance to the industrial arts program, the school, the community—and the individual. The club program can and must make a significant contribution to the future of industrial arts in general, and to the individual in particular.

Mr. Moses teaches at Red Bank High School, Red Bank, N.J.

VALUE THROUGH EXCELLENCE IN HIGH SCHOOL AND THE AIAA

Sister Mary Eligius Shanabarger, RSM

Ernest Hemingway's "old man of the sea" was a loner. He had something he wanted to accomplish, but he tried to do it alone. It wasn't until he accepted some help by taking the bait offered by the boy that he achieved any part of success. Perhaps if he had taken the boy along with him on his search for the big fish, he would have been able to bring it back. We can't break a whole bundle of sticks together, for in their standing together, we meet resistance. Free electrons are hardly powerful, but amass a goodly number of them and they light our lamps. One student may tell me that I'm not getting an idea across and I would regard it as a lack of understanding on his part. But if the majority of the class said so, I'd revise my method of presentation. Loose federations lost this land lying between the Schuylkill and Delaware River to settlers from over the seas who acquired unity they needed through meetings. By unifying, then, we can achieve power.

In measuring the value of something specific, we have to be aware of the general. We wouldn't be gathered here in Philadelphia if we were not convinced of the value of general meetings. Any elementary student of history knows that our nation was established as a result of meetings by our founding fathers: general and specific, national and local. We will go home more aware of the work they did after spending these days in the shadow of the buildings where many of these meetings took place. Here, through meetings, William Penn shaped the city geographically, formed its government, gave it a tradition of tolerance and piety. The Declaration of Independence, Articles of Confederation, Constitution of the United States—all were coined at conventions. Gatherings do produce—and ours can surely do so.

In the September 1952 issue of Coronet Magazine, William LaVerne makes the following statement in his article entitled: "The Real America." "The secret of America's strength today lies in the miracle that began one hundred sixty-three years ago when on September 17, 1787, delegates to the constitutional convention in Philadelphia signed the first step in our national journey: the Constitution''. For 200 years this soil has felt the feet of victorious conventions. It could be the scene of another step toward freedom—this time, freedom for advancement of industrial arts. I am awed, delighted, to be a part of it.

Meetings in general, then, are of proven value. Are student chapter meetings valuable to the student?

The value of anything must be measured by total enhancement. It is not only technical knowledge that is the goal of our excellency but also the total individual, educated to give and educated to be the sort of person accepted in industry and society. What has been accomplished in years gone past in a general way to form a more excellent union can be accomplished through our student chapters. There can be a parallel productivity. Spurred on, as we are, from information out of our national organization, helped through general news, our student clubs can give the boys and girls who make up the membership individually and collectively, opportunities in bringing about on the local level a more perfect union with school and township affairs; we can do our part to establish justice by balancing obligations and opportunities, bring about a measure of tranquility between student members and administration through mutual conversation and interdependence; provide a common defense for the glories of industrial art principles; promote general welfare of the entire student body.

In a general way, then, value of student clubs lies in the fact that excellency of the total high school student is aided and abetted not only in increased technical knowledge but also in increased awareness of life in its totality. Excellency has many facets. The industrial artist of the future is our high school student whose entire output—work and personality—fits into the social and industrial scheme. We live close to one another. The lives of our students touch us as ours touch theirs. Do we want them only to give the correct answer, do the perfect drawing, create the design supreme carried out in wood or metal par excellence? Our student clubs, through meetings and work, help develop excellency of the total teenager. Through group action they acquire an ability to plan together, organize, carry out worthy activities and projects. Group action demands planning in order to succeed. On all levels, failing to plan is planning to fail. As an aid toward successful completion of projects, perhaps it would be good to introduce points of the PERT program to club members. PERT: Program Evaluation and Review Technique. This program was originally developed by the Navy. The Management Center of Cambridge conducts seminars on PERT. Briefly, the tenets are:

1. Define objectives and goals.
2. List important or necessary steps to be carried out before a goal can be reached.
3. Establish sequence to the events.
4. Place time estimates on each job.
5. Give out responsibilities.

A friend in St. Louis, connected with restaurant management, often speaks enthusiastically of what he refers to as positive ''buzz'' sessions. All members gather, all are called upon to express opinions about problems and/or principles. All critical comment is barred - whether by word, grunt or gesture. Then a committee meets to go over ideas presented, adopting some, ruling out others. Much good might result from having such a session at our meetings from time to time.

By securing speakers to address students at meetings, technical excellence is enhanced. Speakers give the members a chance to explore industry and the American industrial civilization, helping consumer knowledge to grow in the student. This exploration and development can be afforded our clubs by experts in the diverse fields serviced by industrial arts. Through worknights and benefit activities we can

1. foster a deep respect for the dignity of man;
2. provide good leisure-time activity, wholesome recreation, hobby; and
3. instill thoughtfulness for others.

Besides such general values, many specific values are provided by speakers. Better achievement must result if we invite men from industry to address our local chapters. We can:

1. make students aware of what industry requires. (The kids hear us stress good workmanship, line value, lettering, projection, so much that it helps to have some one else stress the same points.);

2. bring student work before industry. (While these speakers are at our school they are sure to be interested in the type of work being done there. Praise and constructive criticism from them help both student and instructor.); and

3. enable officers to acquire experience in introducing and thanking speakers; members acquire experience in courtesy.

Conducting and attending meetings demand discipline; desiring to contribute fosters thinking; working for the benefit of others instills thoughtfulness. All activities of the club meetings, lectures, work nights—combine to instill desirable habits, help to achieve general goals of our organization, develop good attitudes toward the American way of life. Field trips provide like opportunities. With students making contact with industry when planning trips, sending follow-up letters of appreciation, arranging transportation and securing necessary permissions, training is acquired. Planning for the physical features: arranging the meeting area, providing refreshments, clean up, all afford occasions for training in leadership, responsibility, courtesy.

For years I had wanted to organize an industrial arts club but felt like it should have central affiliation, some outside goals, for success. When I joined the AIAA and learned about the student chapters, I knew that here was the help needed—here in the handbook's "general goals" were reasons for existing. I told my students about the proposed club and met with ready response. We have elections for organizations before the school year ends, so we had our local meeting last May with elections. We organized nationally with the first meeting in September. We have had 30 members—that number is about doubled now that this year's first-year drawing students are being admitted. Our meetings are held according to parliamentary law, as the handbook suggests but that has not prevented some heated discussions from taking place. The Principal has given permission for members to smoke during meetings. Since this is forbidden anywhere on the school property, we do regard this as quite a privilege. The boys know that as long as their actions conform to this privilege it will remain. We have had few incidents – and they have all been squared away by the members.

Reviewing the year, we can count upon many accomplishments: we made nearly a hundred free-form ceramic ashtrays for the American Red Cross. These were formed, glazed and fired by members. The Red Cross then distributed them to veterans hospitals in the local area. The parking lot lines were repainted, members of the group have built and painted sets for several dramatic productions. Administration wanted scale drawings of floor plans for fire drill purposes and members did these. We have had speakers from building trades and architecture, from trade schools, from drafting programs. We have had films. We have visited foundries and sheetmetal companies. We have had talks given by former graduates, men who as boys began their industrial arts training in the same desks now occupied by the present students. Not all that we planned has been accomplished. Tentative plans were made for raising funds for a student-father banquet around Christmas time, but that fell through. There are many pressures and demands made upon our present-day high school student. Most of our juniors and seniors have jobs in order to finance their education. Free time they have could be spent at any one of several places. Finding it hard to choose between activities, the one exerting the most pressure many times wins the student's allegiance. The founding fathers of our local organization are in my home room. They have taken care of many things. Perhaps they did these tasks better because they claimed membership in the AIAA. I don't know. Sometimes we miss the many things those we work with really do accomplish because we look too far for things near by. Maybe more praise and recognition coming from me would have helped. Wasn't it Calvin Coolidge who had to be urged by the master of ceremonies to say something after he had turned up a spadeful of dirt at a ground-breaking? He looked at the earth and, after a few moments, said: "That's a fine fishworm." Well, perhaps I've been as prosaic in my recognition, as tight with my remarks to our club members. Should I have pressured or praised them more? Could we have accomplished more? If so, I close our first year's activities with a sincere "mea culpa".

In our chapter meetings and worknights, as well as in our classes, we must keep reminding ourselves that we are dealing with very young adults; that what might be a good pace for the teacher is too swift for the student. It's like the man who took his four-year-old son for a walk one Sunday afternoon. The father noticed that every four or five steps was a skip and a run for the boy and he said to him: "Son, am I walking too fast?" His son replied: "No, but I am!" At times we may be walking too fast without realizing it; keeping pace with the young can be difficult. It is harder to hold back than to go ahead. We need to take baby steps, urging our club members to accomplishments which will be within their stride rather than to take giant steps where the span is so great that frustration results.

The industrial arts students we have in our classrooms now will take our places before many years. Those of you who are in industry, those of us who are in education, will give our places to these younger industrial artists just as we took the places of others in our time. As our future members, replacements, successors, we want them to achieve as much as they can in these formative years. Having had contact with the world of industrial arts through membership in student chapters of the American Industrial Arts Association, our students will not go into the next phase of their lives completely unaware of what will be expected of them; completely unaware of the part they must play; completely unaware of the privilege that is theirs to carry on the great traditions of the American way of life. Our meetings afford happy occasions for mutual interchange of thought and ideas. Through meetings and planning for them, greater rapport has been established between faculty and student, between administration and student; with better rapport, better communication.

Our student clubs are tremendous aids in achieving excellence, not only in actual training but also in breaking down barriers of formality. We can leave nothing untried which might help. It is good to see the light of understanding on the face of the student. Have you seen the current movie "The Bible in the Beginning"? In the creation of Adam we might see a parallel. The strong wind blew, the muddy area became a mound, took shape, became animated. Man evolves, breathes, moves. God has created a man! Our students come to us lumps of potential. All the means at our command—class and personal contact, student chapters, meetings, individual help, films, projecturals, models, afford the strong winds of formation, forcing down opposition, forming slowly but surely the industrial artist. God saw that it was good...

and so can we!

Sister Mary Eligius Shanabarger teaches at Mercy High School, University City, Mo.

W-5.1 AIAA
Special Exhibits
SPECIAL EDUCATIONAL DISPLAYS AND DEMONSTRATIONS
Chm., Gerald Detwiler; Panelists, Thomas M. Oliver, Muriel C. Willet
Miss Willet's manuscript for "The Making of Stained Glass Panels" was not provided.

FROM CULPRITS TO CAPITALISTS—THE BLUE COLLARS OF TEXAS

Thomas M. Oliver

I have been given some real stinkers for assignments at one time or another, but the one I received from my principal in 1962 was the one to top them all. It was this, "Build and teach a course in industrial arts that will be interesting and 'entertaining' enough for these kids, who don't like to come to school, will attend all other classes so they can come to your 'special' industrial arts class." He went on to say that he and the counsellor were preparing a list of those students, troublemakers, probable drop-outs and other 'undesirables' for my 'special shop' class. He said that he didn't care what or how I did it, but that Thompson had the worst drop-out rate in town and something had to be done.

The art and homemaking departments were given the same assignments—their accomplishments along this line have been zero!

I tried to give this problem some intelligent research. I talked with my own pastor, he offered to give them some "sermonettes", and church information. Now, we all know how that would have gone over with this type of student. The good reverend's final analysis was, "Brother Thomas, you really have a problem and I'm going to pray for you and your boys". I talked with some college professors who were less help than the preacher. That I had expected. I got the real help from the persons we would least suspect being helpful.

A plumber (unlicensed) who quit school at 4th grade level, told me,

"Learn them kids how to make a livin'! I've worked with high school graduates and some college kids that can't even measure pipe. They ain't got enough common sense to know that "sewage" won't run uphill—without it's got some pressure behind it".

A day laborer summed it up like this: "Teach 'em to do somethin', anything, so long as it's somethin' that not everybody can already do. Then they can get a decent job at it and not have to dig ditches, like me".

The manager of a lumberyard told me, "Whatever you teach 'em, teach 'em to get along with each other. For God's sake, teach 'em to work rather than to loaf. I'd be so glad to get a man who'd work, I'd give him a big fat bonus."

My colleagues in industrial arts were helpful, I received such advice as, "Resign—there's places open all over the state." - "You can do it, Oliver, we'll cheer you on." - "Yes, sir, it's a real problem".

I soon realized that of all the advice I had heard and attempted to correlate, the value of the advice given was inversely proportional to the academic standing of the advisor! I began to realize that I needed empathy. I must put myself in the potential drop-out's place. It was most difficult. You would be surprised at the places I went and the people to whom I talked in an attempt to intelligently plan the program that would be successful the first time. It was important to me to be right first, because there were some boys in the first group who really needed straightening out to be good citizens. The first class had more police record than school record. I made dual plans, and was prepared to change from one to another if it seemed advisable. I was a bit nervous as the first class came in.

The class was composed of ninth graders—you can imagine twelve of the "worst" at the "toughest" school in town. I told them at the beginning that we—they and I—would be an experimental class. We could do whatever we wanted to do. They decided quickly they didn't want to do anything. I agreed. There must, however, be no horseplay, rough-house behavior and such. They agreed. Loafing, gum chewing, candy-eating, joke telling, coin matching and penny pitching were all OK. No dice or poker games. I said I had some paper work to do. I'd be in my office if anyone wanted me. One student came in for chalk to draw a penny pitching line on the floor. First day? Success. Second day. I checked roll; asked for questions—there were none—reminded them of the rules and retired to my office. Toward the end of the class period, two came in, wanting to "make something." Small conference followed. My decision. No, man, you-all don't want to do anything - you said so yesterday - I agreed to that. This is the good old USA where the majority rules and the majority has spoken.

Third day. Larger delegation appeared - five students this time. Their request was the same. They received the same answer. By the end of this period the entire class had been in with the same request. I said we would talk about it next day.

Fourth day. Much discussion took place. Many complaints. I told them they would have to decide on projects. More confusion. More discussion. At length, I said that I had a house-painting job to do, and if they wanted, they could help me and I would share the profits with them. Earning money at school was too novel an idea. Some were skeptical. I reminded them we had the principal's permission to "do what we wanted". I had an eager and enthusiastic beginning.

What I had done was extremely simple. It was only a matter of leading the students to make the decisions that I wanted them to make, and consider those decisions to be their own. The program was immediately successful and has remained so ever since.

I taught them pride of craftsmanship and honesty of fair dealing as if these were a religion. I must admit we had a poor attitude toward "white collar" pencil pushers, and those who couldn't build with their hands. We named ourselves "Blue Collars" because we worked with our hands. We build things. Our boast was—and still is—"If you can pay for it, the Thompson Blue Collars can build it!" We guarantee your satisfaction with our workmanship and our materials. We took all jobs with the learning of a skill involved, we were not interested in cleaning, moving, unskilled work.

We have grossed about four thousand dollars. The students have earned all the profit, some two thousand five hundred. We have taken trips, had banquets and picnics. I must admit that some of our money we spent on "high living". Each Blue Collar who works enough hours earns a jacket with the Blue Collar emblem, which we designed. Currently, fifty hours outside school are required. We work after school, Saturdays, and most holidays. Our jobs are primarily in the building trades, but we have bound over two hundred books for our own and other school libraries. We build items for sale at Christmas time. Last year we built and sold one hundred and thirty dollars' worth of kitchen gadgets from a five-dollar packing case. We have built about everything from a house to a nutcracker.

About two years ago, a young reporter wrote a story about us. It made the Associated Press Wire Service. We have been given a lot of "good press". One would believe that such a class would receive much encouragement and support of the school administration. Not so. After I had shown that I had, personally, three thousand dollars' worth of equipment being used in the program, I was denied three hundred dollars for tool purchase. So you see, we have some small things in Texas, too.

We are, at present, building a car. It is a five-seat convertible. We will take a few trips in Texas and go fishing in Oklahoma shortly after school is out.

Difficulties began to build up the second year of the Blue Collars. You can imagine trying to explain to the student who tells you, "I make my grades, stay out of trouble, and get along with everybody. How come I can't get in Blue Collars and you let them troublemakers in?"

I had built a course for the "bad" ones and now was being plagued with "good" guys because the course was so well liked. I had to tell them that I would let them in on a "space available" basis, and that the other kids really needed the work more than they did.

Mr. Oliver teaches at Thompson Junior High School, Lubbock, Texas.

W-5.2 AIAA
Special Activity Sessions
DEMONSTRATIONS AND ACTIVITIES IN REVIEW
Chm., Gerald Detwiler; Panelists, Donald S. Wilson, George M. Haney, Alan D. Brown, Harvey E. Strine, Ellis M. Wendelin, Wayne A. Wonacott.

JUNIOR HIGH SCHOOL INDUSTRIAL ARTS CURRICULUM

Donald S. Wilson

We want to talk with you briefly about the industrial arts curriculum in the junior high school and what we, in Montgomery County, Maryland, are doing to try to strengthen our program.

First—A few basic assumptions about what industrial arts is and what it intends to do.

Industrial arts is a part of general education because it derives its content from industry—and industry and technology play a dominant role in the structure of our society.

Specifically it deals with tools, materials, processes, products, occupations and the organization of industry. And it further deals with the effects that a rapidly expanding technology has upon Mr. and Mrs. America.

As a subject area in our junior high schools, industrial arts intends to develop, in boys and girls, skills in:

---using a variety of tools and materials to construct projects.
---making, interpreting, and using drawings and visual aids to express ideas.
---critically analyzing a procedure or problem of construction.
---designing, redesigning, and modifying plans or products.
---collecting, organizing, and presenting data.
---evaluating talents and products.

In addition, it intends to develop understandings about how industry organizes men, machines and materials for the production of goods and services.

Thus far, I have told you nothing that you have not heard or read about already. But now let me give you a brief preview of how we are trying to enrich our industrial arts curriculum. It started in 1965 with the Montgomery County Industrial Arts Supervisors enlisting the aid of the University of Maryland in up-dating their curriculum. Sixteen junior high school teachers participated in a curriculum workshop under the direction of Dr. Donald Maley. During the workshop, content and method were developed which teachers later used to implement their curriculum.

Basically the curriculum is concerned with studying industry through our cultural heritage, through the organization of tools, materials and people for production, and through industries' use of research and experimentation. The activities that will be described intend to give a meaningful sequence for learning about industry and our industrial society beginning with the 7th grade and continuing through the 9th grade. The handout that you have describes the program in depth.

With me today are four Montgomery County junior high school teachers who will discuss the various activities or methods used in the program:

Mr. George Haney, instructor at Earle B. Wood JHS will discuss the unit approach at the 7th grade level.

Mr. Harvey Strine, instructor at Thomas Pyle JHS will discuss the group project.

Mr. Ellis Wendelin, instructor at Broome JHS will discuss line production.

Mr. Alan Brown, instructor at Earl B. Wood JHS will discuss research and experimentation.

We would like to hear all of the panelists and then accept questions for discussion from you. Mr. Haney will begin our presentation.

Mr. Wilson is with the Educational Services Center, Rockville, Maryland.

A STUDY OF MAN'S TECHNOLOGICAL ACHIEVEMENTS THROUGH THE UNIT METHOD

George M. Haney

It seems appropriate that the convention theme this year should be "Industrial Arts and Technology - past, present and future". Hardly a day passes without a newspaper account, magazine article or book reporting new technological advances. Walter Buckingham, professor of economics at Georgia Institute of Technology, has called this "the age of technology". He reports in his book, Automation: Its Impact on Business and People: "There has been more technological knowledge gained in the last fifty years than in all previous history, and the growth is accelerating."

The awareness of technology with its influence on society has recently prompted the formation of scholarly organizations for the purpose of studying technology. Melvin Kranzberg, professor of history at Case Institute of Technology, has been instrumental in organizing one of the first of such societies. The Society for the History of Technology has directed its efforts toward a study of the history and development of technology and of the relationship technology holds to society.

In the organization's quarterly Technology and Culture, Professor Kranzberg wrote: "The use of tools, together with the development of moral sensibility, has enabled man to advance from an ape-like creature through the Stone and Bronze Ages eventually into an industrial society whose objects we see all around us and which conditions our daily lives." Professor Kranzberg was of the opinion that technology represented one of the most distinctive and significant of man's capabilities. Furthermore, he felt that it has become essential to learn how technology developed in order to understand the changes it has brought about in contemporary culture.

If we can assume that a fundamental purpose of the formal school is to transmit the way of life or culture of a group of people, than those aspects of American culture characterized by a dependence upon technological and industrial achievements ought to be reflected in the formal school programs. The purpose of this presentation is to reveal briefly the content and method of a program that is attempting better to realize that need.

This program, as well as those to be presented by my colleagues, is supported by the following philosophical rationale of industrial arts. We believe industrial arts to be an area of general education which is concerned with a study of the theoretical and practical aspects of two dominant and interrelated elements of our society—technology and industry. Technology, as an area of study, is concerned with the ways in which man has learned to change the raw materials of nature into devices to make his way of living easier and more enjoyable. Industry, on the other hand, is a study of the ways man has learned to take raw materials, tools, machines and people and organize them for the purpose of producing objects in quantity. It also involves the study of the occupations, problems and benefits related to contemporary industrialism.

One way to introduce children to industrial arts is through a focus on some of the important technological achievements of man. This program is implemented through the "unit method". The "unit method" of teaching industrial arts, as distinguished from the traditional "unit shop concept", utilizes a set of teaching techniques which are common to the study of broad and comprehensive units or areas. These units or areas of study attempt to provide for the student better understandings and appreciations of the growth and development of civilization in general, and of Western civilization in particular. At the seventh grade level, this program uses an anthropological or historical approach to the study of man's mastery over the raw materials of nature and his progress in changing these raw materials to conform to his own needs and wants. In essence, its content is concerned with how and why man learned to make and use tools and machines, harness power and energy sources, and build transportation and communication devices—all of which enabled him to improve his standard of living and to have a more enjoyable way of life. The emphasis of industrial arts subject matter at this level is on technology.

In various Montgomery County, Maryland, junior high schools, this program has been implemented as part of a new comprehensive industrial arts curriculum. Seventh graders have engaged in the study of industrial arts based upon the following major units or unit topics: (1) the development of tools and machines and their contribution to the growth of civilization; (2) the development of power and energy sources and their contribution to the growth of civilization; (3) the development of communication and transportation and their contribution to the growth of civilization.

Each unit represents a broad and comprehensive area of study. Within each unit there are contained certain basic elements or subdivisions of subject matter that relate to the total unit topic.

To help clarify this description, let us suppose that the unit selected for study by a class was on the item (1) above. The teacher's initial role in conducting this program would be to provide the students with general background information, through films, slides, and class discussion, on what were some of the significant early tools and machines that led to the growth and development of civilization. A list, developed by both the students and the teacher, might include a study of such early tools and machines as these: (1) Stone Age tools; (2) potter's wheel; (3) early plow; (4) compass; (5) printing press; (6) McCormick's reaper; (7) hand pump; (8) spinning wheel; (9) loom; (10) spring pole lathe; (11) block and tackle; (12) cotton gin. (This list could be expanded to include several dozen more early tools and machines.)

Based on such an orientation, the student would now be in a better position to select, according to his own interests and desires, a particular tool or machine which he would like to study in greater detail. At the same time, his selection would relate to the overall unit topic.

One of the tangible results of this program is a constructed model or other visible project display depicting the tool or machine the student is studying. After making his sub-topic selection, the student soon discovers that he is unable to begin construction until he first becomes more informed or knowledgeable about the tool or machine he intends to build. At this point, trips to the school library, local public libraries, museums, government agencies and other such places become important in providing the student with the vital information he needs to complete his project. The information he collects on the operation and construction of the tool or machine he has selected provides the student with the necessary data to draw more effectively his own plans and layouts, and subsequently to construct a more authentic model or project display.

The data that the student collects also enables him to convey to his classmates what he is learning with regard to the need that prompted and the technical factors that made possible the invention and development of the tool or machine he is studying. No less important is the conveyance to his classmates of the social contributions to the people of that time period, as well as for present Western civilization. The procedures the student uses for research, the places he visits to collect information, the methods he uses in the project design, the problems he solves and the tools and materials he selects for constructing his project are also conveyed to his classmates.

This phase of the program is most effectively implemented through student-oriented seminars. In these seminars, the student presents his report in oral form before his classmates, using such instructional devices as charts, chalk boards, visual projectuals or overlays, and project models. The oral report, however, becomes a more permanent record in the form of a written seminar or research report incorporating all the elements just outlined.

In summary, an industrial arts program centering around a study of man's important technological achievements and implemented through the unit method provides for the student involvement and active participation in three broad areas of educational experience: research, planning, and construction. In the area of research, students learn to collect information, organize information and present information in oral and written form. In the area of planning, students learn to design, draw, solve problems, and work with others. In the area of construction students learn to select and use tools, select and use materials, and select and use equipment.

I would like to add in closing that the foregoing description of a program focusing upon important technological achievements of man and implemented through the unit method of teaching is one phase of a new and comprehensive curriculum for junior high industrial arts. What I have discussed has been based upon practical application by members of this panel as well as by others in various Montgomery County, Maryland, junior high schools. The projects, drawings and seminar reports which are included in the exhibit displayed before you attest to these applications. They represent the efforts of seventh grade students from these Montgomery County, Maryland, junior high schools.

Mr. Haney teaches at the Earle B. Wood Junior High School, Rockville, Maryland.

RESEARCH AND EXPERIMENTATION IN INDUSTRIAL ARTS

Alan D. Brown

In 1963, US News and World Report reported that there were 14.7 billions of dollars spent on research and development by our country. 14.7 billion---quite a lot of money, to be sure, but do we really know how large a sum that is? Why, if I were capable of stacking 14.7 billion as I'm stacking this money now, do you realize that the stack would go straight up 996 miles! That's right, 996 miles high. Gemini II astronauts at the highest point of their orbit would have seen the stack 146 miles higher than their own space capsule. It is estimated that in the 10-year period from 1963 to 1973, there will be approximately 200 billions poured out by Congress in the name of research and development. (US News 63 N, 55:72-4) 200 billions!! Why, that's a stack of bills 13,551 miles high. Or, if the bills were laid end to end, they would make a financial path 162 feet wide completely encircling the earth.

These figures, transparencies, and money are used to illustrate the emphasis placed on research and development in industries throughout our nation. The emphasis on R & D is steadily increasing. In 1947, when most of us were beginning our teacher training programs, only 0.7 tenths of a billion dollars was considered adequate for all R & D programs. If our industries have changed since 1947, so must our teacher-training institutions and certainly the programs being offered our youngsters, who were not even born at that time. Industrial arts is the study of industry. Industry has changed—so must industrial arts, if we are truly and accurately to interpret modern industry.

The program of research and experimentation in industrial arts is simply one of many programs in the industrial arts curriculum and is geared for the extremely capable youngster. Research and experimentation is designed for the 9th grade youngster. However, it has been taught at the senior high level, and I personally have taught it to 8th grade students. The youngster who is chosen for this program selects a problem area in which he would like to perform a research study. Usually the problem to be studied will be developed from a hobby or a profound interest on the student's part. After selecting a general topic or area of study, the youngster then must develop a statement of the problem.

It must be understood here that there are unlimited research topics from which to choose and that none of the research studies are predetermined or selected by the instructor.

Due to the time limit of my presentation this afternoon, I will describe and show slides of only one research study involving only one youngster. However, the general procedures shown in this slide sequence would be similar for all students even though their research topics are completely different.

The one study I have chosen to illustrate this afternoon was titled by the student: "An attempt to determine which of five completely different shaped balsa rocket fins could best stable, in flight, a rocket under the same atmospheric conditions".

After having developed the statement of the problem, the researcher must then begin to search for information concerning his problem. The search for knowledge, because of a sincere interest in a particular problem, becomes a lasting educational experience. The true researcher will exhaust all areas of knowledge and use numerous means of searching out that knowledge. He learns that a single source will mushroom into many sources—all willing to help a serious researcher in the quest for knowledge.

Jack is shown here drawing the plans which he will use to construct a test apparatus, so that he may begin the testing phase of his study. In his search for information, he discovered that a model wind tunnel was necessary, in order that the stability of rockets might be adequately tested. In this particular problem, a feasibility study was completed by the youngster prior to attempting the more complex study. Of course, after the pilot model proved feasible, Jack began construction on the larger wind tunnel test chamber.

During the construction and testing phase in the laboratory, the entire class meets in the seminar room either weekly or twice a month to conduct an hourly seminar. Two students are usually chosen to report on the progress of their study and support their progress in front of their class members. The students who are not presenting will raise questions and offer helpful suggestions as a part of the critical analysis of the seminar report. It is a time of building and not of destroying. Jack is shown here making his seminar report to the class. He is using a transparency which he has made to express his research techniques clearly to the seminar group. Individual student progress reports and reports of research items found in the daily or weekly publications are also a very important and meaningful part of the seminar.

A typical seminar agenda which was developed by the student moderator looks something like this (transparency).

The final requirement for each student is the completed research study or report which adheres to the following format: (transparency)

In the past, we have voiced our objections to using the industrial arts programs as a dumping ground. We have criticized the counselors and administrators for placing only the low-ability students in our programs---

Could it be that we have no program in the industrial arts curriculum to attract the high-ability youngster? It could be! Research and experimentation could be that program.

Mr. Brown teaches at the Earle B. Wood Junior High School, Rockville, Maryland.

THE GROUP PROJECT

Harvey E. Strine

I am a teacher, not a salesman—even though I have considered selling encyclopedias several times in my career. Today I am here as both. I am a teacher who genuinely feels he has something worth selling.

What I have to sell is not a book, even though the information to be gained from it is worthwhile. It is not a tool, even though it is designed to aid in a specific function. It is not a machine, even though it can be adjusted to meet your needs. It is not a material, even though it can be formed into a useful product. It is all of these, and it is commonly called the "group project" method of teaching.

Because this method is designed to fulfill specific objectives and to meet certain needs, and because the needs of the child determine to a large extent the objectives of a program, and because the objectives direct the content and methods to be used, I must briefly mention needs and objectives.

Regardless of what you believe industrial arts is or should be, there seem to be several common objectives, one of which I believe to be an understanding and appreciation of contemporary technology and its implications for our society. This is derived from the child's need to understand the how and why of the society in which he lives, an industrially-oriented society. This is not to say that other objectives are not as important. I believe, however, the group project is a method that meets this need and fulfills this objective.

The group project, as I see it, is a method in which the class is organized and works together to produce a display-type project that is symbolic of the learning that has taken place during the process. The project can represent the organization, operation and productive function of a major American manufacturing or processing industry. These projects can be a table or panel-type depending on the class and the information to be depicted.

The students also discuss the various jobs and occupations involved in the selected industry, and, through role-playing, they assume these jobs and responsibilities in the construction of the project. Project manager, engineers, safety and training director, procurement, and design and accounting positions are several of the occupational areas in which the student-studies are involved.

Each member of the class chooses a topic of his interest related to the industry under study and researches the information available, and then, by means of an oral and/or written report, he presents this to the class. The topics in my classes have ranged from the "Socio-Economic Aspects of Employment in the Automotive Industry" to "What an Assembly Line Worker Thinks of His Job".

So far I have not mentioned the use of tools, machines and materials; this, however, is a very important aspect of the group project. To make possible the realization of a project, each member of the group selects a part of the total project in which he engages in designing, planning, construction and assembling. Here, as in previously-mentioned areas, the student contributes collectively to the total group project.

This group approach to the study of American industry provides opportunity for each student to achieve some degree of success, to develop qualities of leadership and "followership," and to learn shared responsibilities through student-teacher planning and coordination.

The entire group process is flexible. It can and should be modified to meet specific needs and to challenge the abilities of the class.

To summarize – The group project is a method in which students organize and work together to produce a project that will represent or depict a major American industry. The project may be a table model display, a panel type, or some other means of representing the industry selected by the class.

Several of the activities representative of student participation in the group project are:

1. Contributing to class discussion on selecting the industry to be studied.
2. Assuming the role as a member of the personnel organization of the selected industry and performing the duties of this job.
3. Selecting a specific topic of his interest relating to the industry, researching the topic, and presenting an oral and/or written report.
4. Selecting a specific part of the project and constructing that part using tools, machines and materials.

If we in industrial arts can provide opportunities for students to work together in developing an article of more than personal value, if the various occupations and professions of industry can be viewed in their relationship to one another, if the students can perform the work and develop the skills necessary to accomplish a worthwhile goal of their own choosing, and at their own level of understanding, then industrial arts experiences such as the group project can aid students in making sense out of the technological society in which they live.

Doctor Maley of the University of Maryland has said of an experience similiar to this: "Here we develop ways and means of gaining greater insight into industrial and management operations, and a wider understanding of some basic industrial phenomena. Here we feel that instead of each person doing some little items on his own, we also get enhanced value and opportunity by finding out, through organization, how students are able to work with one another."

In a project such as this, the end product is actually more than an end product. Each class member uses previously learned knowledge to achieve new techniques, skills and more knowledge. It is likely that these experiences will be typical of his future environment. Regardless of what the future brings, we know we will be required to work in close harmony with others.

As previously mentioned, the primary objective of this method is the understanding and appreciation of contemporary technology. However, this has little meaning unless broken down into more specific understandings, realizations and student developments. I feel the following are elements of the primary objective, and several are common to other disciplines:

1. To understand the sociological aspects of group and individual interaction.
2. To develop qualities of leadership and "followership".
3. To realize that each member of the group has a contribution to make.
4. To understand how industry organizes men, materials and tools for production.
5. To understand the role of capital, labor and natural resources in an industrial organization.

The students also develop skills in the group approach:

1. Designing, drawing and sketching.
2. Planning with others.
3. Researching information.
4. Selecting and using materials.
5. Using tools and machines.

In conclusion, I would like to stress the fact that the group project works. It is educationally sound and meets the aims of industrial arts. It is by no means the ultimate method. No method is. Unless it is used with discretion and joined with a certain degree of teacher enthusiasm, it can fail. However, here is one answer to the question, "How can I teach an understanding and appreciation of American industry?" In the group project we are not just using tools, machines and materials; but we are doing something more, something which can enrich and broaden the child's concept of tangible items, something that better fits the day in which he lives. We in industrial arts can and must be aware of the different needs of the students we teach. Awareness alone, however, is not enough. We must be willing to meet these needs, even if it means change.

Mr. Strine teaches at the Thomas W. Pyle Junior High School, Rockville, Maryland.

LINE PRODUCTION

Ellis M. Wendelin

Since many of our children today lack a realistic contact with the fundamental processes, their study of peoples and industries can be made more meaningful through a participation in a line production activity. Here they can more clearly identify themselves with other peoples by understanding the labor and patience required to provide the necessities of life and perhaps even a few of the simple luxuries. They may begin to comprehend something of the difference between our complex machine age and the simpler handicraft societies of other times and other places.

We will probably all agree that our culture today is one that is ever-changing and technological in nature, and since one of the purposes of industrial arts is to provide students with a knowledge about some of the important characteristics of our culture, then we may be better able to do this by studying the nature of mass production through experience with the tools, materials and techniques of industry.

Of course we cannot hope to duplicate an industry with its intricate line production facilities, but we can show movies to the students, or we can arrange visits to industries which use a line production. By way of practical application in our classroom we try to simulate an industry: we form a company, we sell stock, we manufacture an item and then we sell the product for a profit. All of these steps give the students a view of the line production used by the industries of our society.

Henry Ford pioneered mass production by using the four main principles of mass production:

1. Interchangeability of parts (so timely used by Eli Whitney)
2. Automatic conveyance of work to and from the workers (put into use by Oliver Evans in his grain elevators)
3. Division of labor (originated by Elihu Root, one of the great geniuses of our time, the "Colt revolver")

4. Elimination of individual wasted motion (exemplified by Frederick Winslow Taylor, the original "efficiency expert")

These basic principles would lend themselves to the teaching of line production very easily in a junior high school laboratory. Our project would be student-selected. It could be one suggested by a member of the class, or it could be selected from a list prepared by the teacher. There are some criteria for proper selection of the project: cost, size, availability of materials and simplicity as to the number of parts or operations. It should also satisfy some of the desired skills to be learned. At this point, it should be noted that the instructor becomes more and more a resource person or coordinator and not a dictator of the activity.

As stated before, we started by forming a company with each member of the class selecting a role that represented management, such as, general manager, production engineer, safety director, quality control engineer, purchasing agent or supervisor. The student's goals were to study, design, propose and direct the manufacture and sale of a quality product which could be sold at a profit to buyers outside the classroom.

After the product was selected and designed, a prototype or model was constructed by a small group and then submitted to the whole group for further analysis. Now the job was to break it down and analyze it according to various operations. The significance of jigs and fixtures and other devices was emphasized as aids to the production.

Some new factors came in: production costs, proposed selling prices and desired profits. Soon the big problems started to evolve: flow of materials, finishing, inspecting, packaging, distributing and selling. Of course, during the actual production phase, the students assumed the role of workers on the assembly line. Here they attained new social and technical experience as they learned to work together with the tools, materials and machines. They began to realize the importance of each man's doing his job in order to manufacture a quality product.

Each student had an opportunity to identify his role with his counterpart in industry. The safety director made posters; the production engineer analyzed some of his problems; and industrial relations may have had some problems to settle with the grievance committee. The pupils also had an opportunity to feel what it was like when someone referred to the monotony or boredom of working on an assembly line.

In an experience like this there can never be too much planning: what did we do about production bottlenecks? What about the student at the beginning of the line who finished his operation before the others? These were some of the many problems that had to be solved. It was suggested that the student who finished first be assigned a role at the end of the line in packaging or distribution, or, for that matter, he could start the clean-up detail.

One problem which arose was: How much time do we need to plan for the actual run? This was solved by discussing the time element with the administration of the school. Another suggestion which was made was to hold the class over for two periods, if need be, by providing class coverage for the incoming class.

After production, another rewarding phase resulted when the students expressed their learning experiences in discussion groups. This was a form of evaluation, although evaluation was going on all the time. This was the time when the engineers gave their production reports. The production manager reported on costs, sales, investments and profits. The industrial relations man and the safety engineer reported on their roles, and all the students had a new experience by actively participating, along with the teacher, in a line production activity.

Mr. Wendelin teaches at Broome Junior High School, Silver Spring, Maryland.

ELEMENTARY SCHOOL INDUSTRIAL ARTS: A MULTI-MEDIA, MULTI-SCREEN PRESENTATION

Wayne A. Wonacott

The industrial arts program as it is carried on in the Los Angeles City elementary schools was portrayed in a unique, wide-screen, film and sound presentation. Several educational media were integrated to tell a story of an elementary school teacher confronted with the possibility of teaching industrial arts along with the many other subjects of the daily program.

The 30-minute presentation was produced by a group of Los Angeles City and County educators in 1966. They were David O. Taxis, Marilyn Benefield, John Giovannoni, Frank Hedrick and Wayne Wonacott. The program was made originally for the American Council for Elementary School Industrial Arts and was shown at their meetings in San Francisco during the 1966 AIAA Convention. It was then decided to bring the program to Philadelphia in 1967, and to show it to the general membership of the AIAA.

The multi-media technique was devised by audio-visual educators in recent years to show what could be done with equipment usually found in almost every school or college. In a manner of speaking the technique is a "poor man's" cinerama. The wide-screen effect is gained by using three screens and projecting three related pictures simultaneously.

Both 35 mm color slides and 16 mm color motion pictures are used to tell the visual part of the story. Motion pictures are projected onto the center screen with related still pictures on either side.

A tape recorder provides various sound effects and a musical background for the production. Live narration over the public address system helps keep the presentation from sounding impersonal and canned. The whole story is told directly to the audience and the narration is varied according to the type of group that is present.

Prior to the 1967 AIAA Convention, the production had been shown about eighteen times to various types of groups of educators. The entire crew could not come to the Philadelphia Convention to operate the equipment so members of the Phi Alpha Delta Fraternity of Trenton State College volunteered to do the job. This meant that all of the variations of the films and sound had to be learned and rehearsed in one day.

The elementary school industrial arts program in Los Angeles has been in the course of study for many decades, but unless teachers and administrators are kept aware of what the program does for children there is the danger of a freeze-out due to other pressure areas. This film has helped and will continue to give Southern California educators a little more insight to a very worthwhile, but elusive subject.

Mr. Wonacott is supervisor of industrial arts, Division of Elementary Schools, Los Angeles City Schools, California.

W-6.0 AIAA-ACIAS
Third General Session
HOW AND WHERE CAN WE DEVELOP CONTENT FOR TEACHING INDUSTRIAL ARTS FROM TECHNOLOGIES OF THE PAST?
Presiding, Robert L. Woodward; Chm., T. Gardner Boyd; Rec., William F. Bowin; Obsr., G. Wesley Ketcham; Presenter, Earl M. Weber; Hosts, Clifford W. Jahn, Ralph Edelbach

HOW AND WHERE CAN WE DEVELOP CONTENT FOR TEACHING INDUSTRIAL ARTS FROM TECHNOLOGIES OF THE PAST?

Earl M. Weber

"Industrial Arts and Technology – Past, Present, and Future" – that is the theme of this year's convention.

There is a kind of double-barreled load implied in this theme. The first phrase—"Industrial Arts and Technology" seems to say that industrial arts is a study of technology. There is probably no major argument here except the word "technology" is a bit ambiguous and defies a simple, clear definition. I am going to duck that issue because my main purpose this evening has to do with the second phrase of the theme—"Past, present and future." More precisely, the focal point this evening is on one word in the theme—the word "past"—past technologies. If you've studied the plan of the convention program, you have noticed that today's programs have been concentrated on technologies of the past. Beginning with Dr. Kranzberg's excellent address this morning, the theme of past technology was accented in the various special interest groups and panel sessions throughout the morning.

Tomorrow, on Thursday, we shift gears and examine present-day contemporary technology—and on Friday we will attempt some crystal ball gazing as we look into the future in an attempt to understand technology and man's relation to it.

But for tonight it is my job to speak to the topic, "How and Where Can We Develop Content for Teaching Industrial Arts from Technologies of the Past." That was the assignment given by Len Glissman, who had the responsibility for developing this particular session in the program.

There was some excellent practical psychology used by Len as he planned the program.

It was early last fall that he contacted me and asked if I would speak on the general theme of "implications for industrial arts in technologies of the past" at the 1967 convention in Philadelphia. The idea sounded a bit intriguing because I happen to like history (my high school record wouldn't verify that), and I had one or two half-baked ideas that could probably, I thought, be developed into an interesting convention program. Anyway, as I said, all of this took place early last fall and the convention was six months away—that sounded like plenty of time to do the required reading and to allow half-baked ideas to bake.

Well, to use a cliche, time does fly—even faster than it used to, I think—and some ideas need much more baking time than others. If I had been asked again during the Christmas holiday, I would have been a bit more hesitant to accept because I was indeed getting more apprehensive about the assignment. A month later, when the break between semesters came along in late January, I was no longer apprehensive – I was frantic – because the thing simply didn't seem to jell.

For a while I entertained the idea that I could sort of duck the topic—you know—sort of work around it a bit to do something that would be much easier to talk about. Like the college student who thought he had "psyched out" the biology exam. He was sure the exam was going to be on the mosquito. For this he crammed. When the test was announced he saw to his dismay that it centered on the elephant. He wrote as follows: "The elephant is a large mammal with a long proboscis called a trunk. The elephant uses this trunk to kill mosquitoes. ---Now the mosquito is . . ."

But that didn't really seem like the sporting thing to do – so that idea was rejected.

Technology of the Past – that's history pure and simple, and the question immediately comes to mind--what does industrial arts have to do with history? The simple answer is nothing--let historians teach history--and let industrial arts teachers teach industrial arts. That answer is too simple and too pat. It isn't very satisfactory. For one thing, this is a special kind of history with which we are concerned--the history of technology. And technology is our concern. At this point some of us will argue that our attention should be directed to a study of technology all right--but it should be technology of the present. This argument also proves to be bootless--because in this age of rapid change the technology of today is the history of tomorrow's technology. If that sounds confusing, let me say it another way. If a boy in junior high school today is studying the most recent and up-to-date contemporary technology, much of what he learns will have been replaced with still newer concepts of technology before he graduates from high school or college. So really he was in a sense studying the history of technology in the making.

Perhaps it would be helpful at this stage to point up two questions that are basic to this discussion.

1. What is history?
2. Why study history?

If we can answer these two questions for history in general, we should be able to apply the answers to our immediate concern with the history of technology, and possibly then the implications for industrial arts will become more clear.

Before I get into a definition and justification of the study of history, let me assure you that I am not posing as an expert professional historian.

You may have heard of the Communist named Rudolph who got into a big argument with his wife. They were looking out of the window and he remarked, "Look, dear, it's raining." After she studied the precipitation for a moment she observed, "No, dear, it's sleeting." Rudolph took another look out of the window and stubbornly repeated, "It's raining." Without bothering to look again, Mrs. Rudolph said with flat finality, "It's sleeting." Drawing himself up to his full height he announced with exasperation, "Rudolph, the Red, knows rain, dear!"

Well, I do not make that kind of confident claim about my knowledge of history--but I have in the past few months done a fair amount of reading along such topics as the philosophy of history, the method of history and the study of history. Three sources that have been particularly helpful are:

Allan Nevins' Gateway to History, Henry Steele Commager's The Nature and Study of History, and an article by Professor Richard Bauer entitled "The Study of History" which appeared in Social Studies. It was of some passing interest to learn that historians spend almost as much time and effort in defining and justifying their field of study and trying to agree on objectives as do industrial arts people. Instead of arguing about whether their subject is general or vocational education, historians lock horns on trying to decide whether history is art, science or a part of philosophy. I suppose this kind of professional "in-fighting" is present in every discipline.

History is in a sense an ambiguous word. First it means the past--a minute ago, last week, five years ago or thousands of years ago to the times to which historians vaguely refer as the "dawn of history". The past and all that happened in the past--politics, wars, religion, economics, architecture, art and technology--all of these and many more are the stuff and essence of what we call history. But another meaning of the word has to do with the record of past events rather than with the events themselves. Let me illustrate using an example familiar to everyone. Lincoln's Emancipation Proclamation was an historic event. It can be documented accurately as to time and place. But the ink on President Lincoln's signature was barely dry before a great many people had quite a lot to say about the proclamation. Articles, editorials, letters and speeches, both supporting and condemning the proclamation, were in abundance. All of these form a part of the record of the historical event--and they too are history. And this is a never-ending process. Even today--especially today--historians find cause to study the events leading up to Lincoln's Proclamation and to reassess its significance and impact. This is true not so much because new records have been discovered, but because each generation of historians can view events of the past from a new vantage point--that moment in history when they happen to live. And all of this is a part of history.

Allan Nevins, in a chapter titled "In Defence of History", says, "Were history as nearly static as some branches of learning, it would be a drab affair; but it is alive in this, that it is constantly being reborn like a phoenix from its own ashes. As mankind lengthens its record, perspectives steadily change. The lenses through which we look at the past must be refocused from generation to generation. What seemed wisdom to our fathers is often folly to us; what is intensely dramatic to our age may seem naive or banal to the next. While the best history is perdurable, there is a sense in which every generation needs to have history rewritten anew for it; and in this fact lies much of the challenge and fascination which historical activity will always have for thoughtful men."

The task of the historian appears to be threefold. First, he must collect the facts and information surrounding an historical event--which is to say, anything that happened in the past. Second, he must organize this material to give it some order. This might be logical, chronological, geographical, or any other system which seems most appropriate. Third, and in my estimation most important, he must interpret the material. What was its significance? What was its impact on people? What decisions did it influence? These and many more questions must be answered as the historian interprets the historical record. Again, if I may be permitted an irrelevant observation, I believe that one reason so many school children think of history as a cold and dull subject is that too much emphasis is commonly placed on the first two phases of history--the bare historical fact--and the sterile (usually chronological) organization of events surrounding the fact. Who can blame the healthy youngster of 10 or 12 for failing to do handstands when he is informed that Balboa discovered the Pacific Ocean in 1513? Surely this was an important event, but its importance is not in and of itself, but in its relevance to other events and the possibilities for the future. Unless a student can be made to see this relevance, the fact itself is hardly worth learning.

Students, whether in high school or college, are frequently very skeptical about the value of history. If one asks these students why they do not like history, he will likely get the following answers:

Too many dates and wars to remember.

It is not interesting or stimulating.

What good will it do to know what happened in Europe or Egypt hundreds or thousands of years ago--who cares?

What can you do with it after you graduate?

Another student might allow that history is interesting enough, but that it just isn't practical.

How shall such questions be answered? It is easy enough to say that history should be taught in such a way as to make it meaningful and interesting and that to insist on the memorization of large numbers of dates and names of generals is not that way. But how does one answer the charge that history is not practical? The only honest answer is to agree that it is not practical in a utilitarian sense. No one makes a living from his knowledge of history--except those who plan to teach it. History is a cultural rather than a practical subject. But that's quite all right; although industrial arts is commonly thought of as a practical subject, it has a stake in cultural education, too.

In the article referred to previously, Professor Bauer lists several reasons for studying history. As each of these reasons is reviewed I shall attempt to apply it to a study of history of technology.

First, he states that "It will give one a better understanding of modern civilization by explaining how our institutions--whether economic, political, social or religious--(I would add technological) came into existence and what historical forces are at work modifying them. It furnishes answers to innumerable questions concerning various aspects of life. Why has the United States a federal government? What is the origin of American democratic ideals? How has big business come to be? What are the roots of communism and fascism? Under what circumstances has religious liberty developed in America? For answers to these questions, as well as to many others, we must turn to the pages of history for enlightenment."

To this list of questions we might well add:

1. What is the relationship between the Renaissance and Gutenberg's invention--and precisely what was his invention?

2. How did the Puritan Work Ethic develop and how can it be reconciled with today's automation?

3. Besides his contributions in government and politics, what about Thomas Jefferson and his work as an inventor? What technical contribution did he make to plow design? What really does it mean to have a plow "scour"?

4. Why was the Pennsylvania-Kentucky rifle a superior weapon to the earlier muskets? What's the difference between a musket and a rifle? What technical problems did the early gunsmiths have to solve to achieve the rifled barrel?

The answers to these and many other questions are also to be found in a study of history--the history of technology.

A second reason which is advanced for the study of history is: "It helps one to interpret current events. Important developments are daily occurring in Europe, Asia, Africa, Latin America and the United States. It is not enough to know what is happening in various parts of the world, but why events are taking place. History will often furnish the 'why.' In recent years the world has been passing through many serious crises, all of which can be better understood in the light of history."

Here again if we take just one country--Africa is an example--isn't it logical to assume that if we understood much more clearly the problems our own forefathers faced as they were forced to change (during the Industrial Revolution, for example) we could better understand the problems of the African as he is now being forced to change his mode of living and work (at a much faster rate than our forefathers).

Not all of these changes have to do with technology--but many of them do.

The third reason Bauer lists is: "It provides an excellent background for other courses. For the student who plans to study law, a knowledge of Roman history, the constitutional and legal history of England, and the constitutional history of the United States will prove very beneficial. For the student of art and literature a historical background is well-nigh indispensable. Even for the student of science, a knowledge of the history of science should be very helpful."

This one provides a really fertile field for history of technology. In any period or age one can see unlimited possibilities: see, for example, the technology involved in metal armor and weapons used during the Crusades; the technology of printing and its bearing on the Renaissance; the technology of wagon-making and its part in the Westward movement; American technology in developing the plow and the reaper to conquer the vast prairies of the Midwest; or in an earlier age, the technology involved in building the pyramids and the great cathedrals of Europe.

A study of the history of technology could certainly enrich a student's understanding of many other fields of study, ranging from art to agriculture, and from engineering to religion.

The fourth reason which Bauer cites for studying history is: "It tends to sharpen one's critical faculties by providing many opportunities to make fruitful historical comparisons as well as to weigh and sift historical evidence. Such experience will make it much easier for one to detect the errors, half-truths, exaggerations and misstatements to be found in numerous articles, books and newspapers. Citizens who exercise their critical faculties seldom fall prey to demagoguery."

No area is immune to errors, half-truths, exaggerations and falsehoods, and few are more subject to these maladies than the history of technology.

The scholar with no background in technology is frequently guilty of writing such phrases as "the invention of printing by Gutenberg", which is at best a half-truth; or he speaks of wrought iron when the process is actually casting; or he refers to exposed beams of a house when he really means rafters, or vice versa. The list of "wrongs" is much longer--and it continues. Every day I hear my academic colleagues refer to "cutting a stencil" for the multilith or spirit duplicator--and we know that the plates and master sheets used in these processes aren't stencils in any sense of the word.

Today we in industrial arts make the claim that without an understanding of technology one is simply not prepared to live intelligently or to be sensitive to his environment. I believe this is true. I believe it is equally true to say that one cannot truly appreciate the cultures of the past without knowing of the technologies of the past.

The fifth justification which Bauer lists for the study of history is: "It often tends to develop a sense of sympathy and toleration for other classes, nations and religions. Prejudices and ill-feelings, often rooted in ignorance, are likely to disappear with a knowledge of the historical background of these groups. The good history student is able to place himself 'in the shoes' of other people, so to speak, and to think and feel as they do. In doing so he cultivates an attitude of tolerance and understanding, so imperative in our day, when large sections of the world's population are steeped in hatred and bigotry. Good feelings among nations as well as within nations are a prerequisite for the reconstruction of the world."

I think this reason needs no amplification and it also appears to be obvious that the more completely one can "place himself in the shoes of other people" the more likely he is to develop the desired attitude of tolerance and understanding. These "shoes" include the arts, crafts, industries--in short, the technologies of other peoples.

The final reason for studying history is: "It frequently stimulates a greater interest in the finer things of life by introducing us to the writings of the famous philosophers, scientists and statesmen. It points out to us the masterpieces of the eminent painters, musicians and other artists. In short, it acquaints us with our cultural heritage. Students who have cultivated an interest in the finer things need never worry about what to do with their leisure time."

With just a few additions Bauer's statement here seems to be tailor-made for industrial arts. Let me read it again with these suggested changes: "It (a study of history of technology in industrial arts) stimulates a greater interest in the finer things of life by introducing us to the discoveries of the famous inventors, scientists, and builders. It points out to us the masterpieces of the eminent artisans, craftsmen, and artists. In short, it acquaints us with our cultural and technological heritage. Students who have cultivated an interest in these finer things need never worry about what to do with their leisure time."

One could go on indefinitely with a justification for teaching of history in general and for the history of technology in particular--I suspect I may have already belabored that point. And one could find ample documentation for such justification--that has also been demonstrated. However, the real crux of the problem may be whether or not the teaching of history of technology is compatible with industrial arts. I believe it is. This conviction includes both the traditional approaches to industrial arts and several new directions which are now being advocated, or which are now on the horizon.

Let's take a brief look at some of these. Dr. DeVore, in his essay titled "Technology, and Intellectual Discipline", establishes several criteria as being essential elements of an intellectual discipline. The fourth one in his list is as follows: "(it) identifies as a part of its tradition and history a considerable achievement in both eminent men and their ideas." DeVore goes on to show that industrial arts meets this criterion. "For the record," he writes, "we can cite such men as Gutenberg, Merganthaler, Watt, Fulton, Whitney, Bessemer, McCormick, Bell, Maudslay, . . . Steinmetz, Ford, Wright and Goddard. These men contributed ideas and concepts relating to printing, power, production, communication, machine processes, electrical theory, transportation and aerospace."

If, as DeVore suggests, this history is an essential element of our field of study, then it would seem that the intent is to have a student in the discipline become familiar with this historical background. This would support the idea of teaching history of technology as a part of industrial arts.

Research and experimentation, the method advocated by Dr. Maley and others, is admirably suited to a study of history of technology. The anthropological approach, also identified with the University of Maryland, would seem to be very closely allied to the history of technology.

In "The Conceptual Study of American Industry", which is being developed at Stout State University, there seems at first glance to be no provision for a history of technology. In fact, the structure of industry is defined as the "unified basic description of the several facets of industry as found in contemporary American society." But I respectfully suggest that there are two limitations stated in this definition--and that neither is really a basic or essential ingredient to the success of the project. The two limitations are expressed in the words "contemporary" and "American". The conceptual approach, which is the method advocated in the Stout plan, would appear to be equally applicable if either or both of the words "contemporary" and "American" were deleted. In other words, it appears that a "conceptual study of industry" could easily accommodate a study of the history of industry or technology--both American and others.

In general, what has been said concerning the Stout Plan might apply also to the Industrial Arts Curriculum Project at Ohio State. The definition of industrial praxiology would not seem to exclude a study of the "history of technology" (though the researchers on this project might object to the restricted meaning of technology). The matrices which have thus far been developed do not appear to include any historical study. However, the authors of this study have wisely left the door open for further development "along systematic and analytically defensible lines". A study of history of technology could be one of these further developments.

These brief references to a few of the current curriculum studies in industrial arts are intended to illustrate two points.

First, we are not advocating that history of technology become the basis on which our discipline is founded, or even from which its major emphasis or content is derived--but rather that it be included as a part of the total structure to enrich industrial arts.

And, second, no matter which of the current studies and proposals for curriculum change, or what combination of them eventually does determine the direction to be followed, the history of technology could and should be a part of the final plan.

In fact, it should be the beginning--"What is past is prologue".

The teaching of some history in industrial arts is not really a new idea, although it has been rather spotty and inconsistent. In the graphic arts, for example, most of the textbooks begin with a chapter or two on primitive means of communication and the origins of printing. The student learns of piles of stones called "cairns" used to commemorate important events, of the knotted rope "quipus" used by certain Indians to send messages, of clay tablets with their cuneiform inscriptions, of the hieroglyphics developed in Egypt, of early block printing in the Orient and Europe, of the attempts to cast type in clay in Korea, and of the beautiful illuminated manuscripts produced by the monks of medieval times.

He learns that the Egyptians made a kind of paper from the papyrus plant which grew along the river Nile. And increased commerce in the Mediterranean area used so much of this papyrus that, fearing extinction of the plant, an Egyptian ruler issued a royal decree forbidding its export. The Greeks discovered parchment and vellum as a substitute, and these materials were in common use in Europe through the 15th century (Gutenberg printed some of the copies of his famous Bible on parchment and some on paper). This 15th century use of parchment is especially interesting in view of the fact that T'sai Lun in China had made paper from silk rag as early as 105 AD.

It is rather curious that at least this much history is rather common in a study of printing and the graphic arts, and that a similar kind of study is not usually found in wood or metals or the other areas of industrial arts.

I am well aware of the fact that in the short time devoted to this topic this evening

I have not presented a conclusively airtight case for teaching history of technology in industrial arts. I am equally aware of the fact that our curriculum is already crowded and that there simply isn't time enough to do all of the things in industrial arts that we should like to do. However, I don't think these objections are insurmountable. For instance, many industrial arts teachers have felt that a unit in mass production should be included in their programs. It is generally agreed, I believe, that such a unit need not take up a whole year, or semester, but can often be concluded in a few weeks or even a few periods, depending, of course, on the complexity of the plan and the product to be produced. No matter what the product or how detailed the unit, there are certain concepts, such as the use of jigs and fixtures, the interchangeability of parts, and the specialization of labor that the student hopefully acquires. No teacher who plans and teaches such a unit is naive enough to think that he has taught all of mass production. But he does hope, and has a reasonable right to expect, that his students will have gained the ability to comprehend much more completely the ways in which goods of any kind are mass produced in today's complex industrial organization. In much the same way I believe it is possible to include in any area of industrial arts a unit devoted to the study of history of technology. Such a study would serve to heighten one's awareness and appreciation of his heritage--his technological heritage. That would seem to be a worthwhile aim.

If anyone is thinking that such a study lacks appeal or popular interest, let him note the increasing numbers who each year visit such places as Colonial Williamsburg, or old Sturbridge Village, or the DuPont Museum at Winterthur, or Landis Valley. At each of these places there is a heavy emphasis on the crafts and industry of an earlier age. The expansion of the Smithsonian Museum of Science and Technology in Washington, DC, is another testimonial to public interest in this field. And these places are not only--or even primarily--for adults. Thousands of school children make annual visits to each of them. Anyone who has served as a guide or chaperone can attest to the excitement and interest a youngster shows as he sees "the Spirit of St. Louis", or the 20-mule combine, or the Blanchard Lathe for turning gunstocks at Smithsonian.

One of the obvious difficulties with the proposal I am making here is that the field is too big. The technology of man dates back to when he pointed the first stick to fashion a spear and chipped away with a piece of flint to make a crude axe. In every age since then, man's technical skills and inventions have continued and compounded, culminating in today's complex technology. One simply can't teach all of that. But this problem is not new to education. No teacher of any discipline can ever cover all of the available, or even all of the important content. It should also be noted that not many of them restrict their content to contemporary modes. Can you imagine a program of music education that concentrated only on music of the 1960's--rock 'n' roll, Beatles and Monkees--and neglected completely the works of Montaverdi, Bach and Mozart. Or would we call an art program complete if it dealt only with the pop and op art of our time and ignored the art of the Renaissance, French Impressionism, German Expressionism and other important periods.

Teachers of literature must make some rather arbitrary decisions on just how much time should be devoted to English literature as compared to American; how much emphasis on the novel in relation to the short story or poetry; which period is most worthy of study--17th-century Elizabethan, Victorian or Modern. Even after the literature teacher arbitrarily decides to devote six or nine weeks to a study of Shakespeare--what shall it be--the comedies, tragedies or histories, and which ones shall the students actually read--Macbeth or Hamlet, King Lear or Henry the VIII?

These questions don't have easy answers and not all people in the field give the same answers. That isn't important. What is important is that the decisions are made. Partly they are made on the basis of expert and generally agreed upon opinion--Milton's Paradise Lost is more significant than Marvell's "Definition of Love".

Partly decisions are made on the basis of grade level at which the material is to be used--T. S. Eliot's "The Wasteland" wouldn't likely be a big hit in 7th grade.

Partly the decisions are purely arbitrary and the personal preference of teacher or pupil. A senior high class in modern drama may decide to do Archibald MacLeish's play "Job" rather than Tennessee William's "Cat on a Hot Tin Roof" simply because they like it better.

A study of the history of technology in industrial arts could be approached in exactly the same way. Some periods stand out as being extremely important. The contributions of the Egyptians in an early period, the masters and apprentices of the guild system in Europe, the early Colonial craftsmen in America, the Industrial Revolution, the Bauhaus influence on modern design, the factory system, mass production, and automation. Certainly we couldn't cover the whole field, but that does not seem to be adequate reason for ignoring the whole field

It seems reasonable to me that a class in industrial arts in Pennsylvania might be studying the technology involved in early ironmaking at a place like Hopewell Furnace near here, and that a class in New England might choose instead to study the early technology involved in the textiles industry.

Each would be growing in an appreciation of our heritage and an understanding of the forces that have shaped our civilization.

At the risk of being a bit presumptuous, let's assume for the moment at least that it is desirable to include a study of the history of technology in our industrial arts programs. The next question is: How to go about it? What are the methods to be employed?

In answering these questions it would be well to remind ourselves that industrial arts is, and ought to be, a laboratory course. In recent times there appears to be a controversy developing on this subject. In some quarters it is held that cognitive learnings (things to know) should be given much more emphasis in industrial arts programs. Presumably an increase in cognitive learning means a decrease in manipulative experiences. Those who are proponents of this trend argue that manipulative experiences--turning on the lathe, developing a sheet of film, setting type, or welding--serve primarily as skill development activities. They argue further that such skills may lead to fine craftsmanship, but that craftsmanship is not a proper aim for industrial arts today.

This argument is usually supported with perfectly good statistics showing that the need for craftsmen is rapidly diminishing. In its more extreme forms this argument goes on to say that the project as we have known it in industrial arts has outlived its usefulness--if indeed it ever had any. Experimentation, research and testing, should comprise the laboratory activities in industrial arts programs where the emphasis is on cognitive learnings.

The counter-argument, rooted in traditional practice, holds that tools and materials are the backbone of industrial arts. An attempt is frequently made to justify skills and skill development. Craftsmanship is held to be a worthwhile goal, and the individual project is the method.

At this point let me say that I do not have the magic formula to resolve this argument --I wish I did--because this controversy is doing more to tear our profession apart than any other single factor. My only reason for outlining this debate this evening is to clarify what I propose as a proper method for industrial arts to use in presenting a history of technology. However, before we leave the controversy, let me add my biased notion to the confusion that already exists.

Those who are proponents of the "cognitive learnings" camp, and who tend to de-emphasize manipulative experiences are, in my estimation, on the right track--but they give the wrong reasons for being on that track and frequently advocate the wrong methods.

On the other hand, those who slavishly cling to traditional practices in industrial arts and who would claim that industrial arts is a "shop subject" and concerned with developing skills and craftsmanship--these people, again in my estimation, all too often give the wrong reasons and have the wrong aims for doing many of the right things. However, since the purpose isn't clear, the method is frequently ineffective.

The point can be easily illustrated. The importance of cognitive learning is accepted. This means that "to know"--to really know--to understand fully, to appreciate, to gain real insight is truly and obviously an important function of industrial arts. But this kind of knowing is not superficial knowledge, shallow appreciation or narrow understandings. This kind of knowing is rarely to be obtained from looking it up in an encyclopedia (though that may be a good first step) or writing a report or hearing a lecture, or seeing a movie. The kind of knowing or cognitive learning we seek can be realized only after first-hand real experience. If one has read that copper is annealed by being heated to a cherry-red color and quenched, he has indeed gained a bit of knowledge (he may even retain it for a few days), but if one has been raising a copper vessel and felt it work hardening and has then heated it to cherry-red in the furnace or forge fire before quenching and then has gone back to the forming stake and felt the newly softened metal yield to his blows, he has also added to his cognitive accumulation. In both cases the student knows something about annealing copper--but there is a vast difference in what each really knows.

And now back to the history of technology. If this is to be included in industrial arts, it should not be limited to a "bookish" kind of learning. A statement such as that could cause one to be labeled anti-intellectual or anti-books. Certainly that is not my intent. I simply mean that if the history of technology is to be taught in traditional classroom-textbook fashion, then it should probably not be included in industrial arts but left to professional historians. If, on the other hand, there is opportunity for providing real insights into history of technology through laboratory experiences, then it is a proper function of industrial arts.

The kind of laboratory experience would quite obviously vary with the grade level and the area of industrial arts. Henry Steele Commager, in the book to which I referred earlier, wrote:

"History is the memory of the past. For a people to be without history, or to be ignorant of its history, is as for a man to be without memory--condemned forever to make the same discoveries that have been made in the past, invent the same techniques, wrestle with the same problems, commit the same errors; and condemned, too, to forfeit the rich pleasures of recollection. Indeed, just as it is difficult to imagine history without civilization, so it is difficult to imagine civilization without history."

To Commager's quotation I would add--it is equally dfficult to imagine a study of the history of mankind that does not include the history of technology. And technology, including its history, is the proper domain of industrial arts education.

"He who is ignorant of history is destined to relive it."

Dr. Weber, immediate past president AIAA, is the director of the Department of Industrial Arts Education, Millersville State College, Millersville, Pennsylvania.

thursday

Th-8.0 AIAA
Fourth General Session
INDUSTRIAL ARTS—ITS PLACE IN OUR PRESENT TECHNOLOGICAL SOCIETY
Presiding, Robert L. Woodward; Chm., Robert Thrower; Rec., Edward Kabakjian; Greetings, Rufus Johnson; Speakers, A. G. Breidenstine, Howard S. Decker; Hosts, Joseph W. Elliott, Jr.; Robin B. Hatfield.

INDUSTRIAL ARTS—ITS PLACE IN TODAY'S EDUCATIONAL PROGRAMS

A. G. Breidenstine

In this discussion, let us examine quickly three double decades since 1910, an assignment roughly equal to the experience of the country boy called upon to give his opinions and assessments of industrial arts. For today's educational location of industrial arts, let us evaluate the imperatives confronting us. And finally, let us allow a prediction extending into the 1980s. After all, many of today's students will live well into the early decades of 2000.

The double decade, 1910-1930, may be characterized in many ways. We were then a nation of sixth graders educationally. War in all of its nastiness enveloped the world. We were slow-moving; used the large muscles of man and animals generally; had a crude and heavy technology; were awkward in our mechanization; quite rural in our outlook, although already somewhat faced toward the city. Industrial arts as a subject was not so necessary in the rural schools because we learned the basic skills, appreciations and understandings of about 100 jobs through daily encounter with the work and the environment of the farm. In our fights with the city "jerks", we "hayseeds" could usually outscore them. In city jobs we were given preferred status because, as the bosses put it, "we knew a few things" even though we had never been schooled therein. In the steel mills, we were moved from job to job without orientation. Our city cousins were even then the "disadvantaged".

Technology picked up during the double decade, 1930-1950. While in the early 1930s, conferences decried our shortages of power and predicted a gloomy future as solid and liquid fuels dwindled, world-renowned scientists were laying hands upon nuclear power. And then it happened. We as a nation were again at war, and then because of an overwhelming power surplus brought the war to a quick end. Tractors, autos, airplanes and machinery as a whole became more refined. The dawn of a technological revolution of exponential acceleration was predicted, and we had moved into a wholly new frame of reference in power.

Industrial arts as a subject during this time, and not surprisingly, was viewed too largely as career-oriented. The discipline was not yet acceptable for admission into the arts-humanities sector of knowledge.

In the double decade, 1950-1970, we moved full-scale into an era of power surplus. As the angel Gabriel, in "Green Pastures" observed, "Everything nailed down's coming loose." Most of us are, even now, too involved to assess what the influences of the seven or more revolutions in which we live are doing to us. Nor do we fully understand how to cope with them. Thus we resort to exaggerations. Our war potentials are measured in units of overkill; our nuclear-powered technology is variously assessed in units which the general public cannot comprehend. Indeed, these units often remind us of the startling proportions of our national debt, or our GNP. This is a decade of computers. How they reign! And there is space, up there, out there, vast and immeasurable. We used to consider as a truth the saying, 'What goes up, comes down." Now this is true neither for objects, nor debts, nor GNP, nor accelerations of many sorts.

But what now of industrial arts? As is true of many disciplines, it is fast becoming a sophisticated subject needed universally at all levels of today's education. Why this seems true must yet be analyzed.

The day of adding subjects into a curriculum without good reason is over. What you and I may think about industrial arts does not justify its inclusion in a curriculum. With rapidly expanding knowledge on all fronts, objectives must become imperative before inclusion can be justified. What imperatives confront us today? In brief, what are the claims for inclusion of a subject?

Many educators were impressed with the thorough study which preceded the AASA listing of imperatives for today's education. We were impressed by the wisdom which prevailed as the association geared up with an aim at the 1980s.

The imperatives as the AASA understood them were:

*(1) Urbanization and its rewards
(2) Work and its preparation
(3) Creativity and its nurture
(4) Morality and its strengthening
(5) Tension and its tuning
(6) Democracy and its workability
(7) Resources and their conservation
(8) Leisure and its use-time budget
(9) Humanity and its improvability

This is an impressive presentation of imperative goals, and critical assessment will convince educators and philosophers alike that at least five of the goals are appropriate to industrial arts. Where better may a student realize the goals set for work creativity, tension tuning, resource frugality and leisure time use?

"Business as usual" education in today's schools and colleges must be exchanged for education which is appropriate. "New occasions teach new duties", and the occasion of living in a world where man is so largely capable of mastering his physical environment dares not go unnoticed. More and more, man discovers ways to mold his physical environment to serve his purposes. But he must also learn more fully to control it to prevent his destruction and to preserve it for his future welfare and enjoyment. If industrial arts can make a contribution to learning so vitally related to the humanity of man as these imperatives seem to indicate, then security within the curriculum is assured. It goes without saying that "industrial arts as usual" may be no more appropriate than physics which ignores atomic and nuclear physics, or social sciences which omit non-Western countries, or mathematics for which the calculations are unrelated to computer operations. What, then, is the place of industrial arts in today's education?

We have traced briefly the developments since 1910, showing particularly the happenings which are related to curriculum-building. We have also implied that before additions are made to studies, a careful assessment of imperatives should be made. Let me now assume a personal responsibility and propose a place for industrial arts.

I propose that industrial arts be considered as a part of the art-humanities sector of learning. Not only do the reasons relating to the imperatives of education make it appropriate to locate industrial arts in all levels of education, grade school through college, but it should, in my opinion, be included as a phase of the humanities. Ordinarily, the humanities assume two roles, (1) the conservational role designed to conserve the "great works" of the past, and (2) the contemporary creativity and radical experimentation role. To discuss these two roles thoroughly is another speech, and this program doesn't expect me to give two speeches. However, where but in industrial arts, is there a place in education to examine the great works of wood, metals, ceramics, graphics and other solids? Where is there a better opportunity to conserve for posterity the beauty of a design, the grandeur of good taste, the empathy of strength and balance and the needful orientation for further developments of new great works?

The second role is equally appropriate. Contemporary creativity and experimentation with plastics, new fabrics, new designs, new combinations of old materials and designs and an endless opportunity to create without restrictions except those imposed by the materials and the minds and imaginations of the artists must be available in the modern curriculum. And these roles are not grade-bound. Why not an industrial artist-in-residence in a university until such time as the university incorporates the discipline into the curriculum? Why not roaming industrial artists for our grade schools until full inclusion of the field into the on-going curriculum? Aggressive action similar to that of poets, visiting humanistic scholars, painters, musicians et al. may be necessary to attract proper attention to educators.

Also the wide-open arena of continuing education demands the artistry of industrial artists. Skilled craftsmen may require retooling; countless others will want to develop artistry to tune their personal tensions; young people need outlets for creative experimentation; teachers require updating; scientists need skills related to their research; and, for many, industrial arts may be a means to self-fulfillment.

What has gone wrong in our scheme of things, when man has to live in ugly cities without fresh air to breath, without pure water to drink, without good food to eat? What failures of our education have contributed to the honky-tonk along our highways? What has gone wrong in our manufacturing when shoddy products, poorly-designed objects and potentially dangerous appliances are turned out? In what ways have our schools and colleges failed? One is actually forced to the conclusion that our technology is ahead of our comprehension of it. We know that when fire was first discovered, man was awed by it, feared it, and later controlled and used it. More recently the same type of indoctrination was necessary for electricity and for radioactive fuels and materials. But the more subtle implications of our industrial society too largely escape us. With $75 billion worth of construction per annum, who is to be the guardian of beauty and lastingly good design? Where will our art treasures be for posterity? Who shall monitor the new great works now being reared? Educators cannot escape the responsibility, if we believe in education at all. In the last analysis of our situations, the bulwark of our industrialized society is the level of education of our citizenry. Beauty and good function will become common when commonly it is within people

A power surplus and a rapidly advancing technology create many problems but also make possible the solution of problems.

Education is caught in the middle of an unprecedented explosion of knowledge and an insatiable demand on the part of students to learn. Hence educators must sort priorities and be guided by the imperatives of education. Within an industrial society, it seems to me, industrial arts is one of the imperatives and deserves a place within the curriculum of our schools and colleges.

FOOTNOTE

*Shirley Cooper and others, Imperatives in Education. Washington, D.C., American Association of School Administrators, 1966.

Mr. Breidenstine is deputy superintendent, Department of Public Instruction, Harrisburg, Pa.

TITLE III NDEA—ITS IMPLICATIONS FOR TODAY'S INDUSTRIAL ARTS PROGRAMS

Howard S. Decker

I have been asked to speak to you today about Title III of the National Defense Education Act. Before I do, however, I think that we should get our acts and titles straight.

First let me say that the NDEA Act is that piece of Federal legislation which was passed in 1958 at the time of "Sputnik" and was designed to meet the needs of science and mathematics. This Act was later modified and became more and more a general education act.

Previous to this year, industrial arts has qualified for Title XI of NDEA, and this title has to do with the summer institutes which at least some of you have attended.

Title III of NDEA has to do with equipment, educational material and supervision. This is the equipment title which has done such a remarkable job in providing our nation's schools with science and language laboratories. Industrial arts will be eligible to receive NDEA Title III funds beginning July 1, 1967.

This change in Title III came about last fall when, on September 29, Senator Winston Prouty introduced an amendment to the Higher Education Act to include industrial arts in Title III of NDEA. This amendment was introduced in the Senate Subcommittee on education chaired by Senator Wayne Morse. The amendment was introduced and passed about 4:00 p.m. Consultation with Arthur Dufresne, legislative assistant to Senator Prouty, took place the next morning at 10:00 a.m. We decided at that meeting to contact certain members of the American Industrial Arts Association and to ask their support for the amendment before it reached the Senate floor. This call to action left our national office at 4:00 p.m., on September 30, just 24 hours after the amendment was introduced in the Senate Subcommittee.

The membership of AIAA responded well, promptly and overwhelmingly, and on October 9, the Senate passed the Higher Education Act with industrial arts in Title III of NDEA.

Since the House had already passed their version of the Higher Education Act, and since that version needed to be reconciled, after consultation with Mr. Dufresne, it was agreed that our "Hard Core" membership should be contacted again and immediately, even before the Joint Committee of the House and Senate was appointed.

On Tuesday afternoon, October 18, at about 3:30 p.m., the conferees met in the Senate Conference Room 209 to decide our fate. Early on that afternoon, Ralph Bohn, our president-elect, and I kept a lonely vigil outside that conference room. Later in the afternoon, John Conaway, chairman of our Association's Legislative Committee, arrived during a big "thunderstorm". I think it was the "thunderstorm" rather than the prayers of Bohn, Conaway and Decker that resolved the issue. At 6:30 p.m., the committee reported out that industrial arts was still in Title III of NDEA. On Friday, October 21, the House passed the revised version of the Higher Education Act and on November 9, President Johnson signed the bill into law.

As of this date, almost every state has made some provision to include industrial arts in their Title III funds. I believe that industrial arts owes a debt to the American Industrial Arts Association for its role in the passage of this vital legislation, but I do not stand before you today to inflate your ego or to mouth those comfortable reassurances that are so much the haute mode of these convention ceremonials. Rather, I see as my role to inform you quite frankly that our schools are not turning out the products that are capable of living effectively in a technological society, and that our industrial arts laboratories are doing too little to relieve the obvious needs. Now, getting more money, Federal or otherwise and getting more lathes and circular saws, as urgently as they are needed to update the fading glory of the "war surplus" era, are not going to make the difference either.

Our mission, our duty and the handwriting on the wall are all extremely clear. Our first concern must be to eliminate that stumbling block to our progress, that confining of our thinking to purely operational and practical matters, project collecting—how to store shellac brushes, which is best, vertical or horizontal lumber storage—and the other "practical" considerations that have become, through triteness or the passage of time, no longer practical but outmoded and reactionary in that jet-powered computer land in which we live. We live not in the world of T-bevels, and our students live not in the world of our youth; they live instead in a world of ever-increasing change, and the successful participant in that society is he who has an appetite for the future, a passion for life emergent: the person willing to create new solutions for new problems. It is hopeless to even think about producing, innovating educational products if we ourselves cannot or rather will not innovate.

My charge, simply stated, is to use Title III of NDEA not to perpetuate our obsolescence, to perpetuate our "practical" impracticality and our craft guild nostalgias. Rather, let us use this money for innovation, for reform of our "blah" programs, for a projection of an evaluation of the basic reasons for industrial arts' becoming a valid part of the educational experience of all American youth, and for the very major revisions which desperately need to be made both in education and in the industrial arts curriculum, if we are to prepare our students to prosper and survive in this changing, puzzling world.

My second charge to you, simply stated, is not to use Title III of NDEA to intensify the rather dogmatic debates on methodology which are currently in vogue. I am sure that there are those, even in this astute and perceptive audience, who would argue that the use of the project as an instructional method and an evaluative device should be replaced with their particular curriculum heresy, which is to say that grape picking should be replaced with pears. Now I quite agree that the picking of rotten grapes should cease, and I am prepared to concede that the building of poorly designed and poorly executed projects should cease, but I am not prepared to say that well designed and expertly executed projects should not be made in our laboratories, nor that the project or applied unit of work cannot be a valid evaluative criterion, concrete evidence of a creative act, the pilot model of a research and development endeavor or a microcosmic equivalent of the industrial product. However, there is no place in science, technology for industrial arts for those ill-graced monstrosities we often see that are the unfortunate vehicles for misinformation, poor personnel policy and a disintegrating value system.

I am reminded here of a recent visit to a second-hand shop where the clerk, when observing my disgust in examining a particularly bad lamp, remarked that "it must be one of those school shop projects", or the recent comment of the manager of a firm who provides exhibit space for an industrial arts project fair, lamenting the declining quality of the projects exhibited. Must we turn to store clerks and managers for our quality standards?

Title III money can well be used to make it possible for all industrial arts laboratories to be equipped to produce a high standard of machine construction.

The third point that I would like to make is to emphasize that industrial arts is not constructing, not the study of industry, and not the tools and equipment which have a physical place in our laboratories, but teaching. While industrial arts is teaching, it cannot be completely student-centered. Unrequited teacher interest in the student is a fraud, unless it is accompanied by a realistic and sincere interest in the subject being taught. Interest in students is nothing more than inquisitiveness or sentimentalism, unless it is leavened with a genuine concern for what the student should learn.

But teaching is teaching, and teaching involves presenting effectively that which is to be taught. A considerable portion of Title III funds should be spent on the machines that, when given a brief breath of life through the magic of a teacher, become invaluable adjuncts to the learning process. In the same manner, Title III should provide specialized supervision for every state in the nation.

Industrial arts as a subject area is now a part of 74% of the public secondary schools of this nation. 100% of all public secondary schools of 2,500 or more students have industrial arts, and even a majority of public secondary schools with an enrollment of 100 to 200 students have industrial arts. Before we relax, however, let us realize that disregarding the fact that educators generally consider Title III of the National Defense Education Act to be one of the most effective and most valuable programs of Federal assistance to elementary and secondary schools, the Bureau of the Budget has proposed a 41% cut in the Title III (a) appropriation for fiscal year 1968, from $79.2 million to $47 million.

As you will recall, the last year's budget proposed a cut to $54.5 million, but the Congress voted to restore the appropriation to $79.2 million, the same amount as in the preceding year.

Under Title III (b), the supervisory program, the budget recommends an appropriation of $2 million for administration at the state level, and that an additional $5.5 million be made available in Title V, ESEA, which could be used for the supervisory program but would not be earmarked for this purpose. As you know, the current year's appropriation under Title III (b) is $7.5 million; if the budget recommendation is accepted by the Congress, this would undoubtedly result in confusion, trouble and substantial reductions in this valuable and essential program in many states.

There are substantial indications that these proposed cuts in Title III were not recommended by the US Office of Education. I do not feel that these changes are in the best interests of the profession.

In addition, a new piece of legislation was introduced which holds great promise: The Education Professions Act (Title V of Higher Education Amendments).

The proposed Education Professions Act would bring greater order out of the present patchwork of educational training legislation through flexible authority, allowing the coordination, broadening and strengthening of programs for the training of teachers and other educational personnel for all levels of education.

Grants would be made to state and local educational agencies and to institutions of higher education, to enable them to identify and encourage qualified persons to enter or re-enter the field of education. Fellowships under Title V-C of the Higher Education Act of 1965 would be expanded to include preschool and adult and vocational education personnel.

In the field of training for careers in elementary, secondary and post-secondary education, program development grants to institutions of higher education would be offered to strengthen graduate and undergraduate programs, including those for non-teaching personnel. Grants would also be made to institutions of higher education and to state and local educational agencies for pre-service and in-service training, including institutes, seminars and workshops for personnel in all subject matter areas. A special program of grants would support programs or projects designed for persons planning to teach or to undertake other educational responsibilities in institutions of higher education.

A National Advisory Council on Education Professions Development would be established to review this legislation and all other Federal programs for the training and development of educational personnel. The Council would make annual reports of its findings and recommendations. I believe that the American Industrial Arts Association should support this Act.

Title III of NDEA is one way we can preserve that which is good in industrial arts. Let us use this money, therefore, and the other Federal monies to build upon that which has been built, while at the same time discarding the trite, the shoddy, the weak concepts and the provincialism that have characterized many of our programs.

In conclusion, let me say that Title III of NDEA, like other Federal money programs, is neither moral or immoral but amoral. These monies can neither destroy nor create, preserve the ugly and the superficial nor create a new order, a new hope, a second chance. It is you the teacher, the supervisor or the administrator who must have the moral courage to do what is right.

Dr. Decker is executive secretary-treasurer of the AIAA.

Th-8.1 ACIATE
Special Panel Session
THE OSWEGO PLAN AND THE OHIO STATE PLAN
Gen. Chm., Charles Porter; Chm., Vance Snyder; Rec., Raymond Van Tassel; Obsr., Jerry C. Olson; Panelists, Donald G. Lux (manuscript not provided), Paul DeVore (introduction), William E. Huss, William S. Hanks, John Kowalski; Hosts Bryce D. March, Merle D. Brown.

COMMUNICATIONS TECHNOLOGY

William E. Huss

The process of communications technology may be conceived as the design of a complex and interrelated system through the process of coordinating all elements that make up the system and taking into account their interactions as well as their individual characteristics.

In this context, communications technology becomes a system of learning about technology with graphic-photo-optical-electronic sensors for control and communication of knowledge, research and development as used in production, communication and transportation as they serve the needs of mankind. Communications technology is a study of the means by which man has been able to communicate and record information, knowledge and understanding about the universe. It provides concepts and principles about the devices and procedures used in the communications industries to expand man's ability to assimilate, share and use knowledge. It is an area concerned with devices to measure more accurately and control more closely the material and information-handling systems of technology and culture. It forms the basic data handling and precision measurement for research and development of technology.

This proposal searches for channels of communication that connect various disciplines as a means of developing a sense of structure in the Space Age.

This proposal provides a tightly integrated approach to the communications of technology. It is based on an overall structure of technology. Instead of attempting to relate courses based on the materials approach to curriculum in a new way, while leaving each more or less intact, it pulls courses apart into concepts and components and then attempts to reconstruct them into a new, single discipline. The change is evident as soon as it is noted that the key analytical concepts in the new structure are technical elements and cultural-social elements, each with an extremely broad definition, along with the major supporting concepts of production, communication and transportation.

Communications, then, is a study of how men and machines inform each other and, hence, involves information processing. In the case of machines, it also involves control.

The use of automation in business and industry has created a system where processes are too rapid and complex for sensing and controlling by humans. Instrumentation was thus developed and refined as an extension of human senses. Course content and methods of instruction should reflect this approach to subject matter. This conceptual approach to course content and method must be involved in all instruction in technical communications.

Rapid scientific and technological advances in the last decade are due in a large part to discoveries made by behavioral scientists, who found that man has been thinking, acting and living a life of segmentation, and hence has had no system to combine the parts to the whole, or to show the relationship between the whole and the parts. Breakthroughs in scientific and technological development have resulted when man changes his habits of thinking by fragmentation and sees details as they relate to the whole. The process of communication and learning involves a pulsation between the parts and the whole in a spiraling cycle of increasing complexity, and, when used in a combined way, can be considered as a system.

The design of a complex system such as the proposed curriculum by the process of coordinating all elements that make up the system and taking into account their interactions as well as their individual characteristics is known as systems engineering.

A system of communication includes the apparatus, interrelationships and influencing factors necessary to accomplish an end result of understanding. Superior performance of the system of communication will result only when the system is more than a series of independently designed components (sensors). The system must properly integrate the performance of all of the sensors in the system.

Communications as an approach to the curriculum is an attempt to provide process and motion to the learning experience as a means of better alignment with present industrial-commercial practice.

The dynamic influence of motion and process may be brought to bear on a series of existing courses through the use ot systems analysis. Such an analysis shows the need for a restructuring of the concepts from their current vertical segmentation to a horizontal process orientation. A student seeking an education under this plan would not study about communication, but he would become involved in the process of communicating.

Prof. Huss teaches at State University College, Oswego, N.Y.

THE OSWEGO PLAN—MANUFACTURING

William S. Hanks

The notion of manufacturing seems to have begun when man purposely processed materials in his environment to cope with the identified frictions of daily living. Before such directed efforts came to pass, it is reasonable to assume that items found in nature, which approximated the form and function required of a particular tool or device, were used with little alteration. However, as information of materials and ways of doing things mounted, whether by accident or plan, man's understandings began to permit more freedom from Nature in the form and function of tools, utensils and weapons. Thus, manufacturing evolved when man discovered that he could improve upon Nature-formed tools about him, and gained in importance as he increased his knowledge and ability to identify problems and shape materials for himself. The process continues today. However, refinements and sophistication allow making the results of manufacture available to more and more people, and seems determined to free man from the indignities of manual labor and the boredom of repetitive work.

Our contemporary and projected methods of manufacture are more complex than those of earlier times. However, the procedures for gaining an understanding of man's early attempts at manufacturing are largely the same for the more sophisticated learnings of today. It is the purpose of this short discussion to illustrate how learning of man and his manufacture may be structured to reveal areas for study regardless of the era.

It is suggested that an approach to learning of manufacturing must be concerned with all levels of man's thought and knowledge. This is so because it is necessary to comprehend the multitude of philosophic and scientific decisions involved as well as the manipulation of tools and processes. Such levels embody information and procedures from the humanities, the sciences and technology.

A brief description of the levels would be:

Philosophy: Where there is concern for reality; the worthiness of a human need for good or bad, beauty or ugliness.

Science: Where efforts are directed to finding and testing ways of satisfactorily achieving a solution to a need.

Practice: Where action is taken to adapt thought and knowledge to fulfill needs. Such an arrangement demands interaction and consistency between the levels. This is much the same as one's practices as a teacher reflecting his philosophy. By the same token, his testing and experience reflect what is done at the level of practice to be true.

It may be doubted that early man had developed his philosophic thought to any degree. However, before he could proceed on the simplest of solutions (for example, a stone tool), he found it necessary to justify the worthiness of the need in terms of his time and energies, and the value of the outcome with regard to his family and community.

While early man's knowledge of the elements about him was extremely limited, his ability to test and experiment led him to select the most suitable materials and processes available. This level of thought seeks innovation and better ways of doing things.

The level of practice represents what is known and how things are commonly done. It is stored information that may or may not be utilized by almost anyone. Here, also, the results of theory and experimentation are put to the ultimate test of use. Inadequacies are subject to further testing and judgment. It is my opinion that it is the result of interaction between the level of science and practice that our technology develops. Of course, it does so under the watchful eye of philosophic evaluations.

An example from the contemporary scene may serve to point out how the levels might aid in identifying areas for study.

Philosophic Level – From the fundamental tenet of the dignity and worth of man we might say: "We must always be alert to ways of aiding man to be more efficient; that he should be transported quickly, easily, safely and economically from place to place."

Science Level – The above problem and requirements are referred to this level. Testing, experimentation and thought result in a vehicle for transporting man. This accomplishment is based upon knowledge gained of materials, mechanisms, lubricants, power sources, tolerances, fastening methods, etc.

Practice Level – The myriad of problems affecting tooling, economics, labor, material handling, assembly, marketing, etc., culminate in the production and sale of the vehicle. Continued use suggests further refinements to meet requirements established at other levels.

It is felt that more than learning associated with the level of practice is required to gain the full significance of man and his manufacture. Such understanding demands efforts be directed toward an analysis of all three levels. It is hoped that these efforts will identify this content more clearly and fully than endeavors of the past.

Mr. Hanks is an associate professor at State University College, Oswego, N.Y.

THE OSWEGO PLAN—TRANSPORTATION

John Kowalski

With your indulgence, I would like to use the brief time permitted to do two things.

First, I will review some selected points in Dr. DeVore's curriculum presentation of Tuesday, in which he outlined the direction of Oswego's curriculum thinking. This review is pertinent to our topic, since it bears upon the topic of subject matter content within the discipline area of transportation technology.

Secondly, I would like to describe what is presently being planned at Oswego to expedite a teacher preparation curriculum which we hope will stimulate the implementation of the Oswego transportation perspective in public school programs.

Those of you who heard Dr. DeVore's presentation of Oswego's direction of thought in curriculum are aware that the present curriculum rationale is based on the use of technology as a broad discipline base, that is, technology as a body of knowledge, taking its place alongside the other major disciplines in the areas of the humanities and sciences. You will also recall his reference to three "cultural universals", technological in nature, which have perpetuated themselves in all societies; these universals, as identified, are (1) production (including manufacturing and construction), (2) communication and (3) transportation. This triad of functional technological endeavors provides a three-part discipline base for the study of technology.

The transportation content is based on a segment of the technology discipline structure. It has identifiable external limits, yet may be internally modified and adapted as the tools and processes of technology change. Whether it be by oxen and wheel, by steamship or aerospace vehible, man's needs in our culture dictate that he must transport to perpetuate his basic pattern of life; thus transportation represents a "cultural universal" in our technology.

Content-wise, transportation appears to lend itself graphically to a three-plane analysis, as indicated in Dr. DeVore's Tuesday presentation. The transportation matrix may be represented by a rectangle, as shown in this transparency. Webster defines a matrix as that which gives form, origin or foundation to something enclosed in it.

The transportation block, for purposes of graphical analysis, has a form established by its external lines and exists within a larger whole (the body of knowledge called technology).

In continuing with the content analysis of the transportation area, we may identify the mode of transportation by the environment in which it functions. A few years ago the space environment may not have shown here. The environmental analysis lends itself to the inclusion of added modes or added environments. For example, hydroplane study may be added to the marineland areas, or perhaps a category of "sub-surface-earth" may be eventually added to the environmental category.

Another perspective of study may be based on vehicular systems. Here we see the inclusion of "energy and power" which represents a portion of the study of the vehicle. Obviously, this portion of the system represents curriculum content for courses called "power mechanics".

The third base line represents a study of effects of technology upon man himself, and runs the gamut from history of transportation to a study of his inventions, organizations and social changes, as influenced by technology.

These three planes are interrelated and provide a basis for classification of knowledge for subsequent placement into curriculum segments. The intersection of slabs from the block permits the lifting of a portion of the block for inclusion in a course of study. The three-plane examination provides a check for comprehensive coverage in the discipline area.

In examining the curriculum design for technology, common elements or interrelated concepts with communication and production are found, and it is necessary to take these into consideration when specifying total curriculum.

As you can see, the matter of curriculum design is facilitated by some method of analysis and content organization. The content is derived from the discipline base called technology.

What about the question of teacher preparation for the purpose of implementation of the comprehensive transportation concept in our public schools? That matter has been receiving varying degrees of consideration at Oswego since 1946, where a basic transportation lab has been a required part of the teacher preparation curriculum, along with the conventional material-centered labs. Subsequently, our curriculum added elective advanced labs in the areas of marine, air, general transportation and automotive technology. In spite of all this, the comprehensive transportation program has been slow to take hold in public schools. Nevertheless, we feel that the comprehensive transportation concept is sound. Recent developments on the national and state scene have lent credence to the transportation concept. Among them is the development of a federal department of transportation at the cabinet level and a parallel action taken in New York State government. In addition, the New York State Education Department has recognized transportation as a separate lab content area for several years.

As a result of the curriculum considerations and other circumstances mentioned, we are proceeding with the preparation of a transportation teacher preparation proposal, which would provide considerably more background and depth in transportation technology. Its design is intended to implement the concept represented in the matrix cube at the college level. It would extend through the fifth year and would include appropriate background courses in technology, the humanities, sciences and education. The teacher graduate would be identified as an industrial arts transportation major.

Though thinking on curriculum requirements for the transportation major is still in the stage of deliberation, you may be interested in the following proposed course offerings, most of which are already available among the various departments on our campus.

The list of courses will be cross-checked against the matrix requirements and, of course, against undergraduate and graduate requirements at our own institution.

Present plans call for the proposal of a pilot program involving a selected number of teacher trainees. Thought is being given to means by which a limited number of teaching centers may be established; such an opportunity may be created in new federal programs, through state grants or from private resources.

Mr. Kowalski is at State University College, Oswego, N.Y.

Th-8.2 ACIAS
Special Panel Session
INDUSTRIAL ARTS AND THE FEDERAL AID PROGRAMS
Chm., Robert W. Fricker; Rec., William T. Kelly; Obsr., A. E. Pagliarini; Panelists, Paul J. Manchak, John O. Conaway, Marshall Schmitt; Hosts, George Mehallis, John J. Micheals.

NDEA TITLE XI INSTITUTES

Paul James Manchak

Industrial Arts is now a member of the Federal family. It is specifically named in at least two major pieces of legislation—Titles III and XI—of the National Defense Education Act and is eligible for support in many of the other general educational programs.

Title III authorizes matching grants of Federal funds to the states and loans to nonprofit private schools to help equip and remodel laboratories and classrooms, and just as important, it assists the states in expanding and improving their supervisory and related services. Title XI—about which I will be speaking today—authorizes institute programs in specific fields and subject areas for teachers in public and private nonprofit elementary and secondary schools. Industrial arts institutes—along with two other new subject areas, civics and economics—were offered in the summer of 1966 for the first time. The new programs were authorized by the Congress late in 1965 but without an accompanying appropriation. Subsequently, in January of 1966, however, sufficient funds were made available to support five pilot programs in each of the new fields. Thus NDEA Institutes in Industrial Arts were off the ground a year earlier than had been expected.

One hundred and forty-four industrial arts teachers attended the five 1966 institutes, which were conducted at an average cost of $46,000 each. Participants were selected from 771 equally-ranked applicants from the 2,030 teachers who made formal applications —a ratio of 14.4 to 1, the largest for all Title XI institute areas and indicative of the unusual interest in the program.

If the qualifications of these teachers were, in fact, improved by these institutes, as the enabling legislation so demands, then there should be approximately 15,000 industrial arts students receiving improved teaching this year as a result of the institutes.

A recent survey by the US Office of Education reports that there were 40,428 industrial arts teachers in the US in 1963-64. For the 1966 pilot programs approximately 5,000 inquiries were received, or 13.5% of all industrial arts teachers indicated an interest in the institutes by their correspondence. About one third of one percent of the industrial arts teachers in the US were privileged to participate.

The five institutes varied in content and innovative features. One dealt with a technical specialty, designed to update competencies of the participants in the area of numerical machine control. Several were concerned with curriculum innovation based on the nature of the learning process and the characteristics of the learner in industrial arts. Emphasis was on senior high school industrial arts in one instance, while in another it was exclusively on small rural industrial arts programs.

The focus of still another program was on the junior high curriculum. Other variations included an intensive field study of industry, involving first-hand study of the structure and organization of selected industries.

During the summer of 1966, the US Office of Education arranged for a consortium of professional associations to conduct a study of institute programs. A three-man committee was organized to observe and report on the industrial arts institutes. Findings of this study are reported in the Industrial Arts 1966 Consortium Report. Dr. Joe Schad will give you more details about the evaluation and the consortium in his presentation.

Late in October 1966, the US Office of Education announced 493 NDEA Title XI Institutes for Advanced Study for teachers and other school personnel for the summer of 1967 and for the academic year 1967-68. A total of 29 of these institutes, accommodating 716 participants, is in industrial arts. They were selected from eighty-four proposals submitted by 54 institutions. Their cost will be about $1.2 million.

The variety of programs for 1967-68 is understandably greater than that which was found in the 1966 institutes. The range of topics within each subject field has broadened, and now indicates many more of the new curriculum ventures sponsored by progressive school systems. New teaching approaches and new materials are recognized and encouraged. More categories of school personnel are also served, including teachers of elementary classes and teachers of disadvantaged youth. College trainers of teachers and industrial arts supervisors are eligible for some programs.

Of interest to this group may be an examination of some parameters of the 1967 program. The 84 proposals submitted by 54 different institutions from 34 states would have cost an estimated $4.6 million to support.

LIST OF PROJECTUALS
(Statistical Data for 1967 Program)

1. Proposals—Distribution by Type and Code
2. Type and Number of Institutions Submitting Proposals
3. Submitted vs. Funded Projects by Industrial Arts Area
4. Institutes—Distribution by Types
5. Geographic Distribution – 1. Proposals 2. Institutes
6. Distribution by Grade

The 29 proposals recommended for support resemble closely in some respects the profile of the total of those submitted. The following are characteristics of the top-ranked proposals:

1. Successful proposals indicated an intimate and real involvement with the needs of the teacher in his own environment. The institute experience was directly related to the problems and issues encountered by the participant in his teaching assignment.

2. While proposals invariably emphasized the importance of increasing the participants' knowledge of subject-matter, the best of them planned to develop teaching skills as well as to include study of learning and behavior. Thus was pedagogy often integrated with subject matter, to the advantage of each and the potential success of the program.

3. The various components of the proposed programs considered among the best indicated greater opportunities for integration among the formal and less formal program aspects, and between the teacher and participants, than those more traditional proposals which were clearly less imaginative.

4. Often the top-ranked proposals included in their program one or another of the variety of supervised clinical, practicum or other experiences with school children.

5. The top-ranked proposals were clear, specific and tended to show imaginative use of resources in developing programs designed for experienced school personnel.

The summer institute programs in industrial arts sponsored by the National Defense Education Act have dramatically focused the attention of educators in the profession on a matter of fundamental importance to the discipline—the retraining of elementary and secondary teachers of industrial arts. There is no need to dwell on the fact that this new impetus in the preparation of industrial arts teachers is long overdue, or to congratulate ourselves on the fact that the opportunity is at last ours. Instead, it is essential for educators in teacher training institutions to study their programs in terms of content and perspective to see how they measure up to the primary objective of the institute program, which is to provide advanced study for teachers of industrial arts in elementary and secondary schools.

Institute programs are designed to provide an intensive experience to meet the particular needs of participants. As such they are often more effective than the summer schools with which they usually run concurrently.

The most distinguishing factor of a successful program is its closely-knit, integrated character. There is a design which has been carefully planned in advance by a director and faculty working as a team. The major objective of the program is teacher education. During the institute, liaison between teacher and student is informal and personal, motivation is high, and there is mutual interest and cooperation. A high degree of flexibility characterizes the typical program. Evaluation and replanning are weekly, sometimes daily, activities. From all this, there are born rewarding aspects of an institute. Compared to the usual atomistic character of most programs for prospective teachers, which usually consist of a series of unintegrated courses, it is quite clear why the institutes have been so successful in improving the qualifications of elementary and secondary school teachers.

To date, some 61,000 teachers have been trained in a total of 1,500 institutes authorized under NDEA's Title XI and its predecessor, Title VI(B). At the same time, these institutes have brought many hundreds of college and university teachers face to face with the very real need for in-service training of elementary and secondary school personnel. In many ways the dialogue that has thus been initiated between the college professor and the school teacher may well prove to have been one of the most important contributions of the institute program. Certainly it has caused much soul-searching concerning the role of higher education in the preparation of teachers for American schools.

This article was written by Paul J. Manchak in private capacity. Dr. Manchak is chief, Industrial Arts Institutes Section, US Office of Education, Washington, D.C. No official support or endorsement by the US Office of Education is intended or should be inferred.

FEDERAL LEGISLATION FOR INDUSTRIAL ARTS

Dr. John O. Conaway

During the 1964 AIAA Convention, which was held in Washington, many of the members of the Association took time out from the convention to call on their Congressmen.

In June of 1964, Dr. Kenneth Dawson, with the assistance of some of the AIAA members from Indiana, secured an appointment with Senator Birch Bayh from Indiana to discuss the need to include industrial arts as an amendment to NDEA during that session of Congress.

On August 1, 1964, Senator Birch Bayh from Indiana submitted an amendment to the NDEA bill to include industrial arts.

This amendment was withdrawn after strong protest, not because it was for industrial arts, but because it was the feeling of Senator Wayne Morse of Oregon that it did not have a chance to pass for the reason that industrial arts had not been included in any legislation in the House of Representatives, and Congress was in a hurry to adjourn before the end of August. However, Senator Morse at this time gave his assurance that he would cosponsor a similar amendment the following year.

In 1965, through the efforts of the Education Committee of the Senate and our good friend Senator Winston L. Prouty of Vermont, the NDEA was amended to include industrial arts under Title XI for institutes for industrial arts.

During the summer of 1966, the American Industrial Arts Association was faced with a serious problem. The membership of the Association was informed that Dr. Kenneth Dawson, the executive secretary, had resigned.

As you know, Dr. Dawson had directed the legislative effort of the Association when the first historic Federal legislation was passed. This was the inclusion of industrial arts under Title XI, for the institutes for advanced study in industrial arts.

With Dr. Dawson leaving the AIAA office, many of the members were concerned that the legislative program would stop or slow down.

The legislative program of the AIAA, developed under the able direction of Dr. Dawson, has been continued by Dr. Howard Decker and did result in the enactment of Federal support under Title III of NDEA. The assistance now available under Title III, NDEA, will become effective July 1, 1967.

The state may also expand the state department staff to include an industrial arts supervisor to administer the industrial arts section of this program.

The other legislation which offers a wide opportunity for industrial arts, but which has not been used by many school corporations for industrial arts, is the Elementary and Secondary Education Act of 1965.

During the past year, the Title I funds of this act were distributed to some 58,000 schools. These schools channeled the funds into programs of remedial reading, speech and writing projects, guidance, health and food services, educational equipment and home visitation.

Very few schools included industrial arts under the provision of this section of Title I of the ESEA.

This Title of ESEA has been extended through Fiscal 1968 and expanded to $1.4 billion in 1967 and $2.3 billion in 1968. The actual appropriation for 1967 is $1.05 billion.

Title III of the Elementary and Secondary Education Act of 1965, "Supplementary Educational Centers and Services", offers an excellent opportunity for industrial arts.

The purpose of this section of the act is to encourage the efforts of schoolmen to translate the results of educational research into classroom practice. This section of the act has enabled schools across the country to offer their students everything from team teaching to mobile art galleries.

Some suggested industrial arts projects which may be developed and funded under the provisions of this act could include demonstration centers designed to offer instruction in computer-assisted drafting and numerical programming, or some of the other new directions suggested for teaching industrial arts which are currently funded research projects.

The demonstration centers could be used to assist in an in-service training program for the industrial arts teachers in the community.

The proposals for projects under the provisions of Title III, Elementary and Secondary Education Act of 1965, must be developed by representatives of the local school district.

1. Future Federal aid for industrial arts at this time should be directed toward securing adequate appropriation to support the existing industrial arts programs under Title XI and Title III of NDEA.

2. A second responsibility of the American Industrial Arts Association and the Industrial Arts Teacher Education Institutions is to encourage the industrial arts teachers to develop proposals to secure Federal support for industrial arts education under the provisions of the Elementary and Secondary Education Act of 1965.

This act has been funded to over a billion dollars in all categories. Yet, industrial arts is an important area in the public schools, one that can contribute much to the education of the disadvantaged children, and has received only limited assistance under the provision of this act.

The Industrial Arts NDEA Institute programs can at last show that the request for applications is high. This indicates a need.

The future funds to support all forms of aid to education will flow not only to those who are organized for political advantage, but to those who can demonstrate that their work has made a beneficial impact on the lives of people.

In the competition for scarce resources, persuasion is central to a democratic society. The importance of having the right facts at the right time must not be underestimated.

We in industrial arts have had a taste of success. This has come about largely as the result of persuasion.

Closely related to the issue of appropriations is the issue of evaluation.

The first questions that a congressman will ask a legislative representative of a professional organization are, "Do you have research to support your request?" "How effective has this program been during the past year?" The fact that industrial arts had not been included in NDEA Title III was some assistance in securing the passage of this legislation.

To secure additional Federal support for industrial arts, we must first show that the support now received has made a beneficial impact on the lives of those enrolled in the existing programs.

We must also be prepared to consider the possibility that Congress may remove all categorical aid from Federal assistance to education.

During our visits with congressmen last fall, we were questioned very carefully concerning our feelings toward non-categorical aid for education.

Dr. Conaway is professor of Industrial Education at Indiana State University, Terre Haute, Ind.

THE BUREAU OF RESEARCH—OFFICE OF EDUCATION

Marshall Schmitt

The Office of Education's Bureau of Research seeks to improve education through support of a variety of research and related activities. Through authorizations from the Congress, the Bureau provides funds for research projects and programs designed to expand knowledge about the educational process, to develop new and improved educational programs and techniques, to disseminate the results of these efforts to educators and the public and to train researchers in the field of education.

One major factor distinguishes activities eligible for support through this Bureau: they must be research-related, as distinguished from operational, activities which receive support through other Office of Education bureaus. Research, development, demonstration and dissemination help provide objective bases for the improvement of operational programs at all levels of American education.

There are two patterns of research support available from the Bureau of Research: project support and program support.

Application for project support should be made when the initiator wishes to engage in a self-contained activity or set of activities with a few well-defined objectives that can be carried out in a predetermined period of time. A great many different kinds of projects can be supported simultaneously under this pattern. Program support is applicable for specifically-announced problem areas in education where the Office of Education feels there is a need for continuous intensive attention. Programs provide for a concentration of professional resources on these areas over an extended period of time. Thus, project support deals with clearly delineated, limited-time research (of any magnitude), while program support is reserved for certain groups of continuous research or research-related activities which are able to adapt to evolving situations.

Projects are usually planned and initiated by those who submit them as proposals. The relatively flexible format of the general application instructions frees the applicant to focus upon the activity or group of activities he proposes to carry out. These instructions should be sufficient for applying for support for most projects. However, those seeking program support may need to request special sets of instructions that supplement the material in the booklet issued by the US Department of Health, Education and Welfare.

By far the greatest number of activities administered by the Bureau receive project support. Subjects of project research are as varied as the questions educators seek to answer. For example, some projects may explore educational needs or seek to resolve issues. Others may develop materials or methods, or test them in controlled situations or field studies. Still others may investigate the potential of promising programs or practices to bring about desirable educational change—in fact, they may investigate factors related to the change process itself. Projects may analyze, consolidate or synthesize information from research or from practice. They may demonstrate or disseminate educational information or techniques.

There is no limitation on the size, the area of study, or the kind of activity or activities eligible for project support—so long as they deal with educational research, development or dissemination. However, the public interest and the critical needs of education demand careful administration of available funds. Sometimes this means judicious selection from among similar proposals to avoid unnecessary duplication. Sometimes it means making support of a promising research activity contingent upon the investigator's ability to redesign his research, so that its results will be useful in settings other than his own. The size of a study is no measure of its potential for educational improvement. In some cases, a study must be quite large in order to produce valid information; in other cases, a relatively inexpensive pilot study may accomplish a great deal. When it is necessary in terms of total research goals, the Bureau may solicit proposals in critical areas where research interest has been slow to develop.

All proposals are assessed in terms of their promise for meeting stated objectives, for the significance of those objectives to the Office of Education's total effort and for economic efficiency. Small-scale research or development projects can be funded with a minimum of delay for proposal review. Consideration of larger projects takes longer.

Small project research refers to those activities which require no more than $10,000 from the Office of Education and take no longer than 18 months for completion. This special classification has been provided to give adequate consideration to inexpensive yet worthwhile projects; to encourage personnel of small colleges to gain experience in research and related activities; and to support significant small-scale educational research projects by doctoral and postdoctoral students and fellows, particularly those at developing institutions.

Support for these activities is being decentralized to the OE regional offices. This method of administration should facilitate prompt consideration of proposals and bring evaluation, negotiation, monitoring and other assistance closer to those carrying out the projects. The instructions are available by writing to the regional offices or to the Regional Research Program staff in the Bureau.

In addition to these projects, the Bureau of Research also supports continuous programs, each of which provides a particular thrust in the total research and development effort. This type of support is used for the activities of research and development centers and educational laboratories, for training educational researchers and in other appropriate circumstances. These programs allow long-term staff commitments and continuous development and adaptability. Appropriate supplementary instructions for applying for program support are available from the Bureau of Research.

Research development grants support the efforts of small or developing colleges to acquire sound research orientations. Their personnel may use the funds to develop their own research skills, to research their own educational problems, or to try out promising educational innovations. A primary purpose is to help teachers and future teachers learn to use research, research results and the research or inquiry approach in their classrooms.

To encourage the development of research capabilities in smaller institutions of higher education, especially those which train teachers, grants are available to consortia or groups of institutions which plan to combine their ideas and competencies in a research development activity. Single institutions may also apply but should scale their programs and fund requests appropriately. Participating institutions should expect to (1) disseminate information on research findings and research design, administration and management; and (2) provide their staffs with time and money to conduct the research activities.

OE regional offices are being staffed to administer research development grants. Separate instructions with examples of appropriate activities are available either from the Bureau of Research or from the regional offices.

A research and development center concentrates on a single problem area in education and conducts activities ranging from basic research through dissemination. Centers are usually established at universities or other institutions where staff have already demonstrated exceptional competency in the particular problem area and can be expected to produce early, continuous and significant educational advances. The sponsoring institution generally continues to provide substantial local support for center activities.

Each center is interdisciplinary, and ordinarily maintains cooperative relationships with regional laboratories, state departments of education, local school systems, universities and teacher training colleges and relevant professional and nonprofit organizations. Within its established area of investigation, each center can direct its own program without obtaining prior Office approval for individual projects. Thus, center activities can reinforce each other, promising leads from one activity can immediately be followed up, and research findings can quickly be put into practice.

Educational laboratories differ from R & D centers in their focus, composition and activities. Although both may work all along the continuum for basic research to dissemination and implementation, centers emphasize research and development while laboratories stress development, dissemination and implementation. Each laboratory is primarily concerned with educational improvement in a particular region, especially with wider adoption of beneficial educational innovations there. To this end, the laboratory designs its own program and continuously adjusts it to meet emerging needs of the region. In terms of organizational structure, the laboratories are new institutions which draw upon colleges, universities, state educational agencies, local schools, private industry and other educational interests for their staff, membership and affiliations. Laboratories are set up through the initiative of individuals and groups in the regions. These local and regional efforts have resulted in the establishment of 20 laboratories, generally organized as nonprofit corporations, which form a network serving all of the continental United States. Individuals and groups interested in effecting educational improvements through the regional laboratory program should contact the laboratories directly, not the Bureau of Research.

To provide for sound educational research and development in the future, support is available for institutions to train researchers and to develop and improve their own programs for such training. Institutions may request support for undergraduate, graduate and postdoctoral training; and for training institutes, inservice programs, or special projects dealing with educational research. Funds may be used to develop and strengthen research training staffs and curricular capabilities, and for stipends and institutional allowances for trainees. Training may be concerned not only with research per se but but also with educational strategies needed to bridge the gap between research and practice.

The Educational Research Information Center (ERIC) is a comprehensive national information system designed to serve American education by making available reliable, current educational research and research-related materials. The system is made up of a network of information clearinghouses or documentation centers located throughout the country and coordinated through Central ERIC in the Office of Education.

By the end of 1966, clearinghouses had been established in 13 substantive areas. As funds become available, the Bureau will issue requests for proposals to establish additional clearinghouses. Each clearinghouse collects materials in a different subject area and is staffed by specialists who are responsible for document analysis, selection and other activities related to ERIC's mission. Documents collected throughout the ERIC system are abstracted, indexed and put on microfiche, 4 x 6 inch film cards that contain up to 60 pages of text per card.

Starting in November 1966, a monthly journal, Research in Education, is being issued by the Office of Education through the Bureau of Research, Division of Research Training and Dissemination. Each issue contains bibliographic citations and abstracts of recently-funded projects and of final reports of completed projects supported through the Bureau of Research, as well as detailed indexes of cited research documents. Subsequent issues will include documents from the 13 ERIC clearinghouses. A cumulative index will be published annually.

Application for support is made by submitting a standard formal proposal, accompanied by an official application form. This proposal is evaluated for its merit by the Office of Education staff and by non-Federal field readers selected for their research or specialized experience and general knowledge of the field. It is the only contact between the reviewers and the initiator's idea; if it does not convey the message, the staff and readers will not assume meaning or intent. If the activity is approved for funding, the proposal document becomes part of the contract.

It is suggested that the initiator ask several persons who are not close to the problem to read the proposal to make certain that it communicates clearly. Many potentially good research proposals fall short of recommendation for negotiation because the procedures are not clearly written or omit essential details. Others present so many questions for research that the study would be unwieldy or could not be completed with the funds and within the time requested. Should the proposal fail to be selected for funding, a summary of the reviewer's comments may be obtained upon request and a revised proposal may be submitted. However, reconsideration by the Bureau is no guarantee of subsequent selection.

Dr. Schmitt is specialist for industrial arts, US Office of Education, Washington, D.C.

Th-8.3 ACESIA
Special Panel Session

ELEMENTARY SCHOOL INDUSTRIAL ARTS—HERE AND NOW

Gen. Chm., Eberhard Thieme; Chm., W. R. Miller; Rec., Arthur Dudley; Obsr., Paul Kuwik; Panelists, Robert H. Hawlk, Wesley Perusek, Joseph Dispensa, Jr.; Hosts, Arthur Dudley, Arthur J. Rosser.

CREATIVE INDUSTRIAL ARTS PROJECTS FOR UNIT TEACHING

Dr. Robert H. Hawlk

Creation suggests something new made under the intelligent direction of an informed and trained mind. An elementary teacher educated for the development of creativity in students may be the intelligent director of educational activities. This does not imply a complete role of a directive nature for the teacher; rather, the suggestion is for skillfully permitting the student to gain experience in the creation of new, educationally-related objects.

The area for exploration by the students is defined by the teacher so efforts will accrue to the educational objective established for a given period of time. Creativity is not a random approach to making something dictated by emotional urges. Definition of the unit of study and a division of labor among the students is the prerequisite to accomplishment by meaningful creative activity.

Verbalism dominates descriptive educational practices. Reading, writing and listening constitute the more passive aspects of life representative of elementary education. The reasons for recess periods may be easily identified under these conditions. After school, when the students are free to find activities of their own choice, the boys build tree houses and the girls may surround themselves with neat rows of rocks simulating the floor plan for a dream house. In their own way they have chosen to become the builders of tomorrow. All of this is produced by the creative minds of children, after a passive day of learning about the real world. To observers, it would seem this type of meaningful play activity could be utilized by the intelligent educator to produce more natural experiences for the students.

Descriptive education is a necessity for the establishment of various relationships among words. Vocabulary-building is necessary so communication may follow. Meanings of words are enhanced by actual contact with objects as they are being studied. The annual trip to the fire house testifies to this assumption. Role playing has overtones of reflected reality, but all of this effort may be made more meaningful if the students actually build their own versions of projects with skills found in elementary industrial arts. Many of the senses are brought into play that are not used in the more passive involvement with education.

When the elementary teacher finds it possible to build teaching aids with the same basic skills taught to students, elementary industrial arts is again serving to aid the educational efforts of the school. What is built will be admired by the students, for the teacher is constantly being watched and evaluated by the keen minds in every class.

Within a few short years, today's elementary students will be the next generation to assume roles in modern industry. To provide a flow of new products that will keep the wheels of industry moving requires some of the best creative efforts. When viewing a busy class in elementary industrial arts, it is not difficult to project to the future when some of these same people will use their powers of creativity to provide the ideas for new and useful products. Inventiveness, so much the natural activity of elementary-age students, is fostered by experiences with industrial arts. To meet the challenges of the future, the creative process could very well find a place in the center of activities within the elementary school.

Dr. Hawlk is an associate professor at Ohio University, Athens, Ohio.

ELEMENTARY SCHOOL INDUSTRIAL ARTS —KENT STATE UNIVERSITY SCHOOL

Wesley Perusek

The University School at Kent State is a part of the College of Education. It is a single building on the campus, housing grades K through twelve and has a population of

approximately 750 students. Its two major purposes are:
(1) to educate teachers
(2) to educate children.

Within these two purposes the school serves as a setting and laboratory for students and faculty in the College of Education for:

1. Demonstration
2. Observation
3. Research
4. Experimentation
5. Participation.

The industrial arts program and facilities serve grades K through twelve. Two teachers conduct the program. The facilities include a main general shop with areas for woodworking, metalwork and power. Adjacent to this room are the graphic arts room, darkroom, combination drawing-electricity-electronics room and an elementary school industrial arts room. This room has a general work area and a ceramics area. The elementary school boys and girls use all facilities as the need arises, including such items of power equipment as the drill press, wood lathe, hydraulic press, potter's wheel, jig saw, belt and disc sander, pug mill and kilns. With appropriate instructions and supervision, these tools are just as valuable (and more exciting) to younger boys and girls as to older students. Two open tool panels with some common hand tools are placed near hardware and materials storage area in the elementary room.

The elementary grades are organized on a K-6 arrangement with a special education class and a deaf class. Whereas music, physical education and foreign language are regularly scheduled, the home economics and industrial arts times are arranged on a need or call basis. This admittedly presents problems in scheduling and arranging class time. However, the advantages for arranged time far outweigh the schedule problems.

Some teachers prefer to have a work area with tools, materials and work bench or tables in their own room. We try to keep a free flow between the classroom and the industrial arts room, so that children will feel this area is an extension of their own room. Kindergarten children develop a map of the route from their room to the industrial arts room, and post it near their door. This route, unfortunately, is one of the longest in the building.

Children may work as a class, group, committee or individually. Industrial arts experiences grow naturally out of many possible situations. Some of these include:

1. Child interests and needs developed from individual or group-motivated work.
2. Group or class needs or interests developed in the classroom.
3. Cooperative planning by children, classroom teacher and industrial arts teacher.
4. Units of study undertaken by the classroom teacher.

The contributions of the industrial arts to the education of children at the University School are made by many teachers. The elementary school industrial arts teacher (or if you prefer to call him consultant, specialist or resource person) serves these children and their teachers.

We believe an elementary school industrial arts program helps children in a number of ways. Seven of these are presented here.

1. Developing confidence in oneself and respect for tools and materials as these things help develop an expressive outlet for children.

2. Providing personal involvement with materials, tools, construction methods and the problems and processes in altering materials.

3. Helping children develop an understanding and appreciation of things around us, how they got there and how they work or serve to help us in our daily lives: the wood, steel and ceramic materials of our structures, the clothing we wear, the food we eat or the mechanical things we use.

4. Helping children understand and appreciate how goods are produced in quantity and the problems and satisfactions in manufacturing a useful product.

5. Helping children develop an awareness of and skills in planning, measuring, accuracy and in satisfying what might be called the constructive instinct in all of us.

6. Helping children in the development and understanding of science concepts and the interdependence and relatedness of subjects in the curriculum, and in establishing meaningful need for cooperative effort, language, reading and mathematics.

7. Helping children understand the world of work as they work to transform materials, use tools, plan, carry out a construction problem or experience and succeed or sometimes fail in their efforts.

An elementary school without industrial arts may be likened to a blank screen where images can be, but are not made.

Mr. Perusek is at Kent State University School, Kent, Ohio

ELEMENTARY INDUSTRIAL ARTS AT THE UNIVERSITY OF CHICAGO LABORATORY SCHOOLS

Joseph Dispensa, Jr.

John Dewey's "Learn by Doing" school is one of the original University of Chicago Laboratory Schools. In fact, we occupy Blaine Hall, which John Dewey designed and built in 1903. Today it houses about 775 students (K-6) with either four or five sections at each grade level. The average class size is about 25. About one-half of our children are those of the faculty of the University of Chicago, while the other half are fom wealthy families and scholarship students. The average IQ of our students (K-6) is about 125.

At present, the elementary industrial arts program (1-4) is used as a method of teaching. By method of teaching, I mean reducing the level of abstraction in other subjects by constructing, experimenting, visiting, exploring and observing for the purpose of making things easier to understand. Because our fifth and sixth grades are highly scheduled, so is industrial arts. Each student receives a 14-week session, four hours a week in either the fifth or sixth grade. Our fifth or sixth grade industrial arts is usually also related to other subject matter areas such as mural building (art), diorama construction (history), science fairs, math fairs, mass production (social studies), etc.

To illustrate the kind of elementary industrial arts program we have, three examples were presented by means of slides and tape recordings.

A third-grade class was studying the geographical aspects of both Alaska and Africa, the cultures of the people, the industries and means of transportation. After this information was gathered, Africa's and Alaska's similarities and differences were compared.

The industrial arts contributions to this class were two large wooden maps of Alaska and Africa. Using the grid method learned in math, the students drew Alaska and Africa to scale on a plywood sheet. Each map was sawed into three parts. Four students were assigned to each piece of the map for motivation to research the needed information. As the information was gathered by the students, it was placed on the map pieces. When the class finished the maps, the students were able to see similarities and differences previously not noticed. They also gave much insight into the cultures of both lands.

A fourth-grade class studied Western civilization through the study of the theatre as a vehicle. Because this class wanted to perform examples of different types of theatre, a stage was needed. The class decided it should be portable so that it could be easily moved and stored. To get a better understanding of stage construction, the class visited the high school theatre and the drama teacher, who was of great help in planning the stage and curtain. This stage has been moved from room to room in 15 minutes, but has a permanent place in the classroom where it was built and is used daily. One of many activities carried on by the students was the fabrication and use of jigs.

The sixth-grade art teacher and industrial arts teacher decided to work jointly on a mural construction project. We decided to work together, because the art objective of teaching the elements of design and the industrial arts objective of introduction to tools and materials and industrial processes could be fulfilled in a unique manner. We worked jointly in both areas with a class of 42 students. The murals, related to the school subjects, were built with the understanding that they would be hung in the hall as a class legacy. The designing of the murals took anywhere from four to seven weeks. The whole project took 14 weeks, four one-hour periods a week. At the end of the project the class had been exposed to a great variety of industrial materials and processes.

Mr. Dispensa teaches at the University of Chicago Laboratory School, Chicago, Ill.

Gen. Chm., Hugo Fiora; Chm., William T. Sergent; Rec., Donald F. Smith; Obsr., Richard C. Erickson; Panelists, Andrew K. Ault, Thomas G. Latimer, Robert K. Marshall; Hosts, James Bates, Donald G. Dietz

WHAT IS THE DIRECTION—CERAMIC CRAFTSMEN OR TECHNICIANS?

Andrew K. Ault

Today we are to consider a dilemma facing all educators, that of determining the best approach to obtain the goals of educating today's youth for tomorrow's place in a highly industrialized and technical society.

I am much concerned with this problem, since I am directly involved, as are many of you, with the preparation of industrial art teachers. This year the faculty of the industrial arts department at California State College, California, Pa., is attempting to revise and up-grade its curriculum to meet the needs of future industrial art teachers.

It is extremely difficult to keep up-to-date, let alone to project one's thoughts and plans far enough into the future to anticipate the needs of the next quarter of a century.

The January issue of US News and World Report has a tremendous report on "The Wondrous World" of 1990. If you haven't read it, do so. By the year 2000, the US population will be 300 million. The "super city" is described as a score of 100-story apartment buildings in a double circle around the rim of a wheel-shaped city. The high-rise buildings will accommodate a community of 250,000.

In medicine, the transplanting of vital organs, real and artificial, will be routine by the 1980's. Sophisticated teaching machines will speed up the learning process; translating machines will eliminate the language barrier.

The life span will be pushed from today's average of 70 to 100 years. Industry will become more automated and produce fantastic wealth for all. One family in three will earn $15,000 a year. Man and traffic will be computerized. Some of this may sound impossible, but just glance back ten years. There were no satellites in the sky. The ICBM was on the drawing board. There were no commercial jets nor any atomic power plants. Computers were just beginning to be used. Man's dreams, in short, have a way of coming true.

I was asked to speak on changes in the ceramic industries to assist us in determining the type of personnel needed in this industry.

Specifically, my topic is, "What is the Direction – Ceramic Craftsmen or Technicians?"

My last experience in teaching ceramics and the knowledge of the industry dates back more than a decade. I realized I must bring myself up-to-date. I immediately contacted several of the large industries in our area, and spent some time looking over their facilities and talking with the personnel managers.

The companies involved were the Crane China Company, Somerset, Pa., the Cannonsburg China Company, Cannonsburg, Pa., the Homer Laughlin China Company, Newell, W.Va. (one of the largest in the world); the Harker China Company, East Liverpool, Ohio (the oldest pottery); and the Taylor, Smith, and Taylor China Company, Chester, W. Va.

All of these companies, I discovered had several common problems:

1. Competition. The ceramic industries are struggling to survive. Many of the smaller companies have been forced to close. This is due largely to foreign markets with their cheap labor and fine china products.

2. Labor Supply. The ceramic industries are located in the highly industrialized areas of northern West Virginia and western Pennsylvania, the center of big steel industries. The wage scale of the steel industries attracts the more ambitious and industrious workers. As a result, the ceramic industries take or get what is left. As one personnel manager stated, "Our employees are lower in intelligence, less ambitious and much older; however, they do make good employees. We do our best to keep them happy and as a result we get along reasonably well."

3. Division of Labor. The ceramic industry is highly unionized, and the craft is minutely broken down into job classifications, which at times create bottlenecks in production according to the companies' point of view.

For example, one job classification is the wareman, He picks up the ware from the truck or cart and stacks it within reach of the machine operator. The machine operator cannot pick up any ware, although there may be a stack only a few feet away.

Another point of contention is that once the worker is classified, he must work his job assignment. He cannot be moved around or shifted.

As a result of these and other problems, the ceramic industry has been forced to mechanize and automate. The ceramic engineer at the Homer Laughlin Company stated that they must produce more at less cost in order to stay in business.

I noted that the plant facilities were for the most part drab and badly neglected, the direct opposite of what I noted in many of our automotive, steel and chemical industries.

I looked in vain for workers that I would classify as craftsmen or technicians. They did have a few – those that set up the machines, maintained the equipment, the mold designer and maker and several who did hand jobs. One man turned the bases of bowls on a small lathe. These were bowls with unusual base shapes.

They are still using several workers to apply stripes and edge decorations with a small pointed brush. Where they used to employ hundreds to do this, I only saw three so employed. The machines have taken over this job. Some decals are still applied by hand, but most of the decorations are being done by machines using a decal on a paper back, the rubber stamp method and the silk screen method.

I found that 90% of the employees were trained on the job, and only 1% of the employees needed a college education or the equivalent. These were those in positions of management, sales, research, engineering and finance.

Another 1% were classified as technicians, such as the electricians, maintenance and plant facility men.

The type of person that makes the best employee for the ceramics industry is a high school graduate, a small town or rural person, capable of being trained, not too ambitious, stable, reasonably healthy, honest and willing to work.

I explained to the personnel managers what we were attempting to do in the public school industrial arts programs, and asked for any suggestions or changes we should make. One manager said he would like for us to teach the boys some practical economics. He said that the boys should know what was involved in operating an industry, and the cost involved in materials, transportation, equipment, maintenance, development, fringe benefits, taxes, selling, marketing and production. He seemed to feel that many of the workers were holding back and not producing to their full capacity.

He also emphasized that young prospective workers should realize that the success of any industry depends largely upon the productive efforts of each worker.

What does all of this have to do with our public school industrial arts programs? What are the implications relative to preparing industrial arts teachers?

We still have the responsibility of educating our youth to understand our industrial and technical world, with particular emphasis upon the social and economic impact it has upon the individual and our culture.

Due to the complexity and variety of industries, it is futile to have students experience all the basic processes and operations involved. This means there must be less emphasis upon manipulations dealing with material, tools and processes, and more emphasis upon developing understanding and the basic concepts underlying all of the major industries. Students will still be involved in the making and doing stages of industrial arts, but the evaluations will be based largely upon their knowledge and understanding rather than on how well they can rivet or solder.

There will also be greater emphasis upon the development of the individual, his potential, ambitions and aspirations. Personally, I believe the guidance functions of industrial arts is one of our finest and yet most neglected objective. We have the opportunity to introduce the boy to the world of work, to get acquainted with him and help him to find his direction. We are also helping him to form habits and attitudes that help him throughout his life.

For the teacher-educator in industrial arts, this means the industrial arts teacher for tomorrow must obtain a broad understanding of industry. He must, in a sense, become a generalist rather than a specialist. This means we must get the teacher out into industry in some way—actually and vicariously. All our public school students do not go to college, neither do all go into industry. So—let us resolve to expose our'students to a sound industrial arts program centered around the student's needs, with emphasis upon personalized guidance; let us increase our efforts in developing the major concepts of industry; let us stress the value of work and the importance of getting along with people; and lastly, let us do all we can to stimulate and motivate our students to function at their highest possible level. This is quite an order, but we must fulfill it if we are to meet our obligations as educators.

It's not so bad if we follow Thomas Carlyle's advice: "Give us, O give us the man who sings at his work! Be his occupation what it may, he is equal to any of those who follow the same pursuit in silent sullenness. He will do more in the same time – he will do it better – he will persevere longer. One is scarcely sensible to fatigue whilst he marches to music."

Mr. Ault teaches at California State College, California, Pa.

ARE WE KEEPING OUR EDUCATIONAL AND INDUSTRIAL EQUIPMENT RATIO IN GEAR?

Thomas G. Latimer

Automation has brought about a vast change in the size of equipment used in industry along with an increase in the cost of equipment. The size and cost of such equipment, even that designed for our use, is definitely beyond the scope of the high school as well as of most colleges and universities.

The ceramics and plastics industries play an important role in our everyday life as well as in our space endeavors and military undertakings. Ceramics and plastics in our industrial arts programs have been of the craft type, as have other areas in our programs, and a careful look at this approach as to its worth is highly desirable. We see evidence of this by the types of "projects" which the pupils turn out, such as ash trays, vases, planters, etc.

Within the past few years, new equipment of a reasonable size and price range has been placed on the market for school laboratories in industrial arts ceramics and especially plastics, including such industrial processes as extrusion, vacuum forming and injection molding.

I feel that there is a definite need for teaching industrial ceramics and plastics in our programs, even though we may not be able to perform activities in these areas to the extent that industry does. However, we do need to introduce the areas from an industrial point of view rather than from a "hobby" standpoint, as has been done far too often.

It should be kept in mind that the nature of our programs and the nature of industry are different. Our primary concern is to acquaint the pupil with our industrial technological society, while industry itself is primarily concerned with production and the consumer product that will increase its profits as well as make our standard of living materially more enjoyable.

Competing with mass production and numerically controlled automated machines, the industrial arts program cannot hope to duplicate industry, but can implement industry to the extent that the pupil will have insight into industry and the world of work; in other words, our activities will have basic carry-over value to industry and its processes.

I feel that educational equipment in the areas of ceramics and plastics is not in "high gear" with industrial equipment, and I am not sure, at this point, that it is completely necessary due to the factors of size and cost.

The ideal situation might be a laboratory in which we had equipment of every nature with which to work, but it must be kept in mind that industry is willing to guide groups through its establishments as well as to provide literature which can be secured simply for the asking. There are also various visual teaching aids that can be constructed by the industrious teacher with which to present these various processes.

May we re-examine our resources and keep abreast of industry concerning new processes, materials and equipment, even though we might never perform such processes in our programs.

Mr. Latimer teaches at LaGrange High School, LaGrange, Ga.

HOW ARE THE MATERIALS OF INDUSTRY AFFECTING OUR INDUSTRIAL ARTS PROGRAM?

Robert K. Marshall

The development of many new materials in industrial ceramics has unlimited horizons in our technological society. Many professional people whose thinking had been oriented toward metals are currently broadening their scope to include some of these amazing new materials. Similarly, industrial arts ceramics in our junior high laboratories has entailed slip casting and throwing on the potter's wheel, using commercially prepared slip and clay bodies. Industrial methods and materials will also be utilized in this new junior high school facility. During recent months, through personal contact with local ceramics manufacturers, the Rutgers School of Ceramics and various research centers, much information concerning a meaningful ceramics program at the junior high school level has been acquired. These ceramic leaders offered such suggestions as extrusion, dry pressing, slip casting and jiggering, which will comprise the forming methods in our newest program. Donations, such as a small extruder and a laboratory type press, will be made by a local industry, while other necessities, such as mixing equipment and kilns, will be purchased by means of our capital outlay budget. The ceramics program will consist of structural clay products, refractories, whiteware, electrical ceramics, glass and ceramic metal systems.

In the area of the historically significant structural clay products, the technologically advanced stiff mud method of extrusion will be utilized. Local clays are expected to be obtained for this use. Bricks and clay pipe of proportionately smaller sizes will be attempted, after which various finishes will be applied to these pieces. The soft mud method of processing brick by hand in molds will also be undertaken. The processes of winning, drying, glazing, burning, drawing, storage and additional methods of forming will be introduced and discussed. The study of structural clay products will provide a basic introduction to the ceramic industry.

The comparatively small but important industry of refractories is highly responsible for the advancement of our technological society, by making possible the advancement of industries requiring extremely high temperatures of heat. This area will be studied through the utilization of fire clays formed by extruding and slip casting of kiln furniture. Equipment limitations will prevent the use of clays with a fusion point over 2900 degrees Fahrenheit. During this study, the students will become aware of the impossibility of firing ceramic materials without refractories.

The ceramic industry considers whiteware its most stable area. Our whiteware ceramic unit will include the extruding, slip casting and jiggering methods of forming. The slip and clay bodies will be compounded in the industrial arts laboratory. A typical slip will consist of 16 pounds talc, 8 pounds Kentucky-Tennessee ball clay, 1 pound of whiting and 11 pounds of water. Up to 20 percent alumina will be added to the slip for experimental purposes; that is, to discover its effect on the finished ware. An improvement in relation to chipping and impact strength is the anticipated results. Students experiencing slip casting will be encouraged to produce their own molds. Through the whiteware program, the opportunity for creative design and decoration will be realized.

The electronics industry is dependent upon ceramic insulating materials. Thus, through the utilization of this unit, extruding, slip casting and dry pressing forming methods will be introduced. Because steatite possesses excellent electrical properties and is low in cost, a steatite body will be used for extruding. Dry pressing is to be utilized for forming ferrites. The slip casting of electrical parts will be undertaken through the employment of a low frequency electrical porcelain body. The high firing temperature of many electrical ceramics bodies will prevent their use. The division of electrical ceramics will also offer many opportunities for field trips to local industries. These particular industries are utilizing beryllium oxide, glass bonded mica, aluminum oxide, baron nitride, baron carbide, silicon carbide and lava. Through this program the newest ceramic materials and forming methods will be realized.

How different our lives would be without glass, a most important area of the ceramic industry. The glass program will consist of the study of types of glass and their manufacture. Manipulative experiences will include grinding, fire polishing, annealing, forming, welding and possibly glass-blowing. These experiences will provide insight into the qualities of glass.

Industry is finding more and better methods of applying porcelain enamel, actually a glass, to many metals. The ceramic metal systems will include enameling on copper, gold, silver and steel. A local dental laboratory has offered to provide instruction in porcelain crown and bridge construction. Industry is increasingly utilizing this particular method of coating metals.

The new junior high program will provide a background for the present high school's industrial ceramics curriculum, which has been in progress for several years. The industrial ceramic equipment in this particular industrial arts laboratory includes a pug mill, lightning mixer, jigger, extruder and a student-made vacuum filter dewatering machine and hydraulic dry press. Some of the experiences in this industrial arts laboratory have been extrusion of Missouri fire clay for kiln furniture, pressing of low shrinkage lead flux bodies, dry pressing silicon carbide abrasives and dry pressing ferrites. Because ceramics is such a rapidly developing and important field, it is anticipated that our industrial arts laboratories will continue to expand their ceramic programs.

Mr. Marshall teaches at Schuyler Colfay Junior High School, Wayne, N.J.

Th-8.5 Design & Drafting
Special Panel Session
ARE PRESENT DESIGN AND DRAFTING PROGRAMS BECOMING TOO TECHNICAL?
Gen. Chm., Jay Helsel; Chm., Francis S. Orr; Rec., B. M. Hukill; Obsr., William Grieve; Panelists, Glen M. Thatcher, Clifton D. Lemons, John D. Parr; Hosts, Mario Todaro, B. M. Hukill.

TODAY'S TECHNOLOGY—ITS EFFECT UPON ELEMENTARY, JUNIOR AND SENIOR HIGH SCHOOL

Glenn M. Thatcher

The rapid advancements of today's industry and technology are changing the curriculum and objectives of industrial arts.

Many of these changes are taking place as a direct result of industry itself. One change that I can cite with authority, as I saw it take place, was in the State of Florida. Due to Cape Kennedy, the tool and die and electronic industry has flourished in Florida. However, this industry was expanding so rapidly that adequate personnel in the area of jig and fixture designers were not to be found. Upon investigation of the design and drafting curriculum in the schools of Florida, they found that the chapter on jigs and fixtures in French and Vicrek's book was being completely ignored. Desperately needing personnel in this area, the American Society of Tool and Manufacturing Engineers began sponsoring an annual contest with scholarship awards for the fixture that best met their requirements. From this point on, at least one month in a school year was spent in our school drafting rooms preparing for this contest.

Here and there, electricity and electronic units are being offered in our schools. Also, now and then plastic and fiberglass work is being done. Yes, these are changes, but, are they enough change and are they coming rapidly enough?

If you were to ask me at what stage industrial arts is at present, in comparison with American industry, I would have to say, "We are introducing materials and procedures equivalent to that of American industry during the period of World War II."

I have found that when an electronic course is introduced in a school, the response for admission is so great that many students are turned away. This must be an indication that our youth want and need this type of instruction.

Many schools still produce ink drawings because they are unable to obtain more recent duplicating machines.

Accurate sketching and template work is a commonplace thing on the industrial drawing table, but remains an almost unheard of thing in the drafting labs of our schools. In many phases of industry, the compass is practically obsolete, as holes on working drawings are indicated by a dimension arrow whose head marks the center point. Industry is interested in saving time, as time means money to them.

Architectural classes show us that our youth can comprehend and grasp new ideas, as the ingenuity and originality that some of our students show in designing modern homes are comparable to those qualities of the finest architects.

What is the answer? How can we bring all of our labs up to date to match the few that are as they should be?

My suggestion is that before this information can be passed on to the student the instructor must have it, and prior to the instructor the institutions of higher learning must be presenting these new ideas.

These new ideas may be learned in summer institutes which will begin this summer on many of our college campuses for the men of industrial arts. They can be a godsend to our profession. They can be used annually to bring our personnel up to date and abreast of new techniques. This information can in turn be returned to various sections of the country by the participants of the institutes and, by the media of local inservice workshops, be made available to scores more in our profession. If used to their full potential, these institutes can be just the "shot in the arm" the industrial arts needs to expand and progress rather than to decay.

Mr. Thatcher teaches at St. Petersburg High School, St. Petersburg, Fla.

HOW MECHANICAL ARE PRESENT DRAFTING PROGRAMS IN MEETING THE ACADEMIC NEEDS OF ALL STUDENTS?

Clifton Dale Lemons

It is the stated objective of high school drafting in industrial arts to serve the needs of four categories of students:

1. Those interested in drafting as a general education subject only.
2. Those who consider the secondary school as terminal education and plan to enter industry without further education.
3. Those who plan to continue their education in a vocational school.
4. Those who plan to continue their education in some professional technical field.

How mechanical are present drafting programs in meeting the academic needs of all students? To best meet the needs of all these students would require a computer programmed to analyze the abilities, motivations and aspirations of each student and to print-out individualized programs. Obviously, for many reasons, this is not possible.

The next best approach, then, may be identifying and synthesizing the basic drafting needs of all the groups and teasing out the fundamentals. These fundamentals could then form the content core on which to build the drafting programs. This, generally, has been the practice in establishing the existing programs. The success of these programs is somewhat doubtful. Because of this doubt, the area of drafting has been the subject of much research. Eckhart Jacobsen, in the Fifteenth ACIATE Yearbook, cited eighteen studies between 1961 and 1965 concerned with drafting. There have been studies to determine what is being offered, what should be offered, how drafting is being taught, the effectiveness of new methods and techniques and the value of drafting to students in further educational endeavors.

There have been several studies that evaluated the value of high school mechanical drawing to success in college engineering drawing. J. W. Horine found that college drawing students with high school drawing experience made significantly higher skill grades and final grades than those without such experience. He found, however, no significant difference in informational achievement. E. L. Dyke found that high school drawing experience was not as valid a predictor of success in engineering drawing as certain aptitude tests.

Some further data relative to this discussion resulted from a study completed by me in 1965. In this study were involved a pre-test and post-test of engineering drawing students. The instrument used was devised to measure their knowledge of these fundamentals: (1) projection theory, (2) lettering, (3) instruments, (4) geometric construction, (5) lines, (6) orthographic theory, (7) dimensioning, (8) multiview projection, (9) sectioning and (10) threads and fasteners. These were the fundamentals found to be most common to high school mechanical drawing courses and to college engineering drawing courses.

On the pre-test, noticeably low scores were made by students with high school drawing experience on the fundamentals of sectioning, threads and fasteners, orthographic theory and dimensioning. After one semester of engineering drawing, the only fundamental outstandingly low was that of orthographic theory. Students with two or more semesters of high-school drawing made significantly higher total test scores and engineering drawing final grades than those with less than two semesters' experience. No significant difference was found on final grades between students with one semester of experience and those without experience.

In a drafting seminar that I attended this past week, representatives from industry discussed problem areas they are experiencing in drafting. One of the greatest problems identified by all of the representatives was that of obtaining qualified draftsmen. The representative from Ford Motor Company stated that "qualified drafting personnel are more difficult to obtain than engineers." That students with high school drafting experience are weak in knowledge of drafting fundamentals was a common statement. Forty-nine per cent of the applicants for the drafting training program of Ford Motor Company fail to pass the entrance examination. Seventy-five per cent of those with similar experience applying for Civil Service drafting jobs fail to pass the qualifying examination. These statements of dissatisfaction with the products of our educational system were not the results of formal studies, but do represent the general feeling of representatives from seven major industries. I might add that applicants with some college drafting experience did but little better than the high school graduates.

Although these statistics do not provide concrete answers to the questions posed by the title of this panel or of this topic, they do provide implications for examining the problem. First, a close examination should be made to determine if the necessary fundamentals are included in our course materials. Second, are the fundamentals included in the course materials presented in a meaningful manner to the students? Third, what are the students' objectives and how do they compare with the course objectives?

In this age of rapid development in technology, it is easy to broaden our courses to the extent that necessary fundamentals are deemphasized or completely omitted. This is not to imply that the drafting programs of a decade ago are adequate today, if they were adequate then. Recommendations have been made that drafting programs and courses be made more uniform between schools. Based upon valid study, this could be done to insure coverage of fundamentals and still allow the teacher to use individual initiative and ingenuity in the organization and presentation of materials. This could also provide adequate opportunity to relate the drawing to the individual needs of the students.

Research indicates that we are not sure that the needs of the students of the one group most studied are being met in drafting. Observations from industry cast some doubt about the success with a second group. We know little or nothing of the success we are having with the other two groups. Perhaps drafting programs are often too concerned with developing techniques to see the big challenge of developing concepts of the fundamentals.

FOOTNOTES

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Mr. Lemons teaches at Murray State University, Murray, Ky.

THE EFFECTS OF CHANGES IN ENGINEERING CURRICULUM AS RELATED TO DRAFTING IN THE INDUSTRIAL ARTS PROGRAMS

John D. Parr

The topic of this session, "Are Present Design and Drafting Programs Becoming Too Technical?", could certainly stimulate some lively discussions in certain groups. The reactions could be varied according to the viewpoint of the instructor and the objectives he has set for his course.

The topic assigned to me in this discussion required some research and a survey of conditions and changes as they exist in schools of engineering today. In order to acquire a current viewpoint of the changes that have taken place in the curricula of these schools, a survey was conducted of five major universities and one technical institute. The schools selected were scattered across the country. The changes in curriculum and problems and methods connected with these changes were as varied as the number of respondents.

In some of the returns, the schools indicated that 60% of their freshman students had not had drafting in high school. Some indicated a preference to teach all at the college level of the graphics a student will need. The Massachusetts Institute of Technology does not include mechanical drawing in its under-graduate program. They feel that the pressure of the curriculum is too great to allow inclusion of this subject as a formal course of instruction. The acquisition of this knowledge is left to the student and must be done on his own time.

The California Institute of Technology indicated that 70% of its entering freshmen have had one or more years of drafting in high school. They feel this experience provides a helpful background for their only required course in basic graphics. Their course contains the basic theory of projection developed with an introduction to some methods of graphical analysis, and these are applied to a few practical problems such as might be encountered by the engineer.

Some of the schools were rather critical of the courses in drafting that are taught at the secondary level. Some of the criticism is just, some of it is out of line. Two excerpts from the reports received follow: (1) the Engineering Graphics Division of the American Society for Engineering Education stated, "Many of us who have been working with the problem recognize that upwards of 60% of the entering students in engineering have not had any previous training in any type of engineering drawing course. In addition to this, many students who had some high school drafting have normally been exposed to the traditional industrial arts approach that is concerned primarily with the development of manipulative skills. This is not the type of engineering graphics course that we in the engineering graphics division feel is desirable. Normally the high school staff teaching these industrial arts types of courses have not had significant training in any of the engineering sciences or mathematics. Those of us who have worked in the development of upgrading courses for the teachers in high schools find that the teachers are, as a whole, unqualified to teach courses in engineering graphics. They do not have creative engineering design experience, either academically or practically, as considered desirable and consequently are not capable of conducting any kind of an articulation effort with engineering design. Further, it is not likely that their qualifications will improve significantly within the next fifteen years."

(2) A letter from a member of the engineering faculty at MIT stated, "If mechanical drawing is taught in high school, there is a serious danger that it will be equated in the student's mind with the activities of the professional mechanical engineer, or even worse, by a kind of induction, with engineering in general. If, then, the course is taught (as often happens) as a kind of training in drafting, these students who do not like drafting will decide against a career in engineering and will become physicists or chemists or mathematicians instead. In this way, there is a fatal chance of losing good potential engineers because of clumsy inadvertence."

Mr. Earl Black, professor of product engineering at General Motors Institute, and his staff indicated that courses in drafting at the secondary level could be strengthened if the industrial arts teacher would approach local industry and ask to be hired into the company in the drafting department to work actually "on the board" for the summer vacation. This would be of benefit to both the instructor and the industry. The instructor could see the latest techniques that are used in industry, and could update the courses he teaches during the year. Industry would benefit in a long-range program as their new employees would be better prepared to learn to be draftsmen.

The curriculum changes that seem to be taking place are a de-emphasis on drafting and increased emphasis on mathematics and science.

The schools that responded seemed to feel that if a student had his choice of taking courses in mathematics and science or a course in drafting, he should take the math and science. They want their students to have much stronger foundations in these areas. They are also moving away from other areas of practical arts. The University of Michigan has discontinued its courses in machine shop and foundry practice. They present the theory of the courses but not the practical application of the theory.

In the schools that still present a graphics course there is more concentration upon concepts of graphical and pictorial presentation than upon detailed skills in drafting. There is also greater emphasis on creative design, the feeling being that the engineer should be creative. He should be able to give a pictorial sketch or drawing of a basic idea, and a technician can do the necessary detail work to produce a working drawing.

After studying all of the correspondence from these engineering programs, an effort was made to relate the changes to drafting as taught in industrial arts.

One salient factor was evident in the reports from the universities. That factor was the difference in philosophy between engineering and technical schools and industrial arts. The engineering schools fail to recognize that one of the foremost objectives of industrial arts is the interpretation of technology, usually with a general education approach, and the effort to provide exploratory experiences rather than developing professional competencies. By combining the experiences a student has in secondary school drafting classes with courses offered in community college programs, we can begin to develop a degree of professional competency. The knowledge gained in the secondary school classes if taught correctly, can also provide valuable background for a prospective engineering student.

In light of the foregoing discussion, it seems difficult to see how or why we should try to alter our courses to fit the changes in the engineering curriculum. We are working with students at three different levels: first, the student who will go into engineering; second, the student who will become a draftsman; and third, the student who will never make use of his knowledge of drafting. This is not to say, however, that we should resist all change. We cannot be complacent and feel that everything is progressing in the right direction. We need change. All too many courses are taught today exactly as they were 30 years ago. All one has to do is to look at many of the textbooks currently on the market to see that the problems are about the same as they have always been. It is virtually impossible to find open end problems presented in these books or in classrooms. How many instructors allow students to use templates? How many people insist upon using the old heavy manila drawing paper or how many use tracing paper? How many people insist upon students making checkerboard drawings of symbols and plates of geometric designs? The ancient Chinese proverb that says, "To live is to change – to change is to live," seems to be very appropriate.

Let us keep in mind the changes that are taking place in technology and in engineering, but let us not throw out everything in our programs in an effort to align ourselves with these changes. Rather, let us update our courses and teach what we feel our students should know.

Reference was made previously to open end problems. We should start to throw in these problems in first-year drawing classes to make pupils think. These problems could be very elementary to start, and become more involved as the students become more experienced. An example might be to have the students re-design the blackboard eraser. Have them list the inadequacies and problems connected with the present product and then figure out what new materials could be used, what design would be more comfortable, functional and better artistically. This could progress in difficulty up to projects such as the one described by Mr. Frank E. Mahan, Portola Junior High School, Tarzana, Calif., in which his students were doing city planning.

All too often we are accused of spoon-feeding factual material to our students and later, on command, they must regurgitate these facts for us. We tend to make our students entirely dependent upon us for answers to problems. Why not reverse the question and make the student think through the problem and offer solutions that will answer his original question? This is not the easiest way to teach. It is much easier to give the student an answer and satisfy him than to encourage, guide and in some cases prod him to answer his own questions. If we can encourage our students to think, we will do them much greater service than if we make human tape recorders of them.

We should encourage them to show their creative spirit. Problem solving and research in reference material such as lists of standards, machinery's handbook, Army-Navy standards, technical journals and textbooks will bring out the creativity they possess. Probably the hardest thing for an instructor to do is to stay out of the way of creativity. We can't teach it. It is a gift. We can teach creative design in our classes. This should be started very early in the sequence of drawing classes.

These are not new ideas nor are they revolutionary. If they have merit, try them. If you can observe your students developing into independent thinkers, you will have added one facet to their precious stone of life.

Mr. Parr teaches at North Intermediate School, Saginaw, Mich.

Th-8.6 Electricity and Electronics
Special Panel Session
ELECTRONICS EDUCATION IN TODAY'S SCHOOLS—STATIC OR DYNAMIC?
Gen. Chm., Howard Gerrish; Chm., Ronald D. Todd; Rec., William Skelley; Obsr., S. Hugh Capron; Panelists, Frank R. Steckel, A. O. Brown, III, Tod H. Herring; Hosts, L. Dayle Yeager, Cecil E. Sanders.

WHICH DIRECTION—PROJECTS OR BREADBOARDS?

Frank R. Steckel

Our schools are facing a challenge of change. Edgar Dale has said that "The times demand that we learn more, learn it faster, remember it better and apply it more skillfully". Drastic changes must be made in the teaching methods being utilized at all levels and in all phases of education, if teachers and learners are to keep pace with the explosion of knowledge now occurring in all fields.

In addition to this explosion of knowledge, other problems of "keeping pace" are resulting from rapidly developing teaching methods and techniques based on sound principles of psychology of learning. Dr. Ralph Tyler, Director of the Center for Advanced Study in the Behavioral Sciences in Stanford, Calif., stated, "We now know enough about the conditions which contribute to learning to double the productivity of the college years." There is no doubt that all levels of education could benefit greatly from application of what is known about contemporary methods and techniques of teaching.

The premise has been put forth that unless we implement new methods and techniques of presenting industrial arts curriculum areas to students on all levels, we will fall far short of adequately preparing them to face and accept their place in society upon graduation.

We who teach industrial arts have long and often loudly proclaimed that we teach students, not classes. Because of the size of our student load, we have been able to do this. Now, however, we have not only larger classes but a great deal more technical subject matter to cover. We can still teach students and not just meet classes, by implementing one of the front-runners of modern teaching techniques, the teaching system package, which is a sophisticated application of the breadboard. The breadboard utilizes a student-centered, rather than a project-centered, teaching method.

Teaching systems have well organized content. They provide students with the opportunity for finding facts, for testing ideas, for experimenting and for construction of projects. This activity is all based on the time-honored application of learning by doing.

When the breadboard technique is used with the experimental method and experiments are properly conducted, they give each student a chance to combine theoretical information with practical experience which, in turn, offers meaningful experiences. The student learns very quickly that technical knowledge gained through experiments is of no value unless it is based upon correct information. More subject matter can be covered in less time, and it can be covered better by the breadboard technique.

When the breadboard technique is carried out on the higher plane of the teaching system technique, instructors don't have to spend their time making and repairing equipment; this gives them more time to spend on methods and techniques of presenting material to their classes. All too frequently, teachers are so busy getting materials and supplies together that they only expose students to learning experiences rather than take time to teach them.

When a student is encumbered with the complete details of project construction, it is difficult to find time to challenge him to the maximum of his capabilities. One of the teaching system packages using the breadboarding technique may be the avenue to this end, for students are not bound to the conventional and mythical average progression, but move ahead as fast as their ability, time and interest will allow. This can and should be a motivating factor for increased learning experiences.

When electronic projects are breadboarded first, the student can often work out operational difficulties that result when a schematic is converted directly into a chassis. The breadboarded project often lends increased insight to the cabinet design required to house the constructed chassis.

Much of the instruction in industrial arts education, at all levels, is still project-centered. However, more and more industrial arts teachers are beginning to utilize student-centered rather than project-centered teaching methods. This changing emphasis is encouraging. As Oliver Wendell Holmes once stated, "I find the great thing in this world is not so much where we stand, as in what direction we are moving."

Mr. Steckel teaches at Appalachian State College, Boone, N.C.

TEACHING ELECTRONICS: TUBES OR TRANSISTORS?

A. O. Brown, III

Discussing the topic of vacuum tubes versus transistors in the day of microelectronics is a little like discussing whether we should travel by horse or automobile in the Jet Age. We are comparing two well-proven means of controlling electrical energy while a newer method is moving into the front. The new entry I refer to is, of course, the integrated circuit. But let's leave these new integrated devices and methods for later discussion and go back to the original proposition.

Transistors are a very well established fact of life in the electronics industry today. A recent publication by the US Department of Commerce entitled US Industrial Outlook 1967 shows semiconductors (which includes transistors, diodes, silicon control devices and related devices) with a commanding lead over receiving tubes and industrial tube devices. The only saving factor for the vacuum tubes is the television picture tube. Due to the extreme high cost of color picture tubes, this segment of the component market has remained high. Analyzing the graph, it is apparent that vacuum tubes, with the exception of the television picture tube, are a static item in a fast-growing economy. Still another factor to be reckoned with is the growing microelectronics industry (an off-shoot of the semiconductor industry) which, according to the same source, is a $475-million business.

The microelectronics industry, which includes integrated circuits and solid state discrete devices, packaged with micro-miniature passive components, promises to be the dark horse in this race. The annual market report, published in Electronics magazine, January 9, 1967, predicts integrated circuits alone will rise from their 1966 sales figure of $145 million to $250 million in 1967; and they are projected to nearly $600 million by 1971.

Let's tear ourselves away from the world of high finance, as these astronomical figures always make my head reel (this is probably the result of looking at a teacher's paycheck all these years), and look at the implications for teaching electronics.

First of all, the point of this high pressure treatment on semiconductor devices is that we should be teaching "transistors" or semiconductor devices as at least half of our industrial arts electronics programs, and probably working toward a 70/30 ratio for the transistor/tube relationship.

I have given you the statistics showing industry's response to semiconductors; now we should examine the underlying reasons for the change. The transistor itself is the best example of a semiconductor device for comparison with a vacuum device, so we will undertake a comparison on several key points:

1. Cost – The semiconductor equivalent of a vacuum receiving tube is roughly one-third to one-half as expensive.

2. Size – With the exception of the relatively new nuvistor tube, the transistor is only a fraction (possibly one-tenth) the size of the vacuum tube.

3. Heat – The transistor produces no significant amount of heat as compared to the large amount produced by a vacuum tube. However, the transistor is heat-sensitive, and is adversely affected by high temperatures.

4. Efficiency – The transistor is much more efficient than the vacuum tube, due to the absence of a heater.

5. Reliability and Life – The transistor is more reliable and has a practical life rated in years as opposed to practical vacuum tube life rated in hundreds of hours.

6. Ruggedness – The transistor is a solid piece of crystal material and is far more rugged than the fragile vacuum tube.

The points of comparison shown so far are the classic sales points for semiconductor devices. But let's go one step further and examine the so-called other side of the ledger.

The classic arguments against transitor or semiconductor devices have centered around the following points:

1. Power-handling ability
2. Temperature instability
3. Voltage limitations
4. Low impedance
5. Frequency limitations (into the high RF ranges)

Power-handling ability is only necessary where large amounts of power are used: for example, in heavy motor-driven equipment. Yet as far back as 1950, large-area semiconductor rectifiers have been doing most of the heavy work; and with the advent of silicon-controlled rectifiers in 1957, the control mechanisms have been rapidly changed over to solid-state. Evidence of this can be seen in the construction (in 1963) of a 12,000 horsepower reversing plate mill with silicon-controlled rectifier (SCR) drive.

Temperature is still one of the problems of the semiconductor manufacturer; but with new construction methods, the use of silicon in place of germanium, and the proper design of support circuitry, ambient temperature changes up to over 100 degrees centigrade are controllable.

New design and construction procedures have paved the road to semiconductor transistor devices that run on "line voltage" or above. Some of the same fabrication methods and a relatively new device called the field effect transistor (FET), with input impedances of thousands or even millions of ohms, have provided us with a semiconductor device that runs on low transistor voltages, but has vacuum tube range input impedances.

The final assault on the kingdom of the vacuum tube is at hand as the semiconductor designers go to work on microwave frequency devices. The January 23, 1967, issue of Electronics magazine reported an integrated semiconductor circuit (IC) using diodes integrated with a microstrip line on silicon to switch X-band microwave signals.

If by this time you are not ready to trade in your tube caddy and study up on terms such as monolithic, SCR, SCS, triac, large scale integration and descretionary wiring, I have one more trick up my sleeve.

Electronic project magazines such as Popular Electronics, Electronics World and Radio Electronics are favorite sources of ideas and construction features. I have compiled a list comparing 1966-67 construction articles with those of 1962, to show the trend toward the use of transistor devices.

		Tube	Transistor	Hybrid
Popular Electronics	1966-67	7%	80%	13%
	1962	44%	50%	6%
Radio Electronics	1966-67	14%	79%	7%
	1962	41%	57%	2%
Electronics World	1966-67	6%	88%	6%
	1962	17%	57%	26%

A comparison of the number of construction projects using tubes only, transistors only, and a hybrid of both in the magazines Popular Electronics, Radio-Electronics, and Electronics World in the two time periods of 1966-67 and 1962.

If this final bit of evidence does not convince you that transistors are here to stay, I will turn in my integrated circuit tie tac and go home.

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Mr. Brown teaches at Kansas State College, Pittsburg, Kans.

WHICH DIRECTION—SERVICE OR TECHNOLOGY?

Tod H. Herring

The question of "Which Direction – Service or Technology?" is posed as if we must make a choice between these seemingly different directions. If an intelligent choice is to be made, we had better take a look and try to see what the reasons might be for choosing.

Some years ago I gave a talk in which I attempted to show the impact of electricity/ electronics on American culture. I did the usual "search of the literature in the field" and discovered, as you might expect, that in almost every field of human endeavor I could cite an impressive number of examples which documented a fast-rising curve. I am going to cite a few items from that 1957 talk and then jump to the present and report a few more. Remember, the first few are ten years old.

One important development with vast future possibilities for electronics was the discovery in 1948 by Bell Telephone scientists that a tiny particle of the "semimetal" germanium is capable of performing the functions of most vacuum tubes. This speck of metal with three tiny "cat's whiskers" terminals not only has an advantage in size over vacuum tubes but is also extremely rugged and long-lived, does not heat up in use, is not subject to warm-up delay and operates with high efficiency on minute amounts of electric current.

Already the transistor is finding uses in dial telephone apparatus, in the manufacture of better and much smaller hearing aids and in the miniaturization of much delicate electronic equipment. One engineer predicts for the near future "a really personal radio of hearing-aid size running indefinitely on one set of batteries". As evidence of the practical possibilities of the transistor, technologists of the Radio Corporation of America, in November 1952, exhibited experimental portable television receivers, loudspeaker systems, miniature radio transmitters, an automobile radio (minus the high-voltage power supply usually needed) operating directly off a six-volt auto battery, a transformer power amplifier, and automatic computer components—all using transistors instead of vacuum tubes.

Have we had any changes since then?

Item: In an article entitled "Repairman's Paradise" in the Reader's Digest for December 1957, it was noted: "The average housewife has 25 or more appliances in her home, 87% of all U.S. homes have washing machines, 81% have TV sets, 96% have refrigerators and 67% have vacuum cleaners. The housewife is thrilled and enthusiastic, with one sour note. What happens when they quit working? There was a day when a reasonably handy householder could keep things working. However, the day has arrived when our technology has outstripped the ability of the householder to keep things running. Last year the cost of TV repairs alone ran to more than two billion dollars, with all other electric appliance repairs adding another 1.6 billion. As appliances become more and more complicated, it is virtually certain that it will be less possible for the householder to be able to help himself unless the present trend is reversed. The appliance industry is not unaware of the problem, and there are signs that some slow progress is being made. Some units are designed to be accessible, and consideration is being given to making subassemblies plug in, so that they can be removed and replaced with relative ease. In view of the evidence which shows that the trend toward more electrical devices is accelerating, it would seem axiomatic that servicing will become more and more of a problem."

To illustrate the continuing increase in transistor devices, I offer the following from an article in the March 1967 issue of Radio Electronics, titled "Plastic Transistors – The Future Billions". The author says that industry's leaders are predicting that by 1971 the world will use close to two billion plastic encapsulated semi-conductors. This represents only one process of manufacturing; others will no doubt also increase. The price is going down and the quantity available is going up. Certain pieces of equipment are going to be used in larger numbers because price reductions will move them out of the luxury class. How would you like to have a silicon field effect transistor costing under a dollar retail?

The electronic technology is moving at other points also. We are not yet fully transistorized and already there are predictions that the transistor is obsolete. In fact, so are other individual components, such as resistors. The chips are coming. The IC's or integrated circuits are already beginning to invade transistor territory. Why bother with individual giant-size parts like transistors when you can have 12 transistors, 12 diodes and 15 resistors in the same space and for less money?

I have no intention of going on and on with the evidence. I will, however, ask you to fill in some examples of your own of electrical and electronic devices needing adjustment and repair from time to time. Think only of those devices that did not exist ten years ago. To name only a few, we find the electric knife, can opener, tooth brush, SCR speed controls for portable electric hand tools, solid state lighting controls, citizens band radio, solid state tachometers, thermister temperature gauges, pizo-electric scales, capacitor discharge ignition systems and desk top computers.

The foregoing evidence confirms two things. One, the technology of electricity/electronics is growing, and two, the number of devices is growing, both in quantity and in type. The growth if plotted no longer looks like a curve but, like Jack's beanstalk, disappears straight overhead.

To return to the question of which direction, technology or service, I will offer you an opinion. But first, one more piece of evidence. Way back in World War II, the US Navy did some research at one of its radar schools. Two groups of trainees were used. The usual precautions were taken to match groups and control other variables. One group was taught servicing of a particular model radar set while the other was taught principles of radar, systems and use of test equipment followed by a short period of troubleshooting and repair on the same model as the first group. The total time for each group was the same. At the end of the course each group was put to work servicing the radar set on which the first group had trained. After a short time of superiority by the first group, the second group that had trained on principles was ahead in both speed and accuracy in finding and repairing trouble. In addition, the broadly trained group could also service and repair other models while the first group could not.

The answer to the question, technology or service, does not come entirely from the preceding, because from those facts one could support either position. By looking to the objectives of industrial arts, I think we must clearly be in favor of technology over service. Margaret Mead has written, "No one will live his life in the world into which he was born and no one will die in the world in which he has worked to his maturity."

Edgar Dale in an article titled "Education for Flexibility" has offered some interesting and insightful comments on this matter.

"... The world of tomorrow needs the flexible man, the intelligently mobile man, the man who can land on his feet when his job becomes technologically obsolescent."

To educate for flexibility we must distinguish between training and education. To train is to emphasize fixed responses, to stress immediate goals which often have a low ceiling of possible growth. To educate, however, is to foster limitless growth, lifelong learning.

Since change has not only been documented but predicted as a permanent way of life, the most reasonable position seems to be in favor of teaching the technology of electricity/electronics.

The conclusion that I drew from the radar experiment and other similar experiments performed on other groups, with other tasks and at other times, leads me to say that if your objective is servicing, then to be efficient teach the technology of electricity/electronics and follow this by practical experience in a particular kind of servicing. Your students will then be in a position to grow and change. As the new devices come along, they will stand a better chance of understanding and servicing them. The proliferation of devices also increases the importance of a broad background to help meet the objective of consumer literacy.

The question of whether or not service is a proper objective, which I hope I raised with the big if, must be decided on other grounds. My answer is that the ability to service is incidental and should be given low priority as related to teaching the technology of electricity/electronics.

Mr. Herring teaches at Trenton State College, Trenton, N.J.

Th-8.7 Graphic Arts & Photography
Special Panel Sessions
PHOTOGRAPHY—THE BASIC TOOL OF THE GRAPHIC ARTS

Gen. Chm., Philip D. Wynn; Chm., Edmond E. Benini; Rec., Peter Jackson; Obsr., James F. Snyder; Speaker, William Flack; Interrog., Benjamin Kneisley, C. E. Strandbert; Hosts, Lee R. Clendenning, Carl Dreisbach, Jr.

NEW DIRECTIONS FOR GRAPHIC ARTS IN THE SCHOOL

William F. Flack

The graphic arts industry has grown and prospered through scientific advancement. The industry now sets type electronically and photographically by computerized methods at hundreds of lines per minute. Most copy is now transferred to film which is then developed in automatic processors.

Multiple images are recorded in plates by photocomposers, and electronic scanners produce fully color-corrected separations. Plates for all printing processes are produced photographically, and electronically controlled presses print four colors on a single web of paper traveling at tremendous speed. Progressive plants are beginning to install information handling systems to manage exploding communications.

The consumer, however, finds it increasingly difficult to cope with the tremendous increases of information. New ways to communicate more effectively must be found, or man will be overwhelmed with the information of his own creation.

While applying electronics to the more efficient control of mass information, the communications industry is also employing art, design and photography to reduce the abstraction often common with thousands of words.

We now live in a society which is dominated by visual communication. Our educational programs, however, continue to place emphasis upon verbal skills in communication, while the need to interpret visual communication grows ever more important.

Generally, visual communication is the translation of information through the sense of sight for increased understanding. It implies less emphasis on words to describe things, and more reliance upon art, photography and design which quickly and accurately tell a story.

Graphic arts education is in a unique position to provide youth with experiences in developing and translating visual communication. These important tasks will not be realized, however, if continued emphases are placed on manipulative operations restricted primarily to one mechanical reproduction process.

Students should be allowed increased experiences in visual expression, which can provide a natural lead-in to experience in the graphics of communication. Coursework in design, photography, image assembly, photomechanical methods, reproduction, the computer, electronics of communication and others should be brought together in a new visual communications curriculum.

Mr. Flack is the technical editor of the Sales Service Division, Eastman Kodak Company, Rochester, N.Y.

Th-8.8 Mechanics & Power
Special Panel Session
MECHANICS AND POWER ARE ON THE GO IN INDUSTRIAL ARTS AND TECHNOLOGY
Gen. Chm. Paul M.Wighaman; Chm., John R. Ballard; Rec., G.Weldon Franklin; Obsr., Dmitri Slobodian; Panelists, Joseph W. Duffy, John L. Frank, Richard Doutt; Rec., Vincent Dresser, Leander Logan.

LET'S TAKE OFF THE BRAKES

Joseph W. Duffy

A power technology course as a part of the industrial arts curriculum in general education would be feasible because our lives are becoming more and more dependent upon mechanical helots. In fact, man has never had the conglomeration of machines that we have today, and these will yield to more and better contrivances in the future as man searches for ways to improve the atmosphere, live in greater comfort and travel terrestrially and extra-terrestrially. Yes, it is cogent to offer such a course because it enables students to apply the principles of science and mathematics, as well as those of mechanical and industrial nature as they reflect on energy transfer, power conversion and employment as well as concepts of product design, technological development, production, maintenance and service.

Some of the scientific principles are basic to any general science course, and some are advanced or of an engineering nature. It is the teacher's professional prerogative to use that material which is suitable to the interest and abilities of the student. The teacher must extract from one text or several texts the material that he believes pertinent. There is no reason to assume that the total content of one book or several books should be covered to make the course meaningful.

It is imperative that the learning environment be made conducive to instruction. Student experiences are necessary for learning to take place. The environment must be kept dynamic and flexible in order to embrace the new as it is made available. Instructional aids of all kinds must be employed to kindle enthusiasm and nurture understanding. The technological advances in power development are so rapid that it is virtually impossible to design school facilities that can comprehensively cover all facets.

Specifically a power course should provide students with the opportunity to fulfill the following objectives:

1. to study the science of power
2. to study the service industries
3. to study the transformation of one form of energy to another
4. to study the socio-economic problems involved in designing, fabricating and employing prime movers
5. to study the related industries and occupational areas, such as the petroleum industry, metals industry, etc.
6. to study related science and mathematics.

Further studies growing out of this introduction to power course include work in fluid power and control systems, in the specifics of automotive and power mechanics, in training for aircraft, rocketry, or military specialties, home power equipment, maintenance and service, in related fields of manufacturing, construction, transportation, mass communication or electronics, and in mechanical, electrical or power plant engineering. Further study can be provided in high school, or in on-the-job training, vocational and technical institutions, manufacturers' training schools and seminars and armed forces schools, as well as in numerous college programs.

Education for tomorrow, whether it be on-the-job training or of a formal academic origin, must be extensive and varied, providing the student with concepts that can form the basis upon which specifics can be taught. Man himself must not in his vast technology be obscured or frustrated. The potential of each individual must be nurtured and developed. General education and industry must unite in planning systematic educational programs which may be broad or specific to suit individual needs, but all conceived with the common purpose of personal development, a continuous life process.

Prof. Duffy teaches at Central Connecticut State College, New Britain, Conn.

THE TEACHING OF FLUID POWER IN INDUSTRIAL ARTS

John L. Frank

Why should we include fluid power education in the modern high school and technical school program?

Hydraulics has many uses in our present-day society. It is used a great deal in automobiles today and will be used even more in the future. It is also used in the transportation industry-delivering mechanical equipment and sections of a house, for instance; construction machinery uses it to move, steer and dump large loads necessary for construction; aircraft-controls ailerons and raises or lowers landing gears of the plane; industrial machines-for precise power control of speed and smooth steady flow of power; inline automatic transfer machine-controls the machine tools and sequence of the movement of material. Other uses include those of road graders and farm machinery.

Along with uses are applications of hydraulics. The first is the coupling of electronics to hydraulics and hydraulic duplicating devices serving to reduce labor, sense direction and control moving of tools.

There are many units that should be taught in a class in fluid power or hydraulics. The first unit is hydraulic symbols, because hydraulic components are made in all countries and used on equipment throughout the world.

The language is a universal language used throughout the world. Sales and services are world-wide, so there must be no language barrier.

The second unit is basic hydro-static principles. Pascal's law states that "pressure applied anywhere to a body of confined fluid is transmitted."... Boyles' law states "Pressure increases in inverse proportion to the decrease in volume." Another is: heat expands fluids; liquids are slightly compressible.

The third unit is the hardest and longest unit of instruction, and it pertains to the valving. It is difficult to teach because of the similarity of the component parts and the different function that each valve plays in controlling of hydraulic or pneumatic systems.

Mr. Frank teaches at Hampton Institute, Hampton, Va.

IS POWER MECHANICS MORE THAN AUTO MECHANICS?

Richard F. Doutt

What does power mechanics mean to you? Do these two words simply mean a study of the automobile or do they imply an investigation of power and power conversion mechanisms?

In defining power mechanics we have two words describing a study of energy sources and the machines used to convert this energy into useful work. On the other hand, auto mechanics describes a specific study of the automobile and all its components. It is a specialized study of the automobile.

In the last two hundred and fifty years of progress, man has developed steam engines running on fossil fuels to power mechanisms running on atomic energy and the electron. The development of the steam engine and internal combustion engine provided the foundations of a mass transportation system, the likes of which no other country in the world has been able to duplicate.

The steam engine has evolved into the steam turbine and is currently used as the major source of power for electrical generating plants. The internal combustion automobile engine is still one of the major sources of power.

The high speed Diesel engine is now being used as the motive force for trucks, buses, trains, boats and construction equipment. It is used wherever efficient, economical and powerful load lugging capacities are required.

The development of the jet engine for military as well as for commercial use has provided new dimensions in mass transportation.

The gas turbine, free piston and Wankel rotary engines are being tested as new power sources because of their efficiency, size and inexpensiveness.

We have witnessed the unlocking of the atom. Man has been able to control the heat of the nuclear reactor to drive turbines in power plants, submarines and ships.

Rocket engine power may never become a source of power for the average consumer, but it has already written a sizeable chapter in man's history.

Currently scientists and engineers are working on ion and plasma engines, electrochemical engines, solar cells and fuel cells. One or all of these may become the power plants of the future.

Today our lives are increasingly dependent upon motive power. Prime movers, such as the internal combustion engine in its various forms, reaction engines and the steam turbine, furnish the power to affect technological culture.

The study of power mechanics should provide more than instruction in the assembly and disassembly of an engine or how to service and maintain it for operation. It should involve concepts such as why the engine functions as it does, how an engine converts one form of energy to another, the development of each type, both new and old, and its utilization.

These developments in the energy field have been part of all our lives. We have witnessed many of these, and we are currently being informed of the progress made in new areas of power development. We cannot afford to exclude them from the power programs in the schools today.

Mr. Doutt teaches at Millersville State College, Millersville, Pa.

Th-8.9 Metals
Special Panel Session
PRESENT METALS TECHNOLOGY
Gen. Chm., Kenneth R. Clay; Chm., Jerry C. McCain; Rec., Gary P. Bell; Obsr., Dennis Darling; Panelists, Thomas J. Morrisey, Edison R. Morris; Hosts, Bertin W. Michael, Jr., Richard B. Beadle.

ELECTRICAL DISCHARGE MACHINING

Dr. Thomas J. Morrisey

One characteristic trend in the development and introduction of new metalworking processes is that a more direct application of energy to the workpiece is involved. In the past, the characteristic practice was to use electrical energy merely as a method of transferring mechanical energy from the power station to the electric motor in the machine tool which produces mechanical energy that is applied to the workpiece. Machine tools utilizing this system are expensive, large, require considerable time to fabricate, occupy precious floor space and require a considerable amount of mechanical maintenance.

Electrical discharge machining is one of these new metal-working processes. The concept of electrical discharge machining was developed about 1943 in the Soviet Union, and since that time has rapidly developed into a major metalworking process that is employed in the manufacture of all types of tools and dies in the automotive industry and for limited production runs of exotic workpieces, which could not be easily machined otherwise. It is also being used to machine metals whose hardness makes them unmachinable by the chip forming process. When performed on suitable machine tools, the accuracy and repeatability of the process are quite high. The literature frequently mentions figures of 0.0001-inch repeatability.

Although it is slower than conventional machining methods, the process is ideally suited to producing intricate shapes. It is now considered by many experts in the field of metalworking to be a conventional, rather than unique or special, machining process. It is ideally suited to the production of blind cavities used in various types of dies without the need for sectionalizing or extensive hand finishing.

Dr. Morrisey teaches at Trenton State College, Trenton, N.J.

PLASTIC PATTERNS FOR THE FOUNDRY

Edison R. Morris

New innovations in the foundry necessitate a new investigation of this area by those who have foundry units in their curricula.

The foundry industry is the fifth largest United States industry, which gives the unit significance. To quote, "In the United States alone there are over 5,700 foundries employing more than 350,000 men and producing a product valued at $6.5 billion annually."(1)

Industrial educators, upon inquiry, would discover such new innovations as the CO_2 process and shell molding techniques which are now being employed to improve molding techniques. In addition, new approaches are now being utilized in the patternmaking phase of the foundry. This last concept, that of plastic patterns for the foundry, is the purpose of this article.

The conventional wood and metal patterns, when compared to the possibilities of plastics, present some interesting comparisons.

Wood patterns are capable of some 500 to 2,000 mold duplications; whereas metal patterns can produce some 100,000 to 1,000,000 molds. Plastics, then, are placed somewhere between the two media in duplicating possibilities.

On a comparative cost basis, if wood were 1, plastic would cost about 1 2/3 times that of wood, and the cost of producing a metal pattern would be approximately 3 times that of wood.

Tests have been performed to determine wear characteristics. These tests have proven that iron is the best material, with bronze next, aluminum and plastics approximately the same, and wood last.

Plastic patterning has been successfully used in industry in such applications as the restoration of partially worn wooden patterns. In conjunction with this, if restoration proves uneconomical, the casting of a plastic pattern from this worn pattern has proven both economical and time-saving.

Plastic patterning has successfully been integrated with the traditional wooden patterns. As an example, fillets and rounds can be more easily constructed by the pouring of a liquid plastic and utilizing a template to "squeegee" the fillet into the surrounding pattern, thus saving valuable time.

The automotive and appliance industries have successfully been using plastics in the jig and fixture phase for such purposes as protective devices in the assembly line handling of various types of hardware. As an example, a typical car door handle can be used to establish an impression into a liquid plastic, to establish a crotch or cradle device.

Through the use of expanded polystyrene plastics, industry has developed a time-saving approach for one-casting affairs. This process, sometimes referred to as "lost patterns", employs the principle of establishing a mold and simply pouring into this mold without removing the pattern.

To summarize the position of plastic in the patternmaking field, it would be safe to conclude that large concerns such as General Electric and General Motors are finding it economical to utilize this new concept.

Small job shops, however, where most work becomes custom work for one-casting affairs, consider it uneconomical to go along with this plastic pattern concept.

What does all this mean for industrial educators who teach the foundry within the curriculum?

Obviously, the growing importance of the technique in industry deserves recognition as an integral part of this area. Instructors will have to seek information concerning plastics and, in addition, conduct visitations to industry so that industrial applications may be discovered.

FOOTNOTE

1. Bartel, Larry G. "The CO_2 and Shell Processes and Their Use in Industrial Arts Programs," Industrial Arts and Vocational Education, December, 1964.

Mr. Morris teaches at Hopewell Valley Regional High School, Pennington, N.J.

Th-8.10 Woods
Special Panel Session
DIVERSIFIED NEW MATERIALS AND NEW PROCESSES IN THE WOODWORKING INDUSTRY
Gen. Chm., David A. Rigsby; Chm., R. Dwight Pettus; Rec., Herald J. Kliewer; Obsr., Jerome W. Black; Panelists, Rayford L. Harris, Jerry Grover, Hollice Plotts, Jr. Earl D. Redding; Hosts, George Olsen, Ronald Frey.

WHAT ARE THE NEW MATERIALS ASSOCIATED WITH TODAY'S WOOD PRODUCTS?

Rayford L. Harris

Today whether we live in a city or rural area, we have come to realize the vital importance of natural resources in our daily living. An important part of the educational program in our schools today is concerned with these resources as they relate to new discoveries, new inventions and development of new materials brought about through science and technology.

The topic "What Are the New Materials Associated with Today's Wood Products?" concerns itself not only with new materials, but also with the combination of wood and some other substance formed to make for a new usage of application.

First, there are basic materials which are associated with wood products, but they are not necessarily new. In the building and construction field, for instance, wood and steel as well as wood and concrete have been in common usage for many decades. In addition, other materials such as tin, copper, and more recently, aluminum have all been associated with the usage of wood products. The usage of aluminum on home and commercial buildings is steadily increasing. With the ever-increasing and expanding usage of steel in main framing is a further extension of metals used in home construction in conjunction with woods. Nailable steel studs, tubular sections as load-bearing post, lightweight open-web-steel joists as well as steel doors-and-frame units have been on the market for the past few years. New steel pre-fabricated homes have recently been placed on the market. One steel company is testing the usage of steel home foundations, steel floor panel system and galvanized siding.

The discovery of other materials that are associated with wood products and are creating new applications would include the hardboard, particle or chip board, pulp and paper products.

Even though hardboard was discovered in 1924 and is produced from wood which has been reduced to its individual, basic wood fibers, new applications for its use are constantly being made. It is being used as an overlay on plywood to produce a smooth surface which resists wear and weather and maintains moisture. This smooth surface eliminates hairline checking, minimizes grain raise and holds paint longer. A new textured surface coated with a new plastic finish is being produced to give the look and feel of costly marble.

It is news to no one that the pulp and paper industry is one of the most important wood industries and that this industry has grown spectacularly in the last decade. The array of products made from wood fiber at the paper or board mill is impressive. The pulp and paper industry has had a healthy developmental program for many years to stimulate diversification of wood products. This has been necessary because of the competition of associated products. In the past, paper has had few substitutes. Today there are many competing materials.

Polyethylene films have found favor as protective covers for fruits, vegetables and other food items, as containers for toiletries and other high cost or novelty products, as vapor barriers in homes, and in numerous other ways.

Another young but vigorous competitor is synthetic foam. Its biggest challenge so far has been in the packaging field; its ready moldability into complex shapes and its cushioning ability are real advantages. Also, there are numerous combinations of paper and metal, paper and plastic. The combinations provide real advantages in properties and costs, and up to now have probably helped to develop new markets for paper.

Another associated product of the wood industry is particleboard. This is an engineered wood panel made by combining wood flakes, chips and shavings with resins and sizing compound. Because particleboard is an engineered product, physical properties can be altered on a given press run to adapt the board for a specific end use. By far the greatest use of particleboard today is for furniture core stock and floor underlayment. Furniture manufacturers are using it just about anywhere a smooth flat surface is required.

Looking to the future, particleboard manufacturers and woodworking fabricators see bright prospects for this versatile wood product. Molded and custom-formed panels will open the way for many additional uses. They look forward to the day when the wood particles will be combined with other materials for a wide variety of uses. They are constantly experimenting with new resins and flake geometry to improve their product.

The properties of particleboard are affected by variables related to the raw materials, production system and post-manufacturing treatment. Therefore, the list of variables affecting the properties of particleboard is quite lengthy. A partial list of these variables is: resin content, particle moisture content, particle geometry, board density, wax content, pressure application system, wax and resin application, press cycle and others.

As has been previously mentioned, the furniture industry uses the particleboard extensively; however, two new materials for furniture surfaces have just come on the market as an associated wood product. One features a real wood veneer topped with a vinyl film, the result of ten years of research by John M. Wilcox, president of the Wilcox-Woolford Corporation of Springfield, Pa. The other replaces veneer entirely by photographing wood grain on vinyl with a rotogravure process. It is the product of the 3-M Company of St. Paul, Minn. Both of these materials are already in production.

Plastics is another material associated with today's wood product. The field of reinforced plastics is indeed a unique and challenging one. Its rapid growth since its development during World War II and the adaptations to current industrial products has been almost phenomenal. The design possibilities with this new and unique material have opened up areas for production of products never before possible.

Not only is this new product associated with wood, but also it is replacing wood and metal in a variety of products now in use. From all outlooks this replacement will be much greater in the future. In many military applications reinforced plastics can be used, thereby eliminating the need for natural resources, which always become scarce in time of war.

One of the most striking break-throughs in the peacetime use of nuclear energy is the development of irradiated wood-plastic composites, a process based on techniques developed as an outgrowth of the Atomic Energy Commission studies. This product, called Novawood, is manufactured by the American Novawood Corporation of Lynchburg, Va. It is the nation's first commercially produced irradiated wood-plastic product. Novawood is produced by impregnating almost any type of wood with a liquid plastic, which is then hardened by intense gamma radiation from Cobalt 60. The irradiation process links the monomer (plastic) molecules into chains, forming polymers and creating a solid wood plastic composite which represents a union of the best qualities of plastic and wood.

One of the most outstanding features of Novawood is its built-in finish. Dyes of many colors and wood tones can be added to the liquid plastic, impregnated into the wood, and become permanently set by the irradiation process. Hardness of the wood, whether hardwood or softwood, is increased two to ten times when converted to Novawood. All Novawood composites can be impregnated with a fire retardant additive, making the material ideal for applications requiring this characteristic.

As I stated in my introduction, many changes are taking place in education today, especially in the fields of science and technology. Likewise, changes can and must be made in the methods and curricula of our industrial arts programs. Our programs must be organized to give the student an insight and understanding of industry and its place in our society; to help each student discover and develop his talent in the technical fields and applied sciences. As industrial arts teachers we must accept the challenge of educating our youth by teaching and emphasizing new techniques, new processes and skills, not as ends in themselves but as the means for achieving our goals in industrial arts.

Mr. Harris is head of the department of industrial arts at Virginia State College, Petersburg, Va.

ARE WOODWORKERS BECOMING EXTINCT?

Jerry Grover

No! – but . . .

A national report on the trends in major American industries indicates that from the present to 1970, the wood products and lumber industries will continue to expand gradually. Between 1962 and 1970, the plywood industries' consumption of woods will be increased by 52%. By 1980, the increase will be 80% above the 1962 level. However, the per capita consumption of lumber will be 5% lower in 1970 and 10% lower in 1980. The per capita consumption of veneers and plywood will increase 35% by 1970 and 42% by 1980.

New lumber products are being developed which will place wood in a better competitive position with other materials. Some of these developments are: (1) special treatments given to woods such as fire resistance, preservation against insect and water damage and (2) the combination in various ways of wood material and plastic products.

New technological innovations are increasing the efficiency of harvesting procedures and methods of transportation. Sawmills are increasing their efficiency through the use of better saws and other allied equipment.

What does this tell us about our objectives for courses designed to survey the lumbering industry? Does this tell us that there has been a decline of 2% in the job opportunities in the logging and sawmill operations? Are we aware of the areas of the industry that are expanding? Are we considering the non-productive areas of the lumbering industry?

The trends are about the same in the furniture and fixture manufacturing industries. Eight to ten percent of wood furniture production workers are engaged in the sanding operation, and 85% of the shaping requirements are being met by new automatic control-profilers. Programmed routers are becoming more numerous, assembly operations are highly mechanized, and new finishing techniques have almost eliminated the furniture finisher. All this indicates the following employment trends:

Over-all increase in employment is at an average rate of 1.2%. The white collar employee will increase by about 2% to 19.4% of those employed in furniture and fixture manufacturing. Repairmen in the field will increase by 43%, upholsterers by 1% increase; whereas, cabinet-makers decline by 13%, laborers decline by 12.4%. Plant operatives will increase by 15%, to comprise about 50% of the total employees in the industry.

The trends in the pulp, paper and board industries follow a similar pattern.

Is woodworking becoming extinct? Based on the above data we can conclude that the industry is not vigorously expanding, but it is healthy. What about woodworking in industrial arts? Are the objectives kept up to date with a changing and fluid society? In 1965, there were 1,600,000 new houses started. Does this tell us something about our objectives? Cabinet-making is becoming mechanized. Does this fact have any implications?

Those who are in the profession of teaching industrial arts woodworking can answer the question of extinction much better than I. Extinct, no, but what about obsolete in terms of methodology? What is being done in this area to revitalize the program in objectives, new innovations keeping up to date with the technology in your field?

In order to improve our image and expand this vital area of education, we must take a close look at ourselves. Ideas and improvements must come from the woodworking teachers. Nearly all of our recent innovations in industrial arts have been initiated by a university. We must take our rightful position as educators—professionally. We must convey a positive attitude concerning ourselves and our programs. We must keep up-to-date and be aware of the latest happenings. We must mingle socially in the communities in which we serve. No, woodworkers are not becoming extinct – but what about obsolete?

Mr. Grover teaches at Church College of Hawaii, Laie, Oahu, Hawaii.

ARE WOODWORKERS BECOMING EXTINCT?

Hollice Plotts, Jr.

The title of this presentation has been phrased in the form of a question. To best answer this question, it might be interesting to ask ourselves some other equally interesting questions.

Is wood, as a material, an important part of our society today?

The industrial leaders of today have been amazed at the great technological advances in the lumber, plywood and pulpwood industries. Very few trees are either too small or too defective to be used in our modern wood industries. Donald G. Coleman, chief of research, publications and information of Forest Products Laboratory, reports the following facts:

"The United States has only nine per cent of the world's timberland, but we produce forty per cent of the world's lumber and fifty-eight per cent of its plywood. The industrial complex based upon lumber, plywood, mill work, various fabricated wood products and paper products ranks fourth among American industries in its contribution to the national income, and fifth in creation of jobs. Not only in 1960 did the manufacture of wood and paper products contribute nearly $10 billion to the nation's income, but it also created jobs for one million, one hundred thirty-six thousand men and women."

Is there a need today for skilled woodworkers?

In contacting many furniture manufacturers in one small part of the country, it was quite interesting to learn that the answer to this question depended greatly upon the individual manufacturer and his definition of the term "woodworker".

Some manufacturers definitely felt they could use all the skilled craftsmen they could get and were willing to pay a high price to get them. One such company, which produces hand-made antique reproductions, has even gone as far as to import skilled craftsmen from Sweden. Not only did they have to pay a high salary, but they also had to move the men and their families and furnish housing facilities for them when they got here.

On the other hand, many companies were more interested in producing a lower quality product at, of course, a lower price. In this case, the manufacturers felt that they also needed highly skilled woodworkers, only of a different type. Most manufacturers contacted agreed that the more machinery they operated on their production line, the more highly-skilled and technical personnel they require to keep the machinery set up and functioning properly. For this particular man, there is indeed a critical shortage. Because of the nature of this job, he is often required to be even more skilled than our old time manually-oriented craftsman. This man must not only have a high degree of manual skills for working wood itself, but he must also have a working knowledge of woodworking techniques and processes, operations and functions of complex woodworking equipment, and the ability to use his knowledge of the two simultaneously. This combination of skilled craftsman and technician is the man who is becoming increasingly difficult to find in our society today.

What are the characteristics of a skilled woodworker?

In all fields of endeavor where people are involved, we find some persons that always seem to stand above or outshine the rest. The qualities that place one man above another as a skilled craftsman in woodworking are very much the same qualities that classify a man as a skilled craftsman in any field. First to begin to excel he must have developed a good attitude toward his work. He must believe in himself and in the work he is doing. Second, he must have an interest and a desire to excel in his field. Third, he must have mastered vast amounts of knowledge of his field, both technical and general. Fourth, and probably the most important of all, is a highly developed sense of pride in his work. All furniture manufacturers contacted expressed a great concern over a lack of pride on the part of most of their workers.

Have, we, as educators, kept pace with the changing condition of today's woodworking industries?

Almost all industrial facilities across this nation have a woodworking program in one form or another. This point may even be stretched far enough to say that there are more woodworking shops in industrial arts than any other single area of industrial arts instruction. We could then safely say that more high school students are exposed to woodworking than any other form of shop work. If, then, the woodworking industry is only the fourth largest industry in this country, and woodworking is our most common medium of instruction, why can we not provide enough skilled craftsmen to begin to fill the needs of the woodworking industry?

To answer this question is not the purpose of this presentation. However, if we think seriously about it for a moment, we will begin to understand our original problem. Are woodworkers becoming extinct?

Mr. Plotts teaches at Northeast High School, St. Petersburg, Fla.

HOW ARE MODERN PROCESSES CHANGING THE WOODWORKING TRADES?

Earl Donnal Redding

The rocket ships in space are just marking the beginning of a grand new era. Let's see what the futurists see for AD 2000—only thirty-three years away. According to an article in Time magazine... "by AD 2000 we can look for automated and possibly underground highways. Marshall McLuhan predicts that the highway and wheeled automobile will be obsolete, giving way to hovercraft that ride on air. Planes flying just under the speed of sound carrying 1000 passengers will be old hat. The new thing will be ballistic rockets that would be capable of reaching any place on earth in 40 minutes. In Rand's Delphi study, 82 scientists agreed that a permanent base on the moon will have been established long before AD 2000 and that men will have flown past Venus and landed on Mars.

"Huge fields of seaweed will be tended by undersea 'farmers'—frogmen who will live for months at a time in submerged bunkhouses. The protein-rich undersea crop will probably be ground up to produce a dull-tasting cereal that eventually, however, could be regenerated chemically to taste like anything from steak to bourbon. This will provide at least a partial answer to the doom-sayers who worry about the prospect of starvation for a burgeoning world population.

"One of the more dramatic changes will be climate control. Tempo scientists estimate that the entire electrical energy needs of the United States could be supplied by a dozen nuclear generating stations spotted around the country, each with a capacity on the order of 60,000 megawatts (Grand Coulee gives a mere 2000). If one such station were built on Mount Wilson above Los Angeles, the heat produced as a by-product could be guided into the atmosphere, raising the inversion layer that hangs over Los Angeles to 19,000 feet, thus ridding the city of smog. A sea breeze could be drawn into the space beneath, bringing rain that would transform the high desert between Los Angeles and Las Vegas into a flowering land.

"Medicine is in a similar state of anticipation. Already widely discussed today, artificial organs—hearts, lungs, stomachs—will be commonly available by the year 2000.

"In general, drug control of personality will be widely accepted well before the year 2000. If a wife or husband seems to be unusually grouchy on a given evening, says Rand's Olaf Helmer, a spouse will be able to pop down to the corner drugstore, buy some anti-grouch pills and slip them into the coffee.

"The kitchen, of course, will be automated. An AD 2000 housewife may well make out her menu for the week, put the necessary food into the proper storage spaces, and feed her program into a small computer. The experts at Stanford Research Institute visualize a mechanical arm getting out the pre-selected food, cooking and serving it. Similarly programmed household robots would wash dishes, dispose of the garbage (onto a conveyor belt moving under the street), vacuum rugs, wash windows and cut the grass. Edward Fredkin, founder of Cambridge's Information International Inc., has already developed a computer-cum-mechanical-arm that can 'see" a ball thrown its way and catch it. Soon Fredkin expects his gadget to be able to play a mean game of pingpong.

"In automated industry, not only manual workers, but also secretaries and most middle-level managers will have been replaced by computers. The remaining executives will be responsible for major decisions and long-range policies. Thus, society will seem idle, by present standards. According to one estimate, only 10% of the population will be working, and the rest will, in effect, have to be paid to be idle. This is not as radical a notion as it sounds. Even today, only 40% of the population works, not counting the housewives or students. Already, says Tempo's John Fisher, we are rationing work. By 1984, man will spend the first third of his life, or 25 years, getting an education, only the second one-third working, and the final third enjoying the fruits of his labor. There just won't be enough work to go around. Moonlighting will become just as socially unacceptable as bigamy!

"By 2000 the machines will be producing so much that everyone in the United States will, in effect, be independently wealthy. With government benefits, even nonworking families will have, by one estimate, an annual income of $30,000-$40,000 (in 1966 dollars)!!"(1)

These ideas projected by the futurists have no guarantee of course, but they are thought provoking. Can we assume that we will rise out of bed, eat a mechanically prepared breakfast, ride in a helicopter to our air-conditioned plant, and pick up a hammer, saw, and a handful of nails and begin work? No, not likely! The woodworking industry will change also.

Even today an atomic wood has already been developed. It is a plastic saturated wood which has been exposed to Cobalt 60 gamma ray radiation. It changes the entire structure to the extent that it has a built-in finish. If a piece of furniture made of this material is scarred, it may be mended by simply touching up with sandpaper or steel-wool and waxes.(2)

Dr. Conrad Schuerch, chairman of the Forest Chemistry Department of the State College of Forestry, Syracuse, N.Y., has come up with a new twist for bending wood. After thin pieces of wood have been soaked in an ammonia solution, they can be twisted into any number of shapes to become permanent.(3)

Technological changes will occur in the woodworking industries just as they have, are, and will continue to do so in the other phases of American life. My prediction for the near future is that an idea can occur in the mind of a designer, and with little effort the same idea may be put on paper in a number of lines, words and symbols. This sketch, in turn, will be fed into a computer and within a matter of minutes a sample model of the project would be built, molded or shaped. This isn't the end yet. With another flick of a switch, a poll would be taken from the computer as to how the public would react to it; the price, time to manufacture and transportation time to any part of the country would also be worked out by the mechanized brain.

The Grocery Manufacturers Association estimates between 30% and 40% of manufacturer's current rates originate from products that did not exist 10 years ago. Ten years from now over 50% of rates will be from products non-existent today.

Business Week, in reporting on American Machine & Foundry Company, said, "Under the gun of increasing need to develop profitable new products in industrial and consumer fields, AMF has to turn out not only new product ideas, but if necessary, new companies to carry them out."(4)

What will happen to the woodworking men of today? They will go in to design—construction technique, material technology and machine technology. Someone must service the machinery and plug them in.

What will happen in the next 10 years? The next ten to twenty years will be an era of transition. Production machines will continue to take the place of the laborer. According to US News & World Report, "Blue-collar jobs are expected to increase by 2.4 million in the 1970's, but the gain will be nearly 1.4 million less than in the 1960's."(5)

Laborers will be increasingly replaced by machines. Decline in laborers' jobs in the 1970's will be 400,000.... Trade and manufacturing are likely to show somewhat smaller gain in employment than in the current decade. The reason: improved management and distribution methods and increased automation in all industries."(6)

Areas that will open up to the craftsmen and skilled worker will be in the construction fields where automation cannot compete so readily. It is predicted that during the late 1960's and early 1970's will be a great boom for apartment buildings and home building.(7)

We can see where the automatic lathe has increased the speed of turned products one thousand fold.

Modern plants now load and unload boxcars of material automatically.

New electrical gluing machines have replaced the old-fashioned hand clamp and animal glue.

Each new development in the woodworking area brought a decrease in the number of men needed for a certain job. Each development made it possible for the company to become a little more nearly fully automated. Each new development causes a change in the woodworking trade. With industry moving to faster techniques and because of wood shortages, solid wood pieces of furniture will become more valuable. Handmade pieces will be cherished by all and will be considered something of a work of art, much as one now so considers sculpture or a painting.

To sum up the whole woodworking situation, I would encourage the leaders in the field to keep abreast with the demands of our modern times. Make use of research, development and application of the new techniques, modern computers and modified materials. Step out of the horse and buggy days of the past and face the future with a pill of courage.

FOOTNOTES

1. "The Futurists: Looking Toward AD 2000," Time, LXXXVII, No. 8, February 25, 1966. pp. 28-29. Courtesy Time; copyright Time Inc. 1966.
2. Ruby Yoshioka, "Wood Goes Atomic," Science Newsletter, June 19, 1965, LXXXVII, p. 394.
3. "New Twist Discovered for Bending Wood", Popular Science, September 1964, CLXXXV, pp. 70-71.
4. Industrial Design, March 1965, p. 45.
5. "When Business Really Will Boom in U.S.," US News & World Report, LXII, No. 8,

February 20, 1967, p. 15.
6. Ibid.
7. US News & World Report. p. 45.

Mr. Redding teaches in Ronda, North Carolina.

Th-8.11 Special Interest
Special Interest Panel Session A
OCCUPATIONAL OPPORTUNITY AND RESPONSIBILITY WITHIN INDUSTRIAL ARTS PROGRAMS
Chm., Edwin C. Hinckley; Rec., Carl G. Bruner; Obsr., Ray Carrell; Panelists, Jerry Streichler, The Reverend Leon H. Sullivan, S. John Eggleston; Hosts, John R. Casmer, R. Mondell Coger. Rev. Sullivan's manuscript not provided.

THE CURRICULUM IN HANDICRAFT IN ENGLISH SCHOOLS

S. John Eggleston

In England "handicraft" is the generic term used to describe the activities in the school workshops (like the AIAA we search urgently for an alternative word which is more descriptive and contemporary), but though the workshop basis is the same as that of American industrial arts, the objectives are fundamentally different. In America you define your goal as the induction or orientation of young people to the applied arts of the industrial society. In England we talk instead of achieving a liberal education through craftsmanship, with such diffuse aims as "facilitating full intellectual and moral development". Not only are these aims difficult to translate into action; they are notoriously difficult to express, particularly by the craftsman teachers who staff our school workshops. Moreover, because they are believed to be achievable through the practice of traditional handcraft skills, there is little chance of effective pressure from the industrial society to bring the school workshop into line with the adult occupational world. So over the years the school workshops, with some notable exceptions, have tended to become museums of obsolete hand production geared to imprecise and untested objectives.

At a time when these problems afflicted most subjects of the school curriculum, handicraft was at no particular disadvantage. But as the move for curriculum development has spread in our schools, more and more of the school subjects have introduced new contents which are in harmony with the changing needs of society, new techniques of teaching, and above all new and more precise goals which can be used to judge achievement. In such subjects it is therefore not only possible to evaluate attainment objectively, but also it is possible to evaluate the place of the subject in the total school curriculum. The absence of any basis for such objectivity in handicraft is an increasing handicap. There is still no answer to the principal's question "What am I going to get in return for a greater or lesser allocation of students' or teachers' time on handicraft?" or to the superintendent's question "What are the educational benefits of spending £10,000 rather than £5,000 on handicraft provision in a new secondary school?" In order to overcome the ensuing disadvantages for students, schools and teachers it was clearly necessary to apply the techniques of curriculum study to this field. Fortunately, at the time this decision was reached, research support became available from the governmental funds being used to investigate curricula appropriate to the raising of the school leaving age, due to take place in Britain in 1971. It was felt that extended work in handicraft was likely to be of considerable relevance to this new population. Accordingly a feasibility study was set up as a prelude to a major developmental study. The feasibility study, now under completion, is examining three propositions:

1. That it is possible, in handicraft, for curriculum objectives to be clearly identified; for curriculum content, organisation and methods to be analysed, and in particular

to establish teachers' evaluation instruments which are both valid and reliable.

2. That real possibilities of development exist for the handicraft curriculum, both on its own and in relation with other subjects in the schools, and that such possibilities can be tried and tested.

3. That objective assessment of the place of handicraft in the wider context of the school and of society can be undertaken.

To achieve this examination, three phases of work are being staged. These are:

1. The gathering together of groups of handicraft teachers in various parts of the country to identify curriculum objectives, content and methods and to establish instruments of evaluation.

2. The exhaustive review of existing areas of development and the establishment of machinery wherein teachers, lecturers and advisers can work together to consider possible new developments.

3. The initiation of techniques whereby the wider context of handicraft may be considered by establishing consultation machinery with head teachers, non-handicraft teachers, employers, parents and former pupils.

It is intended that the feasibility report be published, as this is likely to be a document which will offer useful preliminary guidelines for future planning by teachers and administrators. An important feature of this report will be an outline of the main areas of likely development. While it is impossible to anticipate all the findings of the research, it seems likely that, amongst other areas, development prospects are likely to exist in the following places:

1. The reappraisal of skilled performance and skill satisfactions in contemporary society. This would involve consideration not only of traditional skills but also of new areas of skilled performance which arise from using new materials and motorised equipment in home, vehicle and garden maintenance and in the development of hobby and recreational activities.

2. Practical studies in three-dimensional design as an expressive and intellectual activity for pupils of wide-ranging abilities.

3. Practical studies in applied technology as an expressive and intellectual activity for pupils of wide-ranging abilities.

4. Handicraft as a "service" subject to other secondary school subjects. An example of work here includes examination of ways in which the non-verbal communication possible in workshop activities might be used to help pupils who, because of cultural handicaps, have problems in the use of the "formal" verbal communication of the school.

In conclusion it may be reiterated that the support for the research and development project springs not only from awareness of its necessity, but also from a realisation that, without such study, the status of handicraft and those who teach it is likely to be placed at an increasing disadvantage in relation to the other subjects of the secondary schools.

Mr. Eggleston is at the University of Leicester, School of Education, Leicester, England.

INDUSTRIAL ARTS—THE TECHNICIAN AND THE TECHNOLOGIST

Jerry Streichler

The panelists have been directed to limit their presentations, to permit other panel members to speak and not to make a major address. Being an amateur student of human nature and attributing some human qualities to myself, I find (and I am certain you will agree) that the directions to the panelists are restrictive, unfair and totally inconsiderate of the fact that each of us is probably overflowing with information which we want to share —and which we strongly believe you should know—and probably could not do without. In response to my need to communicate, and what I believe to be your need to know, I have prepared a one and one-half hour lecture on "Industrial Arts—The Technician and the Technologist". However, my wife, who still loves me and provides for many of my needs (such as advice and counsel), has pointed to the great risk I would run in exposing this group to my captivating personality for more than twenty minutes. Heeding this sage advice, I have compressed an hour and a half of mere talk into twenty minutes of what I hope is clear concise communication.

The information includes:

1. A brief review of occupational programs related to industrial arts in New Jersey.
2. Definitions of the technician and the technologist.
3. A brief review of selected portions of proposed industrial arts programs.
4. Relationships between the proposals and technician and technologist—for the future.

While much verbiage has been expended in the debate of general versus vocational education, the leaders in New Jersey have acted to meet needs wherever they exist. It seems that they do not distinguish between general and vocational education (or is it vocationalized general education or generalized vocational education?).

Almost fifteen per cent of the 1800 industrial arts teachers in New Jersey are directly involved in occupational programs. Of 110 coordinators of cooperative industrial experience programs, 100 were or are presently industrial arts teachers. One hundred fourteen industrial arts teachers are working in pilot programs in industrial occupations. These are attempts to provide occupational training for those comprehensive high school students interested in industrial occupations for which training is not currently provided in vocational high schools. There are also twenty-six introduction to vocations programs on the ninth grade level. These provide exploratory opportunities in business, home economics and industrial arts. No less than twenty-six, and as many as fifty industrial arts teachers are associated with these programs.

The aforementioned programs are remotely related to technician and technologist education, primarily because they are occupational programs. The work in New Jersey, while extremely important in meeting present needs, is not considered particularly appropriate to the purposes and contributions of industrial arts to occupational education in the long run. Definitions of the technician and the technologist begin to clarify the long run relationship which can be built between the fields.

Emerson (1958, pp. 1-5) states that technical occupations differ in the scope and level of ability needed in terms of preparation. Industrial technical occupations, regardless of scope and level of ability required, are the principal concern of this presentation. Some technical occupations have a relatively narrow scope and require a rather low level of ability; these may include work such as inspection and routine testing. Other technician jobs have a relatively narrow scope but require a high level of technical skill, such as radio and television servicing. As the scope widens, one observes positions which require a moderate level of ability and include such jobs as time-study or quality control. Finally, the highest level of technical occupations in industry has a broad scope of activity and requires a high level of ability—these latter technical occupations are usually classified as engineering technicians. These workers assist engineers or scientists or may work independently in the comprehensive field of technical activity.

Another phenomenon is discernible in the spectrum of industrial-technical occupations. The technician is utilizing from sixty to eighty per cent technical skill and from forty to twenty per cent manipulative skill. The engineer, on the other hand, utilizes ninety to one hundred per cent technical skill. In contrast, the skilled craftsman uses as little as fifteen to fifty per cent technical skill, and the semi-skilled worker utilizes applied science and mathematics in five to ten per cent of his work. There is a worker who requires technician competency as well as supervisory and management skills normally beyond the scope of the technician. The term "technologist" has been applied to this individual.

While workers have functioned in technician and technologist categories for a long time, dynamism in industry has channeled more attention to distinguish between the roles of the technician, the technologist and the engineer. In a sense, the definition of technologist is implicit in the definition of technician. Some authorities say that the technologist is a technician with a bachelor's degree. This is not entirely accurate. The technologist can be located on a continuum between theory and application. He, too, uses precision tools of modern technology. Like the technician, through the application of applied science and mathematics, the technologist diagnoses and analyzes, and through common sense, initiative and good judgment turns the ideas and theories of research and development that are the work of the scientist and engineer into the erection of construction projects or of mass-produced items. He, too, needs to be able to collect data, make computations, perform laboratory tests and prepare technical reports. He is often concerned with people, contracts, scheduling and the economics of production and construction. The dividing line between technician and technologist exists in some of the latter capacities. First, industry needs and is using an increasing number of trained people whose formal education extends beyond the basic two years of college. But the principal difference between the technician and technologist does not lie in two years of additional education and a degree. Rather, it is the nature of the education. In a good four-year technology program, the individual receives proper technical training, appropriate industrial experiences, courses dealing with computers, management, supervision, economics and business and, preferably, more general and liberal studies. When properly articulated and sequenced, these experiences prepare the graduate to perform a wider latitude of management and supervisory functions as well as the basic technician responsibilities.

In some cases, four- or five-year engineering schools have developed technology programs which result in a bachelor's degree. The offerings are similar to engineering but de-emphasize the depth in science and mathematics associated with engineering. Two year technical programs in junior colleges have been extended to four-year programs. New York Institute of Technology and Ferris State College were two-year institutions, and are presently offering four-year programs in addition to two-year programs. The offerings at these institutions are similar to engineering offerings, with the specific exception of depth in science and mathematics.

The largest and most dynamically developing area for four-year technology programs is in departments, divisions or schools that had formerly been devoted almost entirely to teacher preparation in industrial arts and vocational education. Their four-year programs differ from those in the engineering oriented institutions primarily in limited specialization offerings. Unfortunately, several technology programs in this latter group are no different from the teacher preparation programs out of which they have supposedly evolved. Except for substitutions of mathematics, science, business and economics courses for education and professional courses, the "technical" subjects are essentially the same in content and facility use as those courses that had been developed as industrial arts offerings. People from industry have every right to question this situation, and they do.

The following illustrations supplement the definitions of the technician and the technologist. The illustrations also provide a bridge to the third and fourth phase of this presentation: the review of selected portions of current industrial arts proposals; and the relationship between industrial arts, technician and technologist education.

While engineers, scientists and skilled workers are generally trained to function in and to be associated with one area of industrial activity (i.e., engineer – research and development), technicians and technologists, it is suggested may be trained to function in any of the areas which range from research to sales and service.

The major industrial arts curriculum proposals have received an appropriate amount of attention at this convention. There are many reasons that can be cited for promoting close attention to these curriculum developments. One that readily comes to mind is that the current research is evidence that industrial arts education has matured. It has moved from what may be called the emotional-evangelical era of curriculum reform to an era in which relatively more objective inquiry is discernible. Anyone acquainted with our history can easily identify the adherents of both approaches. It seems that objectivity—at least as much as can truly be injected into curriculum reform programs – has prevailed. Only selected parts of these proposals and of others not reviewed at this convention are discussed here. They deal almost entirely with word symbols used to call out the content being proposed for industrial arts.

Figure 1 is an abbreviated list of terms which suggest the content advocated for industrial arts. As the terms are examined, similarities and differences become apparent. The content is drawn from industry and technology with DeVore's listing suggesting an interpretation of technology which is broader than that suggested by Maley and Olson. Maley suggests content and experiences derived from industrial practice and implies possibly broader educational values in his anthropological, contemporary and personal approaches in teaching the content. Other proposals cover this ground to some extent.

The American Industry Project defines industry in broad terms as compared to that of the Industrial Arts Curriculum Project being conducted at the Ohio State University under the direction of Drs. Edward R. Towers, Donald G. Lux and Willis E. Ray. Although each of these proposals reflects a slightly different philosophical basis, a different organizational pattern, and defines "industry" and "technology" with some variety, the

D. OLSON	D. MALEY	P. DeVORE
The industrial complex: selected typical curricular components: materials, processes, products, tools, energies, machines, machine tools, facilities, occupations, industries, personnel, capital The human complex: selected typical curricular components: ideation, imagination, invention, creation, research, experiment, development, design, planning, refining, principles, theories, problem-solving, engineering, construction, controls, operation, consumption, aesthetics, organization, management, records, legislation, investment, interpretation, service, safety, health, recreation, evaluation	Anthropological 1. Tools and Machines 2. Power and Energy 3. Communication and Transportation Contemporary 1. The in-depth study of an industry using the group project approach. 2. The in-depth study of industry using the line production approach. Personal Content-emphasis on contemporary units of study, increased depth of study in industry, and greater understanding of problems of industry.	Technology as a discipline - Man as a (a) builder (b) communicator (c) producer (d) organizer and manager (e) craftsman

Figure 1
SUGGESTED SOURCES OF INDUSTRIAL ARTS SUBJECT MATTER AS SEEN IN CURRICULUM PROPOSALS

impression the proposals give individually and in combination is that students will have opportunity to explore, study and engage in a wide range of industrial functions from research to sales and service. Bateson and Stern (1963) advocate the study of the functions of industry for vocational guidance values, and Moss and Stadt (1966) see educational values in having the student assuming, in school, work functions and responsibilities which are based upon and parallel activities in industry. In both cases the content is derived from industrial practice.

What does all this mean? In order to answer this question one tends to become evangelical, since little objective data is available to support a point of view. However, missionary zeal will be controlled and limited to a few concise points:

1. The New Jersey programs (described early in this presentation) which use industrial arts teachers and content for occupational education purposes are serving a formerly unserved group of students. An obvious, and hopefully temporary, problem is being solved. Programs of this nature suggest relationships and values inherent in industrial arts, but are not solutions.

2. Review the terms which imply areas in which workers in industry function and compare these to the terms used in the industrial arts proposals. One may infer that the proposals provide opportunities for students to acquire knowledge of industry and to gain experience in worker functions ranging from the semi-skilled to the scientist.

This should be viewed with optimism. We may be on the threshold of developing a curriculum in which the dichotomy between general education and vocational education ceases to exist in favor of educational excellence for all. Consequently, the emerging curriculum will serve all students and will also be an effective agent in articulating into specialized training programs for industrial occupations.

3. Mathematics and physics are important to all students, yet have special connotations for youth who will be engineers. Biology assumes special importance for youth who become nurses or physicians, yet remains viable for all students. A similar relationship exists between industrial arts and industrial occupations and careers.

4. Finally, technician and technologist educators and others associated with post-

high school education for industry may become interested in the developments in industrial arts. It is possible that students affected by the "new" industrial arts will be more literate about industry and its occupations. Consequently, the post-secondary school educators will find a superior pool of students from which they can recruit for training and advanced education.

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Dr. Streichler teaches at Trenton State College, Trenton, N.J.

Chm., Everett R. Glazener; Rec., Edward Campbell; Obsr., Willard M. Bateson; Panelists, Clois E. Kicklighter, James C. Durkin, Thomas Bowman; Hosts, Marshall L. Mossman, Wendell Roy.

AN EXPLORATORY TAXONOMY BASED ON THE COMMON ELEMENTS OF INDUSTRIAL ENTERPRISES

Clois E. Kicklighter

Major research in the field would indicate that one of the most immediate problems that needs to be solved is the problem of identifying an appropriate content for industrial arts which is compatible with our goals and beliefs. Studies such as the Industrial Arts Curriculum Project, the work of Paul DeVore, Bateson and Stern, and the Stout State Project are evidence enough that a problem exists in the content area of industrial arts.

If one accepts the premise that industrial arts should be a study of the American industrial institution, then he must answer the questions, "What is industry?", "What are the main aspects or parts of industry?", and "What is the structure of the parts?"

A taxonomy or classification based on the "common elements" of large industrial enterprises will serve to answer each of the three critical questions. Such a taxonomy might include the following nine categories of content:

Formal organization structure
Informal organization structure
Union organization structure
Industrial relations structure
Employers' organizations structure
Production structure
Research and development structure
Financial organization structure
Legal structure

The common body of knowledge identified in the taxonomy makes it possible to define the scope of a study of industry which would consist of:

(1) General knowledge of each common element.
(2) General knowledge of each sub-element.
(3) General understanding of the most frequently-used methods of achieving each function or sub-function.

In addition to the common body of knowledge, a student should have a general understanding of the philosophical, ethical and historical foundations sustaining industrial enterprise in the Western world, the structure and direction of the economic and social orders, and the place of the industrial enterprise in them.

Mr. Kicklighter teaches at Eastern Michigan University, Ypsilanti, Mich.

THE TRANSFORMABLE ENVIRONMENT—ITS EFFECT UPON INDUSTRIAL ARTS PROGRAM

James Durkin

The movement to revitalize our industrial arts offerings has been contaminated by a pollution within our facilities—a space pollution. By condemning fresh, vigorous, imaginative thinking to imprisonment within the framework of the unit or general shop, we impose undue restrictions and limitations upon our progressive efforts. The formulae and recipes presently used in designing our facilities stifle any attempt to liberate our use of space. This action is consistent neither with the new programs specifically nor with the contemporary schoolhouse in general.

As we undertake the study of technology, we should be cognitive of the fact that the physical facility must be capable of adapting to the needs of the students and not vice-versa, as is the present case. Since educational events will be varied and often integrated, the facility must be capable of effectively permitting and supporting the necessary activities. The dynamic nature of the study of technology is more akin to a laboratory than to a shop; we will need a technology laboratory. Its uniqueness will lie in its ability to be changed as new requirements are identified. To accomplish this mission, a systems approach to facility design is mandatory.

The following proposal is based on a systems program I call the "transformable environment". The system is unique in that it allows the student to be considered an integral part of the design program. One of the major considerations of the lab design is unobstructed space, clean, clear space. In fact, the only permanent interior walls required are those enclosing the bathroom and darkroom installations. All other interior walls are demountable or folding and can be rearranged as required.

To help in designing the laboratory, a system of spaces is organized and superimposed on a modular grid, both horizontally and vertically. A space within the boundaries of the lab is termed either an area (that space which is partially enclosed by existing walls) or zones (that space which is designated by agreement or appropriately placed apparatus). To clarify a point, we might identify zones for manufacturing, communications, service and construction. This arrangement would allow an educational event to dictate the final configuration of space. We are now able to provide an educational environment capable of permitting students and staff to make optimum use of their activities.

During the interim use of the transformable environment, the laboratory floor will be kept bare, with the exception of an occasional drain grill. All major services will come from above. Suspended from the ceiling over the major portion of the central lab area will be a modular support grid that will provide structural connections every 8 feet in both directions. This support grid is composed of a structural channel system complete with interlocking devices. The grid will support overhead conveyor systems, auxiliary walls and partitions. Interlaced with the support grid are the service arteries. Electrical provisions can be quickly converted to any machine below, regardless of its location on the lab floor. Also included are quick-connect air and gas lines and both fume and debris exhaust.

To complete the proposal, an approach is needed to provide the kind of equipment which will simulate industrial activities and be available when the student needs it, and in such a way that the student can interact educationally. This concept, which I have termed the integrated machine component system, is designed to provide a building block approach to the acquisition of equipment. Thus, a laboratory properly outfitted with a collection of specially selected machine units and components could, by recombining the elements, provide the necessary variety of machinery and apparatus as dictated by the technology curriculum.

The earlier experiences gained during formulation of the system have indicated that the full potential will be realized as the total system becomes operable in various schools during the next two years. Its effect should be stimulating.

Mr. Durkin teaches at Indiana State University, Terre Haute, Ind.

THE INFLUENCE OF TECHNOLOGY ON PRESENT AND FUTURE INDUSTRIAL ARTS PROGRAMS

Thomas Bowman

The greatest influence on present and future industrial arts programs is the degree of rapid change that is taking place in industry. People have recognized that there is a need to keep up with this condition of change, and have now included industrial arts in the National Defense Education Act under Title III, which provides funds for the upgrading and improvement of facilities and equipment for improving instruction. Further, Title XI provides for institutes "to improve qualifications of the elementary and secondary school teachers". Too long the responsibility of the program has been left to the care and direction of a few dedicated men. Now is the time to break away and prepare for the change by encouraging those who have fallen behind, broadening the perspectives of those who are willing, but need direction, and inspiring those with vision of the future to guide us as we make the effort to gain our respected place in educating people for the times in which they will live.

Another influence of change brought about by technology is the need to examine the content of the curriculum and to determine whether we can meet the needs of the students by placing the emphasis on how to do instead of how and why. Our present methods, curriculum and facilities are still influenced by the dogmatic traditional era of the past.

Still another influence of technology is the emphasis on research and development of methods as used by industry to solve problems created while solving others. This is a sadly neglected area of industrial arts, and one which will have to be squarely faced if we are to continue to serve the students and society. What new methods can effectively take the place of the "outdated" ones? We really cannot say until someone takes time to do critical research on the subject. Any efforts to introduce a new system of instruction would run into difficulties caused by the established habits, interests and values of the current institution, but it would be a much simpler task if the change were backed up by research.

One last influence will be the use of technological advances for the development of an educational system that will be of benefit to all members of society. We in education will be responsible for the full range of educable potential—from the slow learner to the genius. To realize the possibility of meeting this radical change, it will be necessary for us to change our concepts of teaching to include a central storehouse of intelligence within each state of the nation, to develop specific units of programmed instruction to meet the individual needs of all students, and to allow the teacher enough time to develop warm, human interaction and exchange of ideas with students.

We in industrial arts know the importance of our program in fulfilling these very aims, and it is up to us to become leaders in helping other people understand that this program has more to offer than just manipulative skills. Technology does influence and direct us toward the future and the goals we set forth. The influence that will be felt will depend upon you, the individual, in your willingness to accept the challenge technology offers.

Mr. Bowman teaches at Merle Sidener School, Indianapolis, Ind.

Th-8.13 College Students
Special Panel Session
AIMS AND OBJECTIVES OF COLLEGE CLUBS
Gen. Chm., Rex Miller, Chm., L. H. Bengtson; Rec., John C. Dockery; Obsr., Floyd M. Grainge; Panelists, Charles Gibson, Don Alexander, Charles Shiflet, Fred Carter, Don Thiriot, Leland Dreyer.
No manuscripts provided.

Th-8.14 Student Clubs
Special Panel Session
A LOOK THROUGH THE LENS
Gen. Chm., W. A. Mayfield; Chm., Herbert Bell; Rec., John Williams; Obsr., Heath Galster; Panelists, John L. Debes, George F. Stauffer.

FROM A COMMERCIAL POINT OF VIEW

John L. Debes

For a year now I've been going about the country talking about visual communication and the importance of teaching it to young people. In that year I have found very few who really seem to understand what I have to say. Yesterday and today at this convention I have met more people who understand the point of view than I have met all year.

Victor Hugo said "no force is as great as that of an idea whose time has come." (interpretation this author's). This is the situation in which we now find ourselves with respect to visual communication. At a number of places in the country people are beginning to teach this new and vital way of communicating. All over the country, people are talking about visual communication and its place in our society.

Why are they so concerned? Well, perhaps, Marshall McLuhan's book, Understanding Media, has stirred up some. Many, however, are simply aware of how non-verbal a generation of youngsters they are facing and how visual! A few days ago I heard about a youngster who was interested in rockets and orbiting the moon. An interested adult visiting a library found him a book beautifully illustrated, showing sequences of color pictures with explanations of orbiting procedures. He brought it to the youngster, but to his surprise, the youngster was scarcely interested. After looking the book over quickly, the youngster put it aside. When questioned about this by the grownup, the youngster said "it's nice, but I've seen all that on TV." What should the adult have done, get angry? Should we be annoyed because a visual-minded child already knows what we would like to have him experience the verbal way?

Thanks to recent developments, we need not deal with such youngsters in anger, but begin to provide them with ways to become more expert users of their visual communication skills. And it is a fact that until the last year or so, we have not been in a position to develop visual communication instructional experiences that would make children literate both as passive recipients of visual communication and as active creators of visual communication. Before our current attitudes and philosophy could exist, we needed to have the structural linguistics of Charles Fries, the general semantics of Korzybski and Hayakawa, the programmed learning of B. F. Skinner, television, Instamatic cameras and many other factors.

What do we mean by visual communication? Perhaps it would be most useful to begin with some visuals, to show what I do not mean. Most of the pictures you ever see were not designed for the kind of visual communication about which I am speaking. Most of the pictures you see are of the family snapshot or advertising type. These are, in general, not made for precise, intentional visual communication. Since nothing precise was intended, nothing precise is said. If you will look at some of the illustrations that are published in magazines, or presented to you as parts of slide lectures or movies, you will see that they fail from the standpoint of transmitting precise intended meaning.

When I talk to you, what I say is what I intend to say. Before saying it, I thought of what I wanted to say. This is what I mean when I'm talking about visual communication. It begins with an idea; a decision is made to transmit that idea; then the idea is encoded in the form of a visual, some words, a gesture, etc.

A picture makes a statement. It does so just as distinctly as a sentence. In the structural linguistics of Charles Fries, it is pointed out that a sentence has object elements, predicate elements and subject elements. A picture can also be regarded as having these elements. Of course, as the semanticists point out, the real situation described by the statement contains nothing of the sort. When a real car crashes into another real car, there is no subject element, no predicate element, and no object element; there is just one car hitting another. So, it is just as valid to refer to considering the picture as containing these elements as it is to regard a sentence as being so structured.

It is possible to have a subject expressed verbally all by itself; the same thing is true visually. Here is a slide showing a corkscrew. That is all it shows. It contains subject elements only. It says nothing except this corkscrew was. Here is a slide containing primarily predicate elements. The arrow shows the turning motion of the corkscrew. Without the preceding slide, it is a bit lost, just as you would be lost if faced with a series of words which merely said something about "turning" but had no subject or object elements.

Can young people be taught to read and use visuals in these ways? Let's look at some more slides. Here is a sequence done by a young girl from 4-H. It is a sequence about canning tomatoes. See, no words necessary.

Here is a slightly different kind of sequence. It tells a story about skiing. Again, no words necessary. Actually, it's a bit of a fraud. The young lady is not congratulating him on being a winner. She is just awfully glad to see him.

All of these visual sequences I have shown you are just a beginning. Visual communication can be far more imaginative and meaningful than what I have shown you. The skills of expressing oneself in these ways can be taught. For the visual child, this provides a way of talking to his peers that may be vital to his whole development. Once the visual child learns that he can organize his thoughts and communicate them successfully, he is on the way to becoming a more articulate person in all modes of communication.

Nowhere can these skills be taught more validly than in the industrial arts program. It is probably through industrial arts instruction at the K-8 levels that the youngsters of tomorrow will learn these fundamental things. You young people and you teachers who are here today can prepare yourselves to serve the educational needs of today's young people by beginning yourselves to learn how to communicate visually.

Mr. Debes is advisor, School and Youth Services, Consumer Markets Division of Eastman Kodak Company, Rochester, N.Y.

THROUGH THE LENS

Dr. George F. Stauffer

Numerous studies have demonstrated that photography provides a unique opportunity for communication with others, one of the most hoped-for outcomes of the classroom activity. The educator may view photography from the viewpoint of the instruments involved, the camera, developing and printing equipment, enlargers, projectors, etc.; the finished product, the photograph, motion picture, slide, etc.; or the application of photographic materials or products to teaching procedures.

The lens is one of the most important parts of the camera. It is mounted on the camera so that it is between the subject and the light-sensitive film on which an image may be recorded. Its chief function is to bring the image into sharp focus. Two other parts of the camera are essential—the diaphragm and the shutter. .A proper combination of the functions of these parts is necessary to control the amount of light reaching the film.

The camera in conjunction with the enlarger may be used to produce pictures of varying sizes. Still pictures or, in special cases, stereo pictures, may be produced. Where motion is essential, the motion-picture camera may be employed.

The photograph is made by exposing and developing the appropriate film and then printing the photograph on a suitable material for use in the classroom. Here a wide variety of materials is available. Photographic prints may be produced in black and white, color or on transparencies for projection.

Pictures may be procured from many commercial sources, but those made by instructors or students have something special—almost personal—about them. The instructor does not need to be a professional photographer. A desire to learn and to do good work is all that is needed. Individual students or groups of students organized into clubs can contribute pictures of great value.

The photographic process affords opportunity to bring to the attention of students the various emulsions in films and printing papers, as well as the darkroom procedures. The principles of photography, composition and lighting are areas that can be studied and applied.

A look through the lens can bring many facets of the classwork to the attention of the learner, especially when it is impractical to show the actual object or specimen. Projected materials are very useful in these situations.

The utilization of the materials produced by photography varies with the situation. Black and white or color pictures of reasonable size (5x7 or 8x10) may suffice for a small group; whereas, projected pictures may be needed to meet the demands of larger groups. The interest of the group, the subject matter to be presented, the time of day, the availability of equipment and facilities are, as an experienced teacher knows, among the many factors involved in the selection of materials.

Pictures may be used to show contrast - the before and after, the small and large, the red and green, the old and new, etc. Abstractions can be made real: the serenity of a sunset, the thought of the poem, etc. Motion, with the aid of the motion picture, can be shown whenever it is an essential part of the subject under study.

A few good pictures are of greater worth than a larger number of poor pictures. The production and use of good pictures can provide opportunity to cultivate an appreciation of quality. The resourceful teacher will find many opportunities to use the materials that were produced through the lens, and in many instances utilized by showing them through the lens.

Not all teachers will use all of the possibilities mentioned, but if a few more base learning activities on photographic processes and products, classroom activities can be enriched and improved.

Dr. Stauffer teaches at Millersville State College, Millersville, Pa.

Th-9.4 AIAA
Standing Committee Meetings
SPECIAL SAFETY COMMITTEE MEETING
Chm., Ralph Bohn; Panelist, Francis McKinney.

HIDDEN ELECTRICAL HAZARDS

Francis McKinney

Electrical safety is a subject which is not often brought to a meeting such as this. In fact, electrical safety is a field which gets very little attention. One person is electrocuted and the item appears somewhere other than on the front pages of the newspapers. After all, what is one electrocution compared to the thousands who are killed daily in bath tubs, automobiles, aircraft? But—one electrocution is one too many.

It may be well to take a few moments to tell how this project of mine got started. Early in 1961 my principal at the Honolulu Technical School, Mr. John Nothom, came into my office quite upset. "Mac," he said, "did you hear of the electrocution at the school just back of us?" This had happened within the hour. A workman was drilling into a concrete wall, using a faulty electric drill. Suddenly he keeled over as though dead! Others in the area, panicking, ran for telephones. After a few minutes the man got up by himself, walked a few yards and fell. This time he was really dead. "What can be done about such accidents? What can we do?" Mr. Nothom wanted to know. "I do not know," I replied, "but I intend to find out."

The project began with letters to friends asking them to send me clippings and reports of electrical accidents, news clips, letters, etc. Within a few months two or three came to me each week, then a bed-ridden girl in Texas suggested that I try the Pen Pal columns to get additional people working with me. As a result, the non-profit group (ESRA) began to grow, 'til now there are over two hundred persons sending material. Each day brings several cases in the mail. Electrical inspectors, fire chiefs, police, and others interested in electrical safety are rapidly being added to the list of helpers. I have brought along copies of the basic ideas of ESRA which you may pick up to take with you.

What comes to you today is but a small part of what could be said, but since time here is very limited, I must hurry along very rapidly, hitting only the highlights. If I can but arouse your interest sufficiently to get you to look farther into the subject, I will have accomplished my mission. Here on the table are several books of clippings covering portable electric tools, schools, appliances, and many statistical reports. Also there are many actual samples of cords, plugs, etc. which have caused death, injury and fires. I hope that you will take a little time after the meeting to look them over. There are now fifty-one of these books, with approximately 50 pages each, pasted on both sides with edited clippings. By "edited," I mean all the non-essential material has been cut out to save space. This, as far as I can determine, is the largest collection of its kind in the country.

Statistics are often very difficult to obtain. When an accident occurs, those responsible would far rather let it be forgotten, not realizing the great educational value of letting others know what has happened, along with making available information which can well work to prevent a recurrence in other places. Figures which I give are from my own collection only. Figures which I give to aid in the development of better laws, safer tools and safer working habits can all be backed by case histories. Reports from other groups, such as the National Safety Council, National Fire Prevention Association, Underwriters' Laboratories, etc., are not included. We may let them speak for themselves. The primary difference between my collection and theirs is that often only figures, without details, are given in the published reports.

Here is a report which is typical, published in the International Association of Electrical Inspectors' News. This supposedly covers the entire United States and Canada. However, let us note wherein it is lacking. For 1964 this report gives 175 electrocutions, while mine shows 229. Over a four-year period my figures show a total of 1580. I would not hesitate to interpolate and say that, since at present my coverage is limited to thirty states with only one or two cities in most, the figures could well be multiplied by 10 or even 100, if all the cases were available.

The statistics on electrical shock injury would be far greater if it were not for the fact that many walk away from them without medical or hospital attention. These, of course, are not reported, so do not get into the statistics at all.

Checking with electrical inspectors and fire chiefs reveals that many do not reply to the questionnaires sent them, but simply file them away. This accounts for the lack of figures from many major cities. It appears that the small towns do a better job of reporting than the larger ones. Going down the list on the IAEI report, we find: In Arizona, only Tucson reported (Phoenix alone has had dozens of cases, which are in my files.); in California, Sacramento and Oakland are missing; in Connecticut we find only Seymour; Coeur d'Alene is the only town reporting from Idaho; the great city of Chicago is missing from Illinois; only four small towns in Indiana reported, while Indianapolis is missing; Kentucky and Louisiana show only two small towns; Boston is missing from Massachusetts; St. Louis is missing from Missouri; Omaha from Nebraska; Toledo and Cincinnati are absent from Ohio; the big towns are missing from Texas (and they have had some big accidents); last year I was in Salt Lake when a baby bit into a cord and was killed, and a lineman died the same day. These are not in the reports. Out of Utah we see only Ogden on this report. So it goes on down the line. I have skipped many. The State of New York is not listed at all, and from there I get hundreds of clippings a year.

What causes electrocution? What causes electrical fires? The answer is the same for both. The number one cause is lack of knowledge. People just do not know the fundamental principles of electrical safety. The number two cause is assumption. We blame faulty wiring, grounded electrical tools, fallen power wires, etc. But the real fault is in assuming. We assume that the underwriter's label on a cord, tool, or other electrical item makes it completely safe. This is not true by any means. This only says that samples were tested and approved by the UL as safe if and when used as intended and properly maintained.

We assume that as long as a drill drills, a toaster toasts, and a light lights, it is safe. Nothing could be further from the truth. Here lie the hidden hazards. A drill can develop faults internally which cause the metal shell to become "hot" (charges with 110 volts of electricity). A lamp cord or extension cord can be almost bare and still the lamp will light. A toaster can be ready to kill for months before the fault appears in its operation.

We assume that 110 volts is not dangerous. It is! More people are killed as a result of contacting the ordinary house current than are killed by the so-called high voltages on the power lines above. This is simply because more people are in daily contact with home wiring and appliances.

We assume that a drill is safe because it has a UL label on it, and it has been tested once a year. In Hawaii we require that all electrical tools be tested before and after each use. This is done with a special tester developed in the Technical School Shops, and placed in each shop using tools.

Since the electrical tool is one of the most dangerous, and also the most common electrical item in the schools, we will spend a little time in this area. As of 1951 most electrical tools have been provided with what I call the "Safety Green". This is a third wire placed in the cords, making a three-wire rather than a two-wire cord. This third wire is intended to ground out or carry fault currents developing within the tool, removing the shock danger. The cord terminates in a three-prong plug known as a "U" grounding plug. Properly used, this provides a tool which is safe. Wrongly used or improperly maintained, the tool will become just as dangerous as though the grounding system had not been developed.

Let us look at the instructions given in a typical manufacturer's instruction manual. "Every electric tool should be properly grounded while in use in order to protect the user against possible electric shock. This tool is equipped with a three-wire grounding plug which is required by the National Electric Code and approved by the Underwriters' Laboratories and the Canadian Standards Association. DO NOT REMOVE IT." "The cord has three leads, two of which are power leads. The third lead (green) has nothing to do with the normal operation of the tool. It is a ground lead, which, if connected to a permanent ground, will protect the operator from possible shock in case the tool should become internally grounded. The ground lead should never be connected to anything but a suitable ground. If the ground wire is not used, the tool will perform satisfactorily, but there is no protection to the user in case the tool grounds or shorts out internally."

This instruction sheet goes on to explain and illustrate how to use the adapter in order to plug the tool into one of the old two-slot wall outlets into which the grounding type U plug will not fit. At this point I get really "shook up". This adapter is the most dastardly thing ever invented. When the code makers realized the dangers involved in electrical tools, they called for the three-wire cord, and the makers began putting them on their tools. But what happened? No place to plug it in. It was only with the 1965 code that the outlet to fit these became law. So we have billions of outlets in older buildings which are useless as safety receptacles for tools. So the tool manufacturers began the development of the adapter which made it possible to use the tool. For safety, the green lead on the adapter had to be connected to a permanent ground.

But no one but an electrician really knows what a permanent ground is. The average user knows nothing about it. Even an electrician cannot determine this without instruments of some kind. Simply connecting this green lead to the screw which holds the outlet cover plate is no guarantee that a ground has been accomplished.

Here is a little tool made from a U plug and a 60-ampere, burned-out fuse case. It will quickly and efficiently tell whether a good ground has been obtained. In use for several years now, it has never failed. It will not only tell whether the adapter (if you must use it) is correctly connected, but will also tell whether the ground is properly completed all the way back to the building system ground at the water pipe. Anyone can make it with simple tools and materials. I will be glad to send drawings and circuits to any of you who wish it, along with complete instructions.

But please do not use the adapter, not if you want complete safety. If you do not have grounding outlets in your school, get them installed promptly. In one community I visited in California, they even have the typewriters grounded. Everything must be provided with the three-wire cord, and they have installed proper outlets for them. In Hawaii, we are rapidly getting the old types changed.

Worse than using the adapter, many people break off the grounding prong from the plug. The worst thing I have ever seen was reported in the March issue of the IAEI News. I have it here: Quote: "Instructions for a Death Trap." Pictured is a tag found on a sump-pump which reads: "NOTICE: If your electric outlet was made for a two-prong plug, this plug can be modified for use by merely cutting off the third (or ground) prong with wire cutters or pliers." It is bad enough when a person of his own accord breaks off this prong, but for a manufacturer to suggest it! The manufacturer's name does not appear. The inspectors are trying to find now who he is, and when they do....! When I saw this, I checked my book and found that four people had been electrocuted and five injured by shock caused by sump pumps. Not having my clippings and case records with me, I cannot tell at this time whether any of them may have been the result of this sort of thing.

Here is something which I do not like. This is a grounding plug of the molded type. I do not like it because I cannot examine it to see whether it is in first-class internal condition as to the connection of the green conductor to the prong. Here is one, for example, which has been cut open. Notice that all but three strands of wire from the safety green are broken. I much prefer the standard screw terminal which can be examined frequently without destroying the plug.

One of the highlights of this trip for me was a visit to Chicago where I spent several hours with one of the electric tool manufacturers. In a conference with the engineers, they said they are discontinuing the inclusion of the adapter in future models. They are also coming out with a shockproof tool which has many improvements. I hesitate to say that this will give complete safety, but perhaps it is a step in the right direction. Others are doing the same.

In a quick summing-up let me say this: Safety depends on us as teachers to give proper instruction, on proper maintenance, and on proper use. Have your electrical equipment safety-checked frequently and establish definite and positive rules for its use. I will be more than glad to answer, by mail, any questions left at this time.

Mr. McKinney teaches at the Honolulu Technical School, Honolulu, Hawaii.

Th-10.0 AIAA-ACESIA
Fifth General Session
IMPLEMENTING TODAY'S TECHNOLOGY INTO INDUSTRIAL ARTS PROGRAMS
Presiding, Robert L. Woodward; Chm., Allan B. Myers; Rec., Rufus Johnson; Obsr., Norton Lownsberry; Panelists, Ralph C. Bohn, Robert G. Thrower; Hosts, John Stamboolian, Ralph Charney.

IMPLEMENTING TODAY'S TECHNOLOGY INTO INDUSTRIAL ARTS PROGRAM: SECONDARY AND POST-HIGH SCHOOL LEVEL

Ralph C. Bohn

Industry is progressing at a rapid and unprecedented rate. Industrial knowledge, as well as all other knowledge, is doubling every seven years. One of the many problems faced by research and development divisions of industry is the cataloging of new discoveries and the finding of needed information. Memory banks coupled with microfilm reports are being developed to store and retrieve the vast quantities of knowledge being developed.

This knowledge explosion is producing many changes in industry, changes which must be reflected in our current program of education. Changes of direct concern include:

1. Automation and manipulative processes. Nearly all machine and fabrication operations can now be automated. Assembly of both small and large units is now in the process of automation.

2. Development of numerical control to direct machine operation, and memory banks to store and provide needed directions. These devices have become the brains of automation.

3. Development of instrumentation to put the directions from numerical control into operation and maintain quality control. These devices have become the senses of automation.

4. Development of fluid power to operate machines and production lines. These devices have become the muscles of automation.

5. Raising of the science of industrial materials and material selection to the level of industrial processes. Developments in this area include:
   a. the interrelation of materials – ceramics and metals into cermets.
   b. adhesives that can hold supersonic planes together.
   c. plastics with strength characteristics superior to metals.
   d. joining of metals in new methods – explosive welding, plasma welding, ultrasonic welding, etc.

6. Automation of drafting and design – computerized technical drawing, products designed by computers, photographic microcircuits, etc.

These are a few of the changes in industry which must be reflected by our current programs. These changes require a reorganization of our thinking towards junior high, senior high, and post-high school instruction. Some of these changes are already under way and being made in the schools. There are many outward and obvious signs of these changes. Just sit back and note changes during the past ten years in the technical books published for our use, in the exhibits and in the content of the section meetings of our convention, and in the nature of summer programs of inservice education. These all reflect the changing technology and are having their effects on the school curriculum. Unfortunately, we still have a number of important steps to take:

1. Establishment of a nationally-recommended curriculum providing the broad guidelines for local curriculum development. This is needed to provide direction for needed change.

2. Establishment of instructional material centers to provide coordinated development of teaching aids, teaching systems and curriculum materials.

3. Development of an organized and continuous program of inservice education of teachers. The institute program can investigate different possibilities of inservice education, and help develop standards and model programs. It probably will never be extensive enough to provide the continuing process of inservice education needed by each teacher on a yearly basis. This must eventually become a state and local school district responsibility.

Unfortunately, resources have not been available to begin the work of the National Commission on Industrial Arts, the first of these three steps. In the meantime, we should continue to accelerate the evolution going on within industrial arts. Before we review the direction these changes should be taking, let's take a look at the problems of the total school program of education.

We are living in a time of free thinking, self criticism and creative planning—a time when many of the problems of education are turning into the problems of society. These include:

1. Parental frustration - people have discovered the value of higher education. Statistics show college graduates often earning salaries 20% or more above non-college graduates. There is an obvious fallacy in equating success with "dollars earned". However, parental pressure for a college education is on most students.

2. Student frustration - colleges are filled and, at best, are able to house about 40% of the college-age population—with the expectancy of 30% plus of these failing before graduation. There simply isn't enough room in college to educate more than the traditional figure of 25% of college-aged students.

3. Teacher frustration - each teacher and curriculum group sees the need for more instruction in his subject area. The knowledge explosion has simply produced more knowledge than can be taught. However, the effort to push more and more into the curriculum persists.

4. Student unrest - students at all levels are seeking recognition through the unorthodox - reckless driving, drugs and narcotics, etc. Generally, these are students unable to gain recognition in the orthodox methods of scholarship, athletics, etc.

5. Lack of recognition - students are being subjected to mass education which provides few opportunities to gain recognition. We recognize the scholars and the athletes; and the church, scouting and other community groups provide recognition for a few more. However, considerable effort must go into finding more opportunity for students to gain the recognition and identification they need.

The question which becomes obvious is, "How might education change to start meeting some of these problems?" A number of changes which involve industrial arts as well as the other school disciplines become obvious. The first, and most basic, change is that we must stop trying to place in the curriculum all new knowledge which comes along—while still retaining the old. A careful scrutiny of "what each high school graduate must know" should be made. This required education should have three broad goals:

1. Provide basic skills needed to perform in society (literary, mathematics, etc.);

2. Provide an acquaintance with our total social order - an understanding of the problems we've faced and are now facing and, as time permits, some experience in solutions (but at the intellectual level of the student). This includes social science, industrial arts, creative arts, etc.;

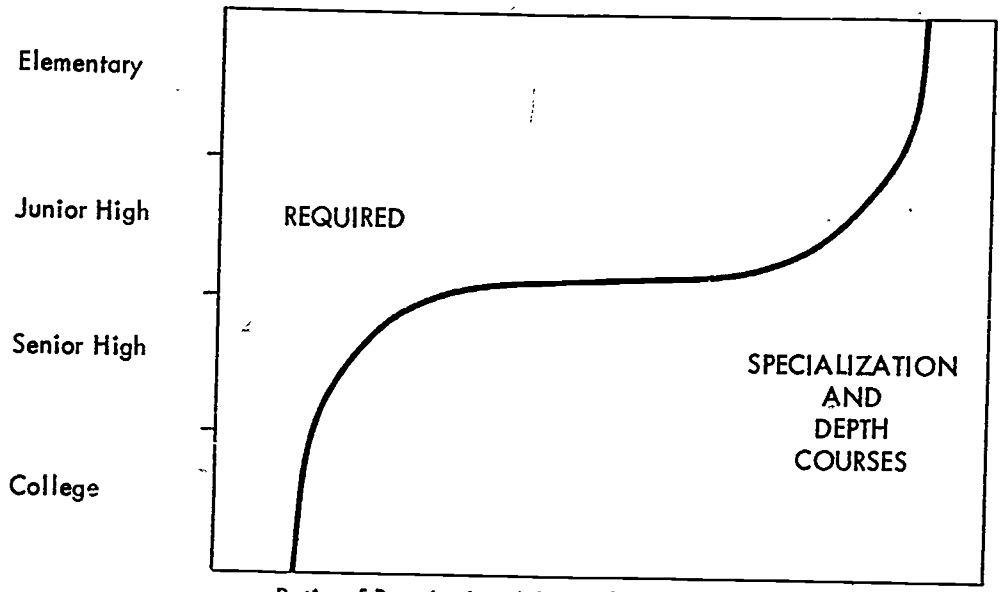
3. Provide a curiosity and desire to continue to learn, and to accept the acquisition of knowledge and the solution to problems as a lifelong process. Schools should graduate students with the desire to continue to learn and gain knowledge, rather than the "I'm glad that's over with, now I can live" attitude.

All three are important, but the last overshadows the other two. Education, unfortunately, only gives verbal acceptance to the last, and concentrates on providing basic skills and knowledge of our social and industrial world.

This tencency is logical, since "providing a desire to learn" is a by-product of total curriculum and instructional method. One way in which we can help work toward this goal is by providing more opportunity for students to seek solutions to problems and to specialize within their own interests. The school curriculum, from elementary school up, should be opened, with required courses occupying part but never all of the school day.

In early grades, students should take on individual projects which require self study and research at their level of ability. In upper grades, this freedom can be emphasized by permitting and encouraging students to gain depth in the subject of their choice. We should encourage all students to study some subject or discipline in depth.

This can be accomplished by narrowing our list of required courses, and by providing many parallel curricula which permit a student to specialize in the subject or subjects of his choice. This specialization may be one of the industrial arts, music, history, English, etc.



Ratio of Required and Specialization Courses in Program

The graph shows a possible relationship between required courses and specialization courses within the curriculum at different educational levels. Naturally, in elementary, specialization might simply be working on an individual project, different from the rest of the class--such as a creative art project, development of a model satellite, or studying how paper is made. As the level progresses, students could specialize in math, history, any of the sciences, any of the industrial arts, etc.

This would provide a number of things now lacking in education:

1. Student identification and recognition — the student is specializing in a subject — he is doing and learning things in which he is interested. He has more opportunity to gain recognition from his peers and from society.

2. Within a major, students can gain experiences necessary to develop a desire to continue to learn. Individual projects, obtaining information new to both student and instructor and accomplishment from gaining some depth into a subject, all provide experiences in self-education and the satisfaction of accomplishment.

3. Such additional gains as using fundamental skills (reading, etc.), working on social or industrial problems, etc. can be accomplished and depend only on the student's and teacher's interest and ability.

To some people, this idea is absurd. "How can we open a curriculum which is already so jammed with knowledge which must be taught?" The answers include the fact that much content is already omitted, there isn't an absolute relationship between exposure time and learning, and much of the information now taught in school will be obsolete by the time the pupils become adults and need it.

There are pitfalls to this concept. The program should not be vocationally-oriented. Obviously, depth in a subject provides knowledge which will help high school graduates find jobs. The emphasis should, however, remain on "education within the ability level and interest of the students" and not on "training for a specific occupation".

Mutual respect for all subject areas is a necessity for the success of a program of this type. College entrance should be based on "student ability to profit from further instruction" and not on an ever-increasing list of required courses.

Now, let's look at industrial arts within this program. We are primarily an elective-and-specialization program in secondary education and a required-plus-elective program in junior high school. We are in need of some standardization of content and improvement of instruction. In order to fulfill our part of the required program in junior high school, we must broaden our thinking and become more inclusive, giving attention to all of industry, rather than emphasizing a limited number of areas. The junior high school required program should provide a basic orientation to industry and technology, in a one- or two-year required program. It must then provide an elective program with depth instruction for those interested in one or more subjects within industrial arts.

The content of the junior high program should include:

1. Materials and processes – an integrated study of wood, metals, plastics, etc. Activities should involve the selection and properties of materials; the planning, design and fabrication of industrial products; experimentation and research; the interrelationships of industry with society, etc.

2. Communications – an integrated study of graphic arts, drawing, photography and electronics as they relate to industrial and social communications.

3. Power and mechanisms – an integrated study of power mechanics, fluid power, electricity and electronics as they relate to the development and utilization of power within industry and society.

4. Guidance, and an understanding of the relationship of the employee and the consumer with industry, represents an important part of this program.

Emphasis should be placed on the introduction of industrial changes, and the understanding of industrial concepts and principles.

Actually, changes which are needed fall into the category of modernization of curriculum, teaching methods and facilities—rather than a completely new emphasis or instructional program. We must evolve our present program at an accelerated rate.

The senior high school program is primarily an elective program at this time. It should provide depth instruction, depending on the interest and ability levels of the students. It's important that the high school program be planned for the ability and interests of the students. This doesn't mean "bringing the program down to them". It does mean that the program must be meaningful and provide needed education, and the students must see the value of the instruction. It should be challenging for each student, forcing him to put forth his best effort.

Course offerings should be broad, based upon the resources and needs of the school. Programs in electricity/electronics, graphic arts, metal, materials and processes, drafting, etc. should be considered. The program should provide for the various needs of the student, whether his interest is in the subject as it relates to college, entering an occupation, or general information. As emphasized earlier, the program should provide depth of instruction, rather than a simple overview.

The emphasis on guidance, new industrial concepts, and instruction in concepts and principles should be present in senior as well as in junior high school.

Teaching methods become important as the depth of content increases. Abstractions must be brought down to experiments and activities which help the student learn and understand. All of the new methods should be considered and used whenever appropriate. Teaching systems, educational TV, experiments, closed loop film, programmed instruction, etc. all have their place in industrial arts instruction.

Industrial arts does not require a revolution in thinking today. It does, however, require a rapid evolution which will produce a more logical and broad integration of content, an introduction of new industrial programs, and an application of the available and developing methods of instruction.

The implementation of these changes brings us back to the three steps introduced earlier. These steps must be accomplished if industrial arts is to meet the current needs of students.

1. Curriculum – the National Commission on Industrial Arts is a priority item of the AIAA, and efforts will be continued to try to finance the program.

2. Instructional Material Centers – the development of a variety of teaching systems, instructional aids, programmed instruction, etc. needs coordination by one or more centers. The present system of individual publication is producing many good textbooks, teaching systems, etc. but is leaving some serious unfilled gaps. Some areas have textbooks only, and a limited number at that.

3. Inservice Education – the present institute program is producing many new and creative ideas but is reaching less than 2% of the profession. Our need is for an annual program reaching the total profession.

Dr. Bohn is chairman of the Industrial Arts Department, San Jose State College, San Jose, Calif., and president-elect of the AIAA.

IMPLEMENTATION OF TECHNOLOGY IN THE ELEMENTARY SCHOOL PROGRAM

Robert G. Thrower

Yesterday, we heard many speakers address themselves to the various aspects of the cultural and educational heritage of our technological society and the implications for industrial arts. Today, a like number of speakers have concentrated their remarks on current technology and the role of industrial arts in our present technological society. Following this pattern, I will address myself to the implementation of today's technology in the elementary school program.

However, before we can intelligently concern ourselves with technology and its implementation through industrial arts activities in grades K-6, we must understand the fundamental concepts which govern the elementary school curriculum. In addition, we need to keep in mind the characteristics of child growth and development which are vitally important if we are effectively to provide meaningful learning experiences.

It has been stated by many authorities that the fundamental objective of the elementary curriculum is to produce effective citizens in our democracy. Thus, the elementary school has a vital role to play in getting young people ready for life and intelligent participation in helping solve the very critical and complex problems which face humanity. The elementary curriculum, much like the secondary curriculum, has weathered many fads, vogues and learning theories in arriving at its present philosophical position. And, let me hasten to add, there is by no means unanimous agreement as to what this philosophical position is, or should be. However, one of the criticisms leveled at old elementary curricula was their failure to correlate instruction around centers of application and interests, such as lifelike problems and projects. Based upon what has been proven concerning learning theories, the major emphasis today in the elementary school is on the Gestalt theory of learning, which stresses that effective curricular patterns do not compartmentalize subjects studied, but attempt to provide opportunities for the unitary, integrative presentation of subject matter. The basis for much of this integration of subject matter is called the unit. H. J. Otto endorsed this pattern of curricular offerings when he wrote, the "unit method (sometimes called the unit organization of teaching-learning situations) was evolved and is today the best-known vehicle for combining appropriate pupil motivation, learning outcomes, learning activities and an effective utilization of content. Unit method holds the best promise of enabling the pupil to acquire meaningful insights, problem solving skills, and the translation of knowledge and attitude into behavior."(1)

Thus we can define the unit as a teaching-learning organization which calls for the integration of curricular areas, which has certain distinctive characteristics of teaching, and which usually extends over a period of several weeks.

Child growth and development constitutes a comprehensive field of study and I will not attempt to cover it to any major extent. The elementary school age child is undergoing many physical, social, emotional and intellectual changes which we must understand and take into account when we are planning learning experiences for him. The above mentioned factors all contribute to an individual's readiness and ability to learn.

Another important factor to be considered in learning is motivation. Concisely we must be concerned with short-term and long-term motivation, intrinsic and extrinsic motivation, a child's level of aspiration, and the ultimate goal of self-motivation. Research tells us that intrinsic, natural motivation results in deeper, longer lasting learnings. It can also be said that children learn more effectively through participation activities, by doing rather than by passive absorption of facts.

Against this very brief and sketchy background of the elementary curriculum and the elementary school age child, let us turn our attention to the implementation of industrial arts in grades K-6. If you accept as the fundamental objective of the elementary school what I stated previously, namely, to produce effective citizens for our democracy, then I doubt if any person here tonight would disagree with me when I state that to produce effective citizens we must acquaint them with our technology and the major influences technology has on our society. And the study of this technology must be an integral part of the curriculum of every grade level of the elementary school. On the other hand, I am sure some here tonight will disagree with the methods of implementation which I am going to present.

Based on the curriculum pattern which I have described and the learning theory commonly practiced today, I contend that industrial arts activities should be incorporated into the units being taught rather than attempting to teach them separate and apart from the rest of the curriculum. This does not mean that I believe industrial arts should be subjugated by the other areas of the curriculum. It does mean that I believe industrial arts should take its rightful place as a contributor to the overall curriculum. Under the unit method, just as there would be science-centered units and social studies-centered units, there would also be technology-centered units. In a social studies-centered unit, industrial arts applications might well be used as an initiatory activity, or as a developmental activity, or as a culminating activity. For example, the unit might be entitled, "pioneers" and the culmination of this unit would be for the class to use some of the tools, materials and processes of our technology and construct a pioneer home, furnishings and implements. As a part of this unit, they might dip candles, churn butter, or tan an animal skin. On the other hand, a typical technology-centered unit might be entitled, "community industries," which could well include a tour of a local plant, talks by an industrialist, and the setting up and operation of their own company with a product being produced, using line assembly techniques.

In New Jersey this past summer, under the direction of Elizabeth Hunt, state supervisor of industrial arts for grades K-6, there was established a Technology for Children project. This institute ran for six weeks and involved twenty-two children ranging in age from four to twelve, and twenty-two elementary teachers representing all grades from kindergarten to sixth grade. The children represented a heterogeneous group with equal representation of both sexes. Two classes were established, with one containing grades K-3 and the other, grades 4-6. The teaching team for each of the classes consisted of a master classroom teacher and an industrial arts specialist. The children spent three hours each morning using tools, materials and industrial processes in solving problems arising from technology-centered units which were presented. Because of the press of time, the units were not fully developed with respect to many of the other subject areas, but even so one of the most prominent findings was that even though the central focus in activity was on dealing with tools, materials and technical devices, all of the areas of the curriculum emerged to be encountered by the children in a meaningful context. These findings were documented by the anecdotal records kept by the twenty-two teachers who observed the children at work. For example, one anecdotal record revealed that the vocabulary of one child was many times the number of different words which would be found in use in a formal classroom situation. Another record revealed numerous mathematical concepts used in solving technological problems. Likewise, another record revealed the same for science concepts, and I could go on.

In addition to observing the children each morning, the twenty-two classroom teachers spent the afternoon developing expertise in the use of tools, materials and processes. Time was also spent in developing technology-centered units which they now are employing in their own classrooms.

I would further add that all of this was accomplished in regular elementary class room facilities with portable tools, materials and work surfaces which are within the budget limitations of nearly every elementary school. If you are interested in hearing more about this exciting project and how it is being continued and expanded, I would recommend that you attend the special session of the American Council for Elementary School Industrial Arts tomorrow morning in the Pennsylvania West Room where Miss Hunt will be giving a more detailed report. In addition, other ACESIA members will be explaining how they are also implementing technology in grades K-6.

This project is just one example of how technology can be implemented in the elementary school. There are many other implementations taking place in all parts of the country. Thus, I share pride with you in knowing that our curriculum area is moving back into elementary curricula across the country, where it has such a vital role to play in preparing effective, productive citizens for our society.

Some of you, by now, are asking yourselves, in the face of our ever-present critical shortage of industrial arts teachers, how we are going to staff this new frontier? Remembering what has been said about the organizational nature of our elementary schools, we should recognize that the key person is the elementary classroom teacher. This classroom teacher is the key for several reasons. First, she, with the help of curriculum specialists, is the person who determines what actually should be in the curricula which will be presented in her classroom. Second, she knows the individual characteristics, needs, desires and aspirations of the children in her classroom better than anyone else. On the basis of these two factors, she is in the best position to put the pieces of the puzzle together so that the most meaningful learning experience possible will result. In order for this to take place, it is imperative that the elementary classroom teacher be trained in the use of tools and materials and how to use industrial arts activities effectively in her classroom.

This being the case, there is a role for each of us, whether we be teacher educators, supervisors, or classroom industrial arts teachers. For those of us who are engaged in the task of industrial arts teacher education, there is the need for each of our institutions to provide collegiate level courses in the use of tools and materials and methods of incorporating technological concepts into the elementary curriculum for every elementary education major. This is being done by a few of our institutions at the present, while some others are providing the opportunity on an elective basis; unfortunately some are doing nothing at all. Greater effort must be expanded in this direction, for as these young teachers graduate and take their places in the elementary classrooms across the land, they will utilize industrial arts activities with their young charges. Yes, they will use construction activities even if their schools do not provide the tools and materials needed. This I know to be true because I have had many, many reports back from our elementary majors telling of their experiences in getting industrial arts activities started in their classrooms, first by either borrowing tools or having tools brought in by the students and then, as the results were presented, by having either the administration or PTA start providing the necessary tools and materials. I take my hat off to the elementary classroom teachers because they dare to go where angels fear to tread.

Particularly those of you who are supervisors or classroom teachers can help the elementary teachers already in the field. You can help by assisting them in getting tools, materials and work surfaces. Also, you can greatly aid these classroom teachers by conducting workshops and inservice programs where these teachers can develop their competency and self-confidence in the use of tools and materials. You can also assist by serving as a sounding board for a teacher's ideas and plans, and by offering technical advice which will greatly increase her chances of success.

I was delighted recently, when a county industrial arts association in New Jersey became so interested in the potential of industrial arts in the elementary school that they rose to professional heights by offering their time and facilities to all the elementary teachers in the county who wished to develop their skills in using tools and materials. This is a professional project which I would strongly recommend to every local group of industrial arts teachers.

Even though I hold to the position that the classroom teacher is the key person in a program of elementary school industrial arts, I do not for a moment underestimate the role of an industrial arts specialist in this program. An industrial arts-trained teacher who also understands the elementary curriculum and the aspects of child development is essential to a program of elementary industrial arts which attempts to come close to realizing its potential in the total elementary curriculum.

With his background of specialized training, the industrial arts consultant can render a valuable contribution by serving as a resource person to the classroom teachers. In this capacity, he can constantly provide technical information, review the teachers' ideas, offer unit suggestions, demonstrate tools, materials and processes, conduct workshops for teachers and assist with classroom projects. In addition, he would be the supplier of tools and materials as well as the person responsible for keeping the equipment in proper condition. Another major responsibility would be to serve as the main spokesman for industrial arts by continually keeping the administration, parents and community in general informed of the contributions of industrial arts to the curriculum. Also, he would be the person who would organize visits to industry for the students and the industrial personnel who could make contributions in the classrooms. We in the profession of educating teachers need to give greater attention to the training of this specialist. His undergraduate training needs to be somewhat different from that of industrial arts teachers preparing to go into the secondary schools.

School systems that seriously want to reap the benefits to be derived from the inclusion of industrial arts in their elementary curricula will utilize the team approach. They will employ classroom teachers who are trained in the use of industrial arts in the elementary classroom, as well as elementary industrial arts specialists. They will make available the tools, materials and facilities necessary for the program, and they will continually upgrade the program through workshops and institutes. Also, they will allow competent, imaginative classroom teachers freedom in the development of learning experiences which will be most meaningful to the students.

In summary, let me state that I am firmly convinced that technology and its implementation through industrial arts activities should be integrated into the very core of the curriculum of every grade level beginning with the kindergarten. Elementary classroom teachers must be trained in the use of the tools and materials of industry. They must also be trained in the methods of utilizing industrial arts activities. Industrial arts specialists must be trained and employed by elementary school systems and the necessary tools, materials and working areas must be provided.

Finally, technology is being implemented in elementary classrooms of many school systems, but we need to increase continually our efforts until it becomes an integral part of the curriculum of every elementary classroom throughout the country. Then, and only then, can we say that elementary schools are presenting a total picture of our society and fulfilling the basic objective of producing effective citizens to take their places in our technically-oriented society.

FOOTNOTE

1. H. J. Otto, Social Education in Elementary Schools New York, Holt, Rinehart and Winston, Inc., (1956), p. 412.

Dr. Thrower is president of ACESIA, teaches at Trenton State College, Trenton, N.J.

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Sixth General Session
INDUSTRIAL ARTS PROGRAMS IN THE SPACE AGE—DIRECTIONS FOR THE FUTURE
Presiding, Robert L. Woodward; Chm., Robert Swanson; Greetings, Neil Musmann; Speakers Harold E. Mehrens, William G. Haynes; Rec., Sterling Peterson; Hosts, Robert G. Anderson; John M. Shemick

NEW DIMENSIONS IN SPACE AGE EDUCATION

Harold E. Mehrens

It is a great pleasure to be with you today, and I hope that I can, in the brief time available, shed some light on the implications of space exploration for education in general, and industrial arts in specific.

The scientific advancements and technological developments of the past decade have been nothing short of fantastic. They have come at a fast pace, and that pace becomes faster and faster. They have rapidly induced changes in our patterns of living and of doing. Our time is truly a period of unprecedented and almost unbelievable rate of change, and it is the rate of this change that is a dominant fact of the era we of this culture have labelled the Space Age.

It has been said that of all the scientific inventions in history, the overwhelming majority have been made by men now living. And of all the scientists and engineers who have ever lived, 90 percent are alive and working today. This is an amazing fact, and one which points up and accentuates the increasingly important role of science and technology as the shaper of human affairs.

Indeed, the scientific research and technological effort in our country has become a dynamic and an integral part of our entire social and economic structure. It has become interwoven with activities of government, industry, labor and education. All factors seem to indicate that the nation which excels in research, development and technical applications will become predominant in the world scheme of things.

The space enterprise involves a great deal of technology and engineering of all types, as well as research and development. I'd like to develop, quickly and in montage fashion, a picture of the dynamic role of technology in the development of civilizations, past, present and future, thus not only emphasizing the important role of technology, but also emphasizing the important role of industrial arts in the general education program to provide better understanding of the importance of technology.

In the "Golden Age" of Greece, the Greeks excelled in philosophy, literature, sculpture and the fine arts. Athens, however, could not get along with sister cities. The state was founded on slavery, their primary source of energy, and the people were continuously fighting wars to replenish the supply of slaves. Hence, Greece was not able to stabilize itself and fell to other nations.

After the decline of Greece, Rome ruled the ancient world for about a thousand years, although it was inferior to Greece in art and literary accomplishments. The secret of Roman success was technology in a broad sense, including engineering, agriculture and medicine. There are still Roman walls and forts in northern England and Scotland, with their water supplies, sanitation and latrines. They built watertight reservoirs without concrete, using stone slabs and molten lead. They invented and used the stone arch for structural strength, they built the famous and still-standing aqueducts, and a workable public water supply system. They established law and order, for which they have been glorified in history books. But it was their technology which brought on the requirements for law and order.

Later on, in the 1700's England became supreme with only three million people on a small island, because it had some natural resources, such as coal, and knew how to use them. Newcomen produced a steam-pumping engine to enable workers to keep water out of mine shafts and made possible deeper mining operations. This started a chain of events, such as the invention of the spinning mule and the jenny. The British took handicrafts out of homes and put them in factories. Through mass production they oversupplied, so they sought world markets. This required ships and their protection. Thus, the greatest navy on earth was developed and led to Pax Brittanica, which lasted about 100 years. Again, technology led the way. We can move through time quickly to the Germans in the early 1900's. They turned, because of shortage of natural resources and manpower, to research and engineering. You all know of the power they developed.

We go rapidly to the Pacific in the pre-World War II period, and we find Japan becoming a great power, not because of political genius, or a superior economic system, or sociological innovation—but by engineering and technological excellence.

The whole point is obvious, but worth stating: namely, that applied technology has been the underlying basis for national power and pre-eminence and hence a great determinant of the course of world history.

If I had the time I could make the case that men have not always been wise enough to take advantage of scientific and technological breakthroughs. A couple of examples might suffice. Michael Faraday produced an electric motor in 1840. Yet it was not put to use until 1880.

It is said that radar was accidentally discovered in the Navy Laboratory in Anacostia in the early 1920's. We couldn't get up $15,000 to carry on further study of this electromagnetic wave echo phenomenon. So England, faced with the threat of German airpower, took the available data and produced a radar system which helped stave off the Germans and ultimately defeat them. Sir Watson Watts was knighted for this development.

And so it goes! The lag between technological innovations and the human ability and tendency to deal with them constructively has been voiced over the years. "Cultural lag" has been a cliche—but it is so. The question is, in this day of accelerated change, can we improve on the situation by the utilization of the industrial arts?—I think so.

Dr. Lee A. DuBridge, president of the California Institute of Technology, has said that from a purely technical standpoint we now know enough to:

"1. Produce enough food to feed every mouth on earth—and to do this even though the population should double or triple.

"2. Make fresh water out of sea water and then irrigate all the world's arid regions.

"3. Produce enough energy from uranium to light and heat our homes and offices, electrify our railroads, and run all of our factories and mills.

"4. Build houses, buildings, and indeed whole cities, which are essentially weatherproof—heatproof, coldproof and stormproof."

He went on to explain that we are not doing all these wonderful things because we do not know how to bring to bear on these problems such matters as money, labor, materials and—most of all—management. He established education as the necessary part of the process of building strong national economies and of solving mankind's problems.

Now then, before I start to focus on the assigned topic, the industrial arts educational implications of space exploration, I should like to present a brief of the US space program. I am doing this for several reasons, which will become evident later.

Our national space program has two basic ingredients—mission to explore the vast unknown both scientifically and technically, and missions to apply this advancing science and technology to the direct benefit of all mankind.

With unmanned but well-instrumented satellites and sounding rockets we are exploring the region about the earth, the moon and the planets. With observatories in orbit about the earth, we are looking at the sun and the stars with vision unobscured and undistorted by the heavy blanket of air surrounding the earth. We are studying the effect of space environment on earth organisms, plant and animal life. We are also searching for extraterrestrial life.

Through the Ranger, Surveyor, and Lunar Orbiter spacecraft, we have taken thousands of revealing pictures of the moon's surface. These will help us to select a site for the first United States astronauts to land on the surface of the moon. I'm sure you've seen some of these on TV and in the newspapers and magazines.

In communications, we already have operational satellites which make possible the transmission of programs over the Atlantic or the Pacific. We are rapidly developing the capability to beam television, radio broadcasts and phone conversations to every spot on earth equipped to receive them. In the foreseeable future, live TV will be beamed into homes from all points of the globe, via satellites.

Our weather satellites are providing meteorologists with a view of clouds over large areas of the world from 450 miles above them. These weather pictures already have helped locate storms, making possible early warnings many miles away, saving countless lives and millions of dollars in property.

In addition to both short- and long-range weather forecasting, there are other benefits from these miracles of outer space. For example, we will be able to obtain early detection of forest fires, locate distressed ships and aircraft, track icebergs and estimate the extent of snow coverage for conservation and water management purposes. There is also the real possibility that information and understanding given to us by weather satellites may some day help us to modify and control weather.

At sea, the ancient method of observing the height of the stars and planets above the horizon is still used to calculate position. When heavy weather hides celestial bodies, as it will do for days at a time in the wintry North Atlantic, ship navigators cannot accurately state where they are. We have now in operation a series of navigation satellites which correct this deficiency. In addition to its value to our navy, this competence can become a boon to commercial shipping, as a matter of both safety and economy. Our manned program is the most dramatic, glamorous and highly publicized. You are familiar, I'm sure, with the early Project Mercury flights and of the follow-on Gemini Program recently completed with the flight of Gemini XII. All the objectives of our manned missions have been met, and a few bonus achievements, too. We know men can perform tasks in space up to 14 days; we've accomplished rendezvous and docking in several different ways; we've taken photographs of earth and the stars never before dreamed of; and we've accomplished a variety of extra-vehicular activities.

Project Apollo is next, the program designed to land men on the moon and bring them back safely to earth. The moon explorers will conduct scientific experiments and collect samples to bring back to earth.

NASA is also conducting aeronautical research to develop and define new knowledge and capabilities of aircraft.

This, then, is the quick look at the NASA program.

The vast accumulation of knowledge resulting from these space activities will help us develop applications to human progress and welfare.

The field of electronics provides many good illustrations of this. For example, heat-resistant electronic components, which are so vital in space vehicles and spacecraft, will find uses in radio and television sets, where self-generated heat is a problem.

In the field of materials, the space program demands faster and more powerful vehicles and engines that are light, strong and resistant to heat. We have developed engines which produce controlled power at operating temperatures 1500°F above the melting point of steel.

Solid lubricants have been developed which are usable up to 2000°F for a short period of time.

Research on paint pigments aimed at reflecting the sun's heat away from fuel tanks of spacecraft will find application in paints for industrial use, such as fuel and gas-tank storage and refrigeration plants, and perhaps to keep our homes and buildings cooler in summer, warmer in winter.

The fuel cell is a device for converting chemical energy directly into electrical energy. The Gemini spacecraft utilized such a power source, and NASA continues to conduct research on many types of fuel cells. Some experts say they will be supplying 30 percent of the nation's power needs by 1990. Perhaps by the year 2000 homes will be equipped with this source of power. Surface vehicles using the fuel cell may be provided with essentially trouble-free motive power—eliminating not only many moving parts but the unwelcome exhaust fumes that now smog and bedevil our cities.

These are a few examples of space-related developments with obvious applications for use here on earth. There are many others; materials that keep their strength and shape at extremes of temperature, micro-miniaturized electronic components of great ruggedness and reliability, instruments of extreme sensitivity and accuracy, medical devices stemming from manned space flight research, and so on.

In regard to the last item, NASA, as part of its telemetry research, has developed a tiny radio transmitter to be swallowed by an astronaut and suspended in the stomach without surgery. It will enable scientists to monitor his physical condition, especially thermal stresses, gaseous conditions and tensions. The device is only the size of a large vitamin capsule.

Some hospitals are planning to test its use in the internal studies of patients suffering from ulcers or other disorders. As the small transmitter courses through the digestive tract, it will broadcast internal temperatures. A temperature rise around a fevered condition such as an ulcer or a tumor would pinpoint the trouble spot

Astronauts are fitted with several tiny body sensors to monitor their physical conditions. Such data is transmitted to doctors on earth who monitor the men in space flight. Now, in our most modern hospitals, intensive-care wards have been established, using "electronic nurses". These sensors, attached to patients' bodies, signal an instantaneous alarm if their conditions worsen.

The latest cardiogram technique is also patterned after astronaut sensor monitoring. Men and women may now be fitted with a little black box attached to sensors on their body, then work a normal 8-hour day before reporting back to the doctor. On tape the doctor has a perfect record of the heart's action at all times, not just for 30 minutes in a prostrate position. Real daily stresses, strains and emotions are recorded and analyzed.

Many persons are walking around with miniaturized devices, originally developed for spacecraft, implanted in their bodies—devices ranging from heart beat stimulators to artificial ears to help the deaf to hear.

In aeronautics we expect exciting progress.

In addition to the emphasis on higher top speeds, there is a growing interest in achieving lower minimum speeds for take-off and landing, and in efforts to develop safe and more versatile aircraft. We are, then, doing research at both ends of the speed spectrum, one might say. A great deal of research is being conducted by NASA on the problems of the supersonic transport, or SST.

The supersonic transport will probably become a reality and will operate on trans-oceanic flights at speeds up to Mach 3, or about 2000 miles an hour. It offers attractive and exciting possibilities, but there are a number of technological as well as social and economic problems which will require extensive research before operations commence.

At the other end of the speed spectrum is the vertical and short take-off and landing aircraft, or VSTOL for short. Certain concepts of the VSTOL show real promise. Someday such transport systems may become an important part of the over-all air-transport system in this country. They show particular promise for the dispersion of cargo and passengers from large major trunk-line airports. They will also contribute to opening up of underdeveloped countries because of their capability for operating in and out of clearings and improvised landing strips.

While the current impact of our space program is enormous, the potentials and implications for the future are almost infinite. Through the imaginative use of the capabilities and equipment which we are creating in the Apollo Program, we will be able to carry out a wide variety of missions of direct benefit and of significant scientific value to mankind.

Let us consider a few of these applications of our space resources. Use of the space near earth is already yielding practical dividends and offers the opportunity for worldwide exploitation. I've already mentioned weather and communication satellites.

Space technology is also being put to use to survey the earth's resources to care for the world's growing population. At the present rate of growth, it is estimated that population will double by the year 2000, totaling from 6 to 7 billion people. And in another 35 years, it will double again, totaling from 12 to 14 billion. The daily task of providing adequate food, clothing and shelter to these multitudes will be unbelievably difficult.

Manned satellites in earth orbit, equipped with suitable sensing equipment, can search for and monitor the world's natural resources and provide information of great value to national and international agencies concerned with feeding the world's hungry mouths.

For example, the causes of crop diseases and of water or mineral imbalances in the soil may be detected from space. Excess salinity of the soil in cotton fields of Texas showed clearly in photographs made during the Gemini flights.

To offset the growing consumption of surface water, underground rivers can now be detected by measuring the tiny differences in soil temperatures above them. Such streams hold thousands of times more water than all known surface rivers. Snowfall may be measured, and spring thaws predicted, for the subsequent control of floods, and for overall management and control of water resources.

Couple these fantastic achievements in space technology with the great accumulation of new knowledge in space-related science, and we do have the ingredients for the profound effects of the space enterprise on our patterns of living.

Now, what are some of the effects on education? I'd like to list five, which, in my opinion, also represent a set of criteria for evaluating the influence of the aerospace enterprise on education. They are as follows:

1. A continuing demand for engineers, scientists, technicians, and all other skills which support industry, and, most important, the provision for adequately training them.

2. The examination and revision of the curriculum in high schools and colleges to include new concepts and knowledge to provide enrichment of basic principles through space-related activities and materials.

3. A recognition of the need for better teacher training at the pre-service stage to

meet the needs of the expanding role of technology as it relates to the industrial arts in the Space Age.

4. The recognition that industrial arts should be a basic part of general education for all students, and that we must develop a technologically literate public.

5. The continuing effort to develop a well-balanced national effort in technology, the social sciences and the humanities, and science.

Time does not permit in-depth development of any of these elements, but a few comments may serve to identify elements of the impact of the aerospace enterprise upon education.

Each of NASA's research centers has training programs geared to its specific personnel needs. NASA employs about 35,000 people, of which 39 percent are in the scientist, engineering and mathematician specialties. Several of these centers have excellent apprenticeship programs for the development of technicians and master craftsmen. Aerospace industries also maintain similar training programs, as you know. The aerospace industry employs around 400,000 workers, of which 27 percent are identifiable as scientists and engineers. A large part of the remainder is the category we call the technician, which comprises highly-skilled manpower. We are continually taking steps to assure a continued supply of these specialized people.

NASA has supported a program in higher education that is producing more than 1,000 new PhD's a year in several branches of learning.

At the elementary and secondary level, the teacher is our focus. Institutes, seminars, symposia and workshops for teachers have been offered with the help of private foundations, industry and agencies within the Federal government. Many of these have summer-session programs, and others have been held during the late afternoon and evenings of the regular school year. In relation to this, NASA, through its educational programs division at headquarters and through the educational services of most of its centers, participated in almost 200 college workshops for teachers in aerospace education this past summer. The teachers represented all age-and-grade levels, K through 12, in virtually every discipline.

I will say, with tongue in cheek, but I think each of you will agree, that there is as great a need to "update" the college undergraduate faculty, and there are stirrings in this direction. You will also agree that practically nothing has been done to redesign curriculum for teachers in preparation, with the exception of a few institutions. Thus, the nation's colleges and universities continue to produce teachers who, because of their inadequate initial preparation, must be placed immediately in programs that are designed to update their knowledge.

The National Aeronautics and Space Administration has heard from many college representatives who would like to have in-service programs in the various disciplines, with emphasis upon the space exploration results and impacts as they relate and affect a given subject-matter area. The biologists want some space biology; the physics professors some space physics; the chemists the space-related chemistry, and so on. As a matter of fact, one of the important results of the space age efforts has been the development of interdisciplinary education programs. We now have biochemistry, biomedicine, physical biology, biotechnology and other combinations of the basic disciplines.

The greatest revolution in curriculum development history has been taking place for the past ten years in this land of ours. We have movements within your profession, industrial arts, but also we have had the new physics, new chemistry, new biology, new mathematics and others, as you well know. Consequently, within the profession of industrial arts we must not stand still. There is considerable delay in the appearance of new technical knowledge in textbooks in the industrial arts, and an even greater lag before it appears in the teacher-training process, as I've already indicated.

There is, fortunately, a growing mass of good supplementary material in the nature of periodicals, pamphlets, films, educational television and supplementary resource books. The NASA is becoming, in my opinion, a leader in this realm.

There is also a growing need for continuing education, or adult education, as we used to say. When we get down to cases, we can consider the educational institutions to be the reproductive system of our society. In this system the gestation period is anywhere from 5 to 20 years. The people who will become our industrial, military, political, scientific, technological and educational leaders of the 1980's are now living. They have already had, or will soon have had, their formal education. Yet new knowledge is pouring out of our aerospace efforts at a phenomenal rate. An interesting and gratifying sign is the development in some communities of evening courses or lecture series to acquaint groups, cross-sections of our adult society, with the space programs and their significance. Furthermore, educational TV and regular commercial TV channels have offered informative programs with assistance from NASA and Industry.

Getting back to the education of our youth, I feel that aerospace science and technology, coupled with considerations of their social and economic impacts, provide an excellent catalyst to generate interest and desire for learning.

I further feel that there can be little excellence in education without this interest and desire. A major ingredient in the educational process still is motivation. Aerospace information and knowledge, responsive to a natural interest and enthusiasm of our young people, provide considerable motivation and stimulation to achieve high standards in the substantive areas.

Although our space and aeronautical efforts have created a need for many more technically-trained people, this is not the whole picture. We also need and must have a citizenry which understands that aerospace activities constitute powerful societal forces exerting influence upon our present and future—socially, economically, politically and even morally. Here again, most of us would agree that the artificial separation between industrial arts and a science education should somehow be removed.

Many of the demands of our present day society upon the average person will be nonscientific and nontechnical in nature. They will affect 90 percent of students, the large majority who are not headed for technical careers but will take their places in our society as wage earners in countless professions and jobs, voters and citizens. They will be called upon to evaluate and judge events in the emerging New World—a world in space, space technology—and to understand the implications of the new technology, some of the results of which I have already mentioned. The demands upon them as adults will be for open and understanding minds, broader tolerance, imagination, confidence, faith and original thinking. This kind of education requires much more than just keeping up with the facts as we go rapidly from one achievement to another.

At the elementary and secondary levels there is a major need for better interpretation, for examination of the meanings, for discussion and thought in terms of influences. As you know, children are factfinders, and generally will collect information on headline accomplishments in space or any human endeavor. What they generally do not do alone is to relate facts to each other, to systematize them and to associate them to broad and complex social patterns. This is where the teacher plays an important role. This is where he or she can engineer, foster and encourage creative thinking. For this reason we in the space program have made the teacher our focus in our educational programs.

I began this talk with the thesis that technology has in the past had great influence on the course of history. I propose to you that today's accelerated rate of change, induced by a new technology which is racing down the pike like a runaway horse, will have even greater impact on human affairs. Also, I'm happy to say that we are at least cognizant and making an effort to reduce the historic lag between technological developments and practical applications. As one good example, we have in NASA an office of technology utilization. This office records, analyzes and disseminates to industry the results of NASA research which appears to have developmental possibilities. Some surprising results are already evident. A hat manufacturer learned of nonstick coatings that had been used for solid rocket propellant mold releases. This manufacturer's hats no longer stick to the blocking mold.

It was known that Parkinson's disease could be treated by the use of a surgical probe cooled with liquid nitrogen to locate and destroy by freezing parts of the brain. The big problem was to find a means of measuring and controlling the temperature of the probe. A small thermocouple developed for the space program now provides this means.

So, there is real hope that we can shorten the span between fundamental scientific discovery and technological utilization for a better life.

The progress of America has been shaped in a vast open continent. Our rise as a nation has been due in large measure to the magic influence of a frontier. It is already apparent that the space frontier is providing an unprecedented peacetime stimulus to science, industry and education. The very presence of this new frontier, which is unlimited, is a guarantee that we will not find ourselves without great challenges.

History has also taught us that man has progressed only when he has had the courage to reach for new heights. Therefore, amid the changing winds of progress, and at that fateful point in human destiny where star trails are being charted, the school has become more than a mere instrument for perpetuating the culture. It has become the prime index of our greatness, functioning not only as the seat of our hereditary strength, but as the ultimate measure of our fitness to survive and grow as a nation.

Aircraft and spacecraft, and all the marvels they will account for in the future, can be harbingers of peace, progress and the fulfillment of man's dreams for the abundant and good way of life. They can help men of all nations to close the cultural and economic gaps between them.

In closing, may I say that if we are to remain pre-eminent in science and technology, then we must reach toward the objective of marshaling the total resources of the nation to strengthen schools, colleges and universities—for the educational institutions are truly the launch pads for all man's thrusts into space—and into the future.

Mr. Mehrens is chief of Educational Programs and Services, John F. Kennedy Space Center, Cape Kennedy, Florida.

SENSE AND NONSENSE ABOUT EDUCATIONAL INNOVATION

William G. Haynes

The other day, one of my associates at the General Electric Company had his birthday. His secretary—who kept a close watch on such things—surprised him by presenting him with a small birthday cake and inviting a number of us to share it with him when she brought it in. After we congratulated him on his birthday and had started eating cake, he turned to me and said, "You know, man is the only animal that eats when he is not hungry, drinks when he is not thirsty, and makes love at all seasons."

And, he might have added, gives speeches... because speech-making is a peculiarly American passion. Unlike some other American customs or fads, it hasn't passed with time. Many trends or movements in this country, in fact perhaps most, fade away or are replaced with another one. For example, during the 1930s, it was open season on business. Today, the most explosive domestic issue in this country is no longer business or religion or politics; it is schools. Education became public issue number one around the time of the first Sputnik in 1957. Since then, the feelings of millions of parents have gone from concern to obsession to near-hysteria. Educators have been besieged on all sides by people who claim to know exactly what's wrong with education. Businessmen, labor leaders, politicians and a variety of pressure groups ranging from the John Birch Society to the Single Tax Association all have ideas on education—and most haven't been bashful about expressing them.

As a businessman myself, I was pleased and somewhat surprised to receive your invitation to speak at this conference. But I do have to admit that my work in industry has brought me into association with many educational leaders—and, just as important, given me an incentive to seek out the best approaches to solving the training and educational problems that we face in industry.

In an era of change such as ours, the future growth of business vitally depends upon the continuous outpouring of new ideas in every facet of its operations. Whether in shaping change or adapting to it, it is the new idea—the new product, the new process, the new service, the new way of managing—that gives a company its competitive edge.

These creative ideas can originate only with trained intellects. Progress is literally unthinkable without them. And this, in the final analysis, is why business must be engaged in its own "quest for leadership and excellence"; this is why business is, and must be, pro-intellectual. The day has long since passed when the "practical businessman" can think of himself as being "anti-intellectual".

Obviously, this intellectual excellence is not merely the product of a man's formal education. We now conceive of education as a career-long process: any manager, to be professional, has to be a part-time student to keep up to date with new ideas and new developments. In this connection it is worth recollecting what Ralph Cordiner once said:

> "The manager who does not keep up with the times—or rather, keep up with the future—is going to find himself as obsolete as yesterday's newspaper, and almost as quickly."

We have to learn to live with the perpetual threat of "managerial obsolescence" hanging over us.

Faced with this challenge, we have tried in General Electric to make career-long education a reality. With a wide variety of technical, professional and management courses, with an annual enrollment of 35,000 employees as students, with an internal education and training expenditure of over $40 million and with programs of tuition refund, General Electric is indeed in the education business. In fact, it is only half-jokingly that some of my associates refer to the company as an "educational institution with a manufacturing subsidiary".

And I think the rising tide of public interest in education—we've only seen the beginning of it now, there's much more to come, I believe—is simply a reflection of the fact that the world is changing much faster than most of us can or want to understand. Consider these items; nine out of ten of all the scientists who have lived in the history of civilization are living and working today; within the brief span of one generation, two epochal ages have begun, tumbling one after the other with breathtaking rapidity—the atomic age and the space age; a world-wide competition for men's minds and souls—unparalleled in history—is increasing in intensity; beliefs and customs that have gone unchallenged for centuries are being questioned or rejected by millions of people throughout the world—they want better lives now, not later; and, man now has the power totally to destroy life on earth.

All of these things—particularly the expanding frontier of science and technology—are having an impact on education... one hell of an impact I might add, as you're all undoubtedly aware.

The American people, more than the people of any other nation, have always pinned their highest hopes and aspirations onto the educational system—and with good reason, because American education has provided the impetus for much of the success and growth of this nation. Francis Keppel put it this way:

> "A growing body of evidence indicates that the development of human capital—particularly investment in education—has actually been more important as a source of economic growth than has the accumulation of physical capital. . . . It has been estimated, in fact, that in recent years our investment in education has been responsible for up to 40% of the nation's growth and productivity."

At the same time, greater and greater demands are being placed on the educational profession.

One of our favorite words today is the word "crisis"—and it has frequently been applied to educational themes by various commentators. It's instructive to note that in the Chinese language, the symbol for the word "crisis" is made up of two characters—one is danger and the other is opportunity.

Certainly the danger is great. When we consider such situations as the high school drop-out problem and high unemployment rates among teenagers, it's evident that we are indeed facing a crisis.

Teenage unemployment is certainly one of the most "explosive" social problems in US history.

James B. Conant, former Harvard president, called this situation "social dynamite" – "I submit that the existence in the slums of our large cities of thousands of youth ages 16-21 who are both out of school and out of work is an explosive situation," he declared.

In some areas, two out of three high school drop-outs are unemployed, and in the nation as a whole almost 30% of the drop-outs do not have jobs. I wouldn't be appalled by the drop-out rate, if our students had something to drop out to... but these figures show that they don't. And the situation is self-perpetuating. Drop-out marries drop-out and breeds a new race of drop-outs.

These young people, especially when they are pocketed together in large numbers within the confines of the big-city slums, must be a major concern. What can words like "freedom", "liberty", and "equality of opportunity" mean to them? With what kind of zeal and dedication can we expect them to withstand the relentless pressures of competitive ideologies? How well-prepared are they to face the struggle that shows no signs of abating? ... The building up of a mass of unemployed and frustrated youth in congested areas of a city is a social phenomenon that may be compared to the piling up of inflammable material in a city block. Potentialities for trouble—indeed, possibilities of disaster—are surely there.

There is danger to our way of life in these situations, but let's not forget the second meaning of crisis... there is also opportunity... opportunity for action... opportunity for people to assert leadership... opportunity for us to prove that a free society is aware of its problems and willing to attack them vigorously.

If we take action—and there are encouraging signs that we will—we will be reaffirming our belief in a great tradition.

This tradition has its origins 2,500 years ago. It is a striking fact that the founders of most of the world's high religions and philosophies were born at about the same time: the sixth century BC. Confucius, Lao Tze, Buddha, Zoroaster, the great Hebrew prophets and founders of Greek philosophy—all made their great innovations in ethics, religion and philosophy in that same century—and, in so doing, permanently changed the course of human history. Historian Henry Bamford Parkes calls this the Axial Period for the human species.

It was as if, after centuries and centuries in which power and violence had dominated human affairs with accelerating destructiveness, and the gods themselves seemed irrational, the human race decided that something better was possible. And simultaneously, there appeared inspired men who proclaimed that the Creator Himself demands that men live by higher principles of reason, morality and love; and that these, rather than brute power, must become the dominant principles of life if the human race is to keep from destroying itself.

Whether you see the simultaneous appearance of these great innovators in human thought as a coincidence, or the hand of God in history, or a great step in the evolution of human culture—you cannot avoid living with its consequences.

The ideas set in motion at that time never died, and they are the foundation stones of our present concepts of religion, ethics and science. There have been many times when these great principles were almost extinguished, but for small remnants who held firmly to them regardless of consequences. And each of us, as individuals, must decide where to cast his lot: whether to commit ourselves to the higher principles of reason, morality and love, or whether to follow the law of brute power and selfishness.

Perhaps this is the contrast H. G. Wells had in mind when he defined human history as a race between education and catastrophe. Education, for better or for worse, is intimately related to the whole fabric of society. Last year, the Secretary of Health, Education and Welfare gave testimony to Congress on this point. "For a nation accustomed to living with the threat of thermonuclear war," he said, "it is perhaps difficult to think of crisis in terms of education."

"Lack of adequate education and lack of opportunity for education are major contributing factors to our present high rates of unemployment, dependency, delinquency and crime. They lie at the root of our inability to meet urgent needs for skilled and highly-trained manpower."

Industry has, all too often in the past, played the role of the critic to education without offering constructive alternatives. Some of you may have seen quoted a letter to the editor of the New York Herald-Tribune, published in the issue of April 13, 1890. The author was Andrew Carnegie and the subject of his letter was higher learning.

Scottish-born Carnegie's formal schooling had ended at age 13. Now looking about him at the peak of his career, the steel titan found few college-trained executives in the upper echelons of business. He thought this was significant.

His letter said: "The almost total absence of the (college) graduate from high position in the business world seems to justify the conclusion that college education, as it exists, is fatal to success in that domain. The graduate has not the slightest chance, entering at 20, against the boy who swept the office, or who begins as a shipping clerk at 14. The facts prove this."

Business attitudes have changed somewhat since then and I'm sure if Mr. Carnegie were alive today, his views would be different.

Significantly, many critics of modern American education are not to be found in the forefront of those calling for new and better methods and innovations in education. Among their more imaginative ideas is the proposal that we go back to McGuffey's Reader. Despite this longing for a dear, dead world, the last few years have seen the development of several promising new learning methods. For example, experiments in "programmed learning" suggest that every child, except the seriously retarded, can learn to read—with pleasure. And the lack of reading ability is at the very heart of the drop-out problem.

There are, of course, a number of other new methods and systems which are being tried, some of them very successfully. I believe these new techniques, along with the development of more sophisticated and more widely available technical education opportunities, are the key to continued progress in American education. Those who would turn the clock back to some imagined golden era in education have rather short memories. For example, in 1900, only 6 percent of young Americans graduated from high school.

Separating the useful from the frivolous in proposals for educational change and innovation is undoubtedly an Herculean task. However, there are a few guidelines that can be most helpful.

First of all, we must realize that there is no magic formula for forwarding education in this country. Looking for such a formula is about as helpful as trying to cure cancer with coughdrops.

One important fact stands out, though, and we in business are witnesses to its validity. In simple words, it's this: innovation which leads to firm and steady progress costs money, a lot of money. Research and development are expensive, as my co-speaker here this morning can testify from his NASA experience.

Good, creative ideas are not enough. They must be backed by governments and institutions that are willing to put their dollars where their policies are. How can an urban public school system solve its many-faceted problems, for example, when it spends less dollars per student than suburban school systems, which often have far fewer cultural deprivation problems?

So, we must be willing to pay for the advances and the progress that we all desire.

Secondly, because something is new doesn't necessarily make it good. Each new proposal or idea must be investigated, experimentally tried and looked at through critical and objective eyes. Conversely, because something is old or traditional doesn't necessarily make it good. The same tests should be applied to traditional practices in the light of new conditions or new information.

Third, all the good ideas in the world are useless unless they are communicated to the proper audiences so that action can be taken. There are educational experiments going on throughout this nation and in others that I'm sure can offer valuable insights to many teachers and administrators—if they hear about them. Conferences like this one are one good way to make sure that information is being communicated.

Fourth, we must have people who have empty heads—and by empty heads, I mean heads that are receptive to new ideas, that seek out the best of the new in order to blend it with the old. The desire and willingness to move ahead, to progress, are necessary foundations for any innovation.

I have said how education can help business—by providing the necessary skilled and well-educated people. Now I want to suggest one way in which we in business can help educators fulfill their goals.

We at the General Electric Missile and Space Division have been quite active in the area of vocational guidance conferences. Our employees have participated in many such sessions, and we have worked closely with a number of schools to provide them with this resource. During this past spring semester, we took part in 66 sessions in schools throughout the greater Philadelphia area, giving counselling to about 15,000 students. In fact, our reputation for activity in this area is probably the reason I was invited to give this talk today.

However, despite our participation in many guidance conferences, career days and motivational assemblies, we are left with a feeling of frustration. One morning a year, or one day a year, is not enough. The exposure students have en masse to our specialists and technicians for a few brief moments, perhaps once in their school career, is like trying to bail out a sinking boat a thimbleful at a time.

It is, I think, a hit-or-miss approach that too often hits only a few already somewhat-motivated students. It lacks continuity and it lacks reinforcement. Certainly we have been pleased with the results of some of our conferences—but too frequently the benefits are unmistakably modest.

You, as teachers, must be painfully aware of this. What I am going to suggest is designed to overcome these problems.

It's designed to give teachers a new resource in the struggle to motivate, inspire and inform our youth.

I call it "industrial consulting". Its purpose is to give a new dimension to the tasks of education... to put in the hands of teachers a new tool to use—a tool that can be used as they see fit—a tool to help educators fulfill their goals.

The key to this concept is continuity and flexibility. Its essence is this: a group of experienced and highly-skilled General Electric employees will act as industrial consultants on an "on call" basis, to teachers and students, throughout the academic year.

We are preparing an index of consultants and their specialties, numbering more than forty trades and professions. This will be sent to all schools in the area we serve, to provide them with a service that can be used to help particular teachers and students.

This service would remedy the "one-shot" approach to career conferences. Getting the index at the beginning of the school year, the school contact can inform the faculty of the availability of the resource and the nature of the service. Then, throughout the school year, the teacher and our representative—working together—can bring in selected consultants or a single consultant to help a particular student or group of students.

For example, if a class began discussing toolmaking in modern industry, the teacher could have a consultant toolmaker in to talk to the class by simply referring to our index and making a phone call. The toolmaker could explain and show how industrial toolmakers use trigonometry by demonstrating the use of levels and transits... or, in another situation, an electronics technician could discuss and give examples of the calibration of instruments.

Ideally, then, consultants would be talking to various groups of students or individual students at appropriate moments during the school year, sharing their work experiences with the students and developing in the students an awareness of the requirements and opportunities in the outside world. A formal career conference, scheduled toward the end of the school year, would then help to reinforce the previous contacts, and serve to integrate the aspirations of students with potential applications.

We think this program can help ease the task of presenting career alternatives and suggestions to our youth. And we think that it helps to fulfill industry's responsibility to the community and the nation.

As we offer this program to you now, I am also calling on the other hundreds of businesses in the nation to join us in this effort to stretch the horizons of our youth. We will need their help.

Properly implemented, "industrial consulting" will require the cooperation of many firms. I'm sure this cooperation will be forthcoming.

Motivating students through this and other programs will help build the kind of balanced skills we need for our increasingly-automated society. And the more humble as well as the more exalted skills are necessary.

This, as I'm sure you're aware, involves educating the parents as well as the children. Too many parents unwisely push their offspring into college preparatory programs for fear of some social stigma in vocational-technical education. To them as well as the students, I would like to quote the now-famous but still pertinent observation of John W. Gardner: "An excellent plumber," he said, "is infinitely more admirable than an incompetent philosopher. The society which scorns excellence in plumbing because plumbing is a humble activity and tolerates shoddiness in philosophy because it is an exalted activity will have neither good plumbing nor good philosophy. Neither its pipes nor its theories will hold water."

Mr. Haynes is manager of Communications and Community Relations, Missile and Space Division, General Electric Company, Philadelphia, Pa.

F-12.1 ACIATE
Special Panel Session
NDEA TITLE XI PROGRAMS—THE INSTITUTE
Gen. Chm., Charles Porter; Chm., Willis E. Ray; Rec., Albert G. Mudgett; Obsr., Alan R. Suess; Panelists, Paul Manchak, Joseph A. Schad, H. James Rokusek; Hosts, Kenneth Barton, Robert Cox.
Dr. Manchak's manuscript not provided.

NDEA TITLE XI PROGRAMS—THE INSTITUTE

H. James Rokusek

This is a rather difficult assignment for several reasons.

1. Your speaker is not merely representing Eastern Michigan University, but four other NDEA institute directors and institutions of 1966, and, to an extent, the 28 directors and institutions approved for 1967.

2. Our audience this morning is composed of both teacher-educators and secondary school teachers of industrial arts.

3. Only 15 minutes has been assigned to cover the topic.

4. We do not have one of the individuals who served as a participant in one of the 1966 institutes on this program with us this morning. I am aware, however, that Bruce Hamersley of Opa Locka, Fla. is making a presentation on a participant's impression of an NDEA Institute in the Pennsylvania East room as of this very moment.

Consequently, an effort will be made to provide both general and specific statements which will be meaningful to both groups in the very short period of time that we have available to us.

Let's turn back the calendar to February 21 of last year. This was the date that the five schools and institute directors were notified by the US Office of Education that their proposals had been accepted for the summer of 1966.

All of us who were to serve as directors went into this program somewhat green, and, of course, there was much to be done and little time to accomplish what we hoped to do. There was publicity to prepare and disseminate, the budget to negotiate, the applications to screen, a second proposal to write for summer, 1967, participants and alternates to select and notify, orientation materials to prepare and send out, housing and local arrangements to be made and guest speakers to coordinate.

But throughout all of this, we enjoyed fine cooperation and support from the US Office of Education and our university administration. One thing that you learn in a hurry is that the operation of an institute is not a one-man show. It takes a good deal of teamwork and help from a great many individuals in preparing for and conducting this type of program.

Let's turn now to the five programs offered in 1966. Four of the five were designed to accommodate 30 participants. Ours at Eastern was limited to 24, making a total of 144 participants for the pilot program. This, of course, is a token figure when compared to the 40,000 industrial arts teachers in the nation. The programs offered last summer varied from six to eight weeks in length and cut across a number of specialty areas. Three institutes were focused on curriculum or content and methodology, one program concerned a field study of industry, while still another was devoted to a technical specialty.

Specifically, what does an institute provide?

First of all, it enables you to develop a program which is unique. It provides the resources to try out those things which you have thought about for some time, but have never been able to implement. It gives you a chance to go beyond the typical graduate program offerings and enables you to provide a program which does not have to be approved by several university committees.

Secondly, it provides an excellent opportunity for team teaching. As one of our participants stated, "It would be impossible, or at least very difficult, to have visited and talked to these men in any other type of program."

Thirdly, it provides an opportunity for a departmental staff to work together in planning and conducting an institute program. It gave our people a chance to sit in on each other's sessions, and to renew our understanding and appreciation of the specific contributions which each staff member could make toward a common goal.

Fourthly, by housing the people in the same dormitory where they can interact on an informal basis with other participants and staff members, the institute provides a much more comprehensive view of the total educational process than the conventional summer school program.

Finally, the weekly stipends of $75 for the participant and $15 for each dependent make it possible for the participants to become completely absorbed in their program of studies without having to be concerned with such things as part-time jobs and household responsibilities.

In addition to these rather general statements, which certainly could apply to practically any institute, I would like to consider some statements made by a few of our participants in answer to the question, "What was the most significant thing that happened to you this summer?":

"I believe the ability to think. The institute has made me think about what I am teaching."

"The ability to accept or at least look at opinions different from my own."

"I see the need to teach people, rather than things."

"I was able to interact with 23 industrial arts teachers from all over the United States. I found that many of us had the same problems, and some of us had answers. I must admit that I was somewhat narrow in my outlook before I came, but I think this has changed considerably."

"It's encouraging to find out that my problems with respect to industrial arts are shared by others throughout the country. I believe now that I'll have a better outlook toward teaching my subject. I'm certainly going to try some of these approaches we've talked about here this summer. The study of industry is going to be emphasized to a greater extent."

"I don't think I can answer this question today. Perhaps a year or two from now, but not today."

"Association with colleagues and speakers and sharing experiences of a professional nature provided a great strength and initiative for me. A broader outlook on the industrial arts program in terms of technology has developed through association at this institute. I plan to incorporate to a greater degree the technological point of view into my classroom next year."

"I believe I will be able to judge the strong points and weak points of my program much better. I am sure that when I read the professional literature I will understand the approaches of industrial arts much better, and that I will implement some of the good points much faster. I will not be as afraid to attempt curriculum change or development, now that I have more information on the subject."

After having had the opportunity to host one of the first five NDEA Institutes in industrial arts, there are several things that our institute staff would consider significant. These feelings are contained in the following statements:

1. We feel very strongly that the geographic area be kept open rather than regional. We feel that the heterogeneity of the group made it considerably stronger than selecting from a single state or perhaps four or five states.

2. We feel that all participants should live in a single dormitory on campus, regardless of whether families do or do not accompany the participants.

3. We feel that industrial arts teachers or industrial arts supervisors should be selected for institutes in industrial arts; trade and industrial or vocational-technical people should not be invited to participate. The legislation and resulting institutes have been designated for industrial arts personnel.

4. We believe in good program organization and structure, but also feel that participants should have enough free time for independent and group study.

5. We feel that visiting lecturers should be brought in for more than one day, so that several opportunities for interaction between students and the guest lecturer may be provided.

6. We believe that the type of institute program should be sufficiently broad in scope to be able to justify graduate credit.

7. We feel that the director should not be so deeply involved in the instructional program that he is not available to carry on the administrative work which needs to be done to coordinate the program effectively.

8. We feel that the assignments given to the participants should (1) be meaningful, (2) serve as an integrating device and (3) be critically analyzed and returned promptly to the participant.

9. We believe that the credit hours received by students should be specifically applied to course numbers and titles offered in the department of the host institution. These hours, therefore, would not appear simply as "problems in ----" or "6 NDEA institute hours in ----". This would help the participants in transferring these credits to another institution.

Although the task of directing an institute is quite demanding and involves long working hours, it is a tremendously satisfying and rewarding experience. It is difficult to describe in words what it is like to conduct a program of this type. Let us hope that we will be able to provide many more institutes for industrial arts personnel in the years ahead.

Dr. Rokusek teaches at Eastern Michigan University, Ypsilanti, Mich.

SOME INDUSTRIAL ARTS INSTITUTE OBSERVATIONS

Joseph A. Schad

The first five institutes for industrial arts were conducted during the summer of 1966 at Eastern Michigan University; Northern Illinois University; State University College, Oswego, N.Y.; University of Maryland; and University of North Dakota. One hundred forty-four participants, selected from 3,100 applicants, were enrolled in the five programs. The participants represented .35 of one percent of the number of industrial arts teachers in the United States in 1962-63.

Early in the summer of 1966, the US Office of Education engaged a consortium of professional organizations to conduct a study of institutes then in progress. Committee members for the study dealing with industrial arts were Donald F. Hackett of Georgia Southern College, Joseph A. Schad of Virginia Polytechnic Institute, and Robert E. Stake of the University of Illinois.

Following visits to the five institutes, the committee prepared a report, a copy of which may be secured from either the US Office of Education or the Assoication of American Geographers, Washington, D.C.

Stemming from the study are a number of conclusions, two of which are as follows:

1. The principal purpose of the institutes, which was to improve the competencies of teachers of industrial arts, was successfully achieved. This finding was based on responses from participant questionnaires and observations of consultants.

2. The quality of instruction by institute faculty was deemed very good. There were some criticisms, the chief complaint being that most institutes worked participants too hard and provided too little time for contemplation and relaxation.

The report contains thirty-one recommendations. Selected ones in abbreviated form are as follows:

1. The profession should identify some of the major needs in industrial arts education and encourage institutions to prepare and submit proposals to fill these needs.
2. Institute participants should be selected from as wide a geographical area as feasible.
3. Some form of weekly evaluation should be carried out to aid participants and staff in recognizing institute strengths and weaknesses.
4. A strong effort should be made to acquaint guest speakers with the objectives of an institute.
5. Industrial visits should be carefully planned and arranged to provide opportunities to study industry rather than simply to tour facilities.
6. Instruction should reflect the latest and best in educational theory and practice.
7. Newsletters, photographs and other public relations materials should be prepared in each institute to serve as examples for emulation by participants when they return to their schools.
8. Participants should be encouraged to prepare an institute summary report for distribution to teachers in their respective states.
9. New directors should have opportunities to examine compendia of organizational and management materials developed by directors who have had experience conducting institutes.
10. Consideration should be given to running a two-or three-day conference, seminar or institute for new and potential directors. Cooperative planning involving experienced administrative personnel and selected participants should determine the nature of the learning experiences to be provided.

Mr. Schad teaches at Virginia Polytechnic Institute, Blacksburg, Va.

F-12.2 ACIAS
Special Panel Session
INDUSTRIAL ARTS IN SPACE TECHNOLOGY
Chm., Edgar Hare; Rec., William M. Devenald; Obsr., Richard A. Froese; Panelists, Ralph V. Steeb, John L. Fierer, George Ditlow, John R. Lindbeck, Ira Johnson, Warren Smith, Thomas Brennan; Hosts, Raymond Larson, Brother Hilary McGovern.

INDUSTRIAL ARTS AND SPACE TECHNOLOGY PROJECT

Dr. Ralph V. Steeb

We are in a decade when renewed emphasis is being placed on the industrial arts curriculum. Teachers are experimenting with new techniques. Universities are engaged in basic curriculum research. All such activities strengthen our belief that the basic content of industrial arts is found in industry and technology.

Because industrial arts has not organized its learning activities and experiences on industry during its first fifty years, its position in the school curriculum has been secondary to other general education subjects. This was not especially inconsistent for that time, but today we are encircled in all we do by a complex technical world. Now the narrow view of industrial arts must give way to a more comprehensive and flexible interpretation of technology.

To a state supervisor observing existing programs, it was evident that teachers need to be introduced to technology. Teachers respond and change classroom techniques and content when they are involved in experiences where they can observe and learn firsthand about contemporary technology.

The usual tours of industrial plants were one attempt to orient teachers. But these tours in general exposed teachers only to one industrial field or material per visit. What was needed was a comprehensive study of all facets of technology: construction, power, communication, personnel, etc. Being in Florida, we had within our state the ultimate consumer of many and varied facets of the latest technology, the John F. Kennedy Space Center.

With the rationale that the space program represented at Cape Kennedy could provide industrial arts educators with a firsthand experience and a knowledge of a wide cross-section of industrial technology, the idea of an Industrial Arts Symposium for Florida teachers was presented to Mr. Harold Mehrens, Assistant Chief of Educational Services at the Cape. He was enthusiastic. A proposal, including a detailed program for a three-day symposium, was written and submitted to Mr. Mehrens, who in turn prepared the proper forms for application to the national NASA headquarters.

A part of the original proposal emphasized the importance of getting "behind the scenes" at the Cape into the technical support areas if the purposes of the symposium were to be achieved. Also included was a feed-back session at which teachers, at the conclusion of the symposium, would summarize ways in which they could relate the technologies observed to the daily teaching. The national NASA headquaters, in accepting the proposal, requested that the summary suggested be expanded and that a curriculum document be written. Also the symposium was expanded to include Georgia, Puerto Rico and the Virgin Islands.

At this point and with approved funding, the symposium had grown to a full-scale conference on industrial arts and space technology. The University of South Florida was selected to direct the administrative functions of the conference. A team of leading industrial arts educators was carefully selected and invited to serve as directors with responsibilities to coordinate and write the curriculum document. Dr. Ralph Steeb prepared a program for the conference, and Hal Mehrens of the Space Center provided the technical personnel, facilities, tours, equipment, exhibits and publications necessary to carry out the suggested program. We cannot overemphasize the enthusiastic and detailed assistance toward making the conference successful that was given by the personnel at the Cape.

Seventy-five leaders, including industrial arts teachers, teacher educators, and supervisors, attended the conference by invitation last May. The conference program included presentations by NASA administrative and technical personnel on educational services and materials, design and construction of launch facilities, quality control, photography, electronics, plastics and ceramics, and technology utilization; space program demonstrations; tours of technical and support areas, including maintenance, instrumentation, operations, fluid tests, pyrotechnic, control centers, block house, launch pads, vertical assembly building and the moon base. Persons responsible for the converence included: Dr. Ralph Steeb, Florida State Consultant, proposal and program planning; Mr. James Pope, University of South Florida, conference administration; Dr. John Feirer, Western Michigan University, chairman of directors and editor of curriculum document; Dr. Thomas Brennan, West Virginia University, director for woods, plastics, ceramics; Dr. George Ditlow, Millersville State College, director for electronics; Dr. Ira Johnson, Mankato State College, director for metals; Dr. John Lindbeck, Western Michigan University, director for design-drafting; Warren Smith, Nova Education Center, director for power; and Harold Mehrens, Kennedy Space Center, technical assistance and speaker-demonstration arrangements.

The first release of the curriculum document, Industrial Arts and Space Technology, was in offset form and was distributed to those who were original participants in the space conference. The document now is being printed by the US Government Printing Office for international distribution. Over 40,000 copies will be printed. Official release was scheduled for the 1967 AIAA Convention, but art work and other contracts have delayed the publication. All industrial arts personnel will receive a copy shortly.

NASA has been most complimentary about the curriculum document. A 28-minute NASA film, "The Big Challenge," has just been released and is suggested as an introduction to a space program. The film contains many scenes showing the construction and development techniques related to the inception and building of the moon port. NASA has announced also that it is preparing an educational unit for each instructional area in the curriculum document. The first unit, already in production, will be on power. It will contain a short film, technical data sheets and other instructional materials.

This project is an important contribution to the progress of industrial arts curriculum development.

Dr. Steeb is a state supervisor with the State Department of Education, Tallahassee, Fla.

THE CURRICULUM DOCUMENT ORGANIZATION

John L. Feirer

It has often been suggested that, if industrial arts is to survive, it must literally hitch its wagon to a star. The opportunity to do just that was provided when the National Aeronautics and Space Administration (NASA) invited a group of 75 indstrial arts educators from the southeast part of the United States to participate in a tour and conference at the John F. Kennedy Space Center. The conference had two major purposes. The first was to show the relationship between the Center's activities and those of the industrial arts laboratories and shops. The second, and perhaps most significant, was to produce a bulletin entitled "Industrial Arts and Space Technology". In planning for this conference, which incidentally lasted only three days, it was necessary to carefully outline the general contents of the bulletin so that the most efficient use of the teachers' talents could be made during the time they were at the conference.

As a first step, a board of directors was selected to coordinate and supervise the activities at the conference. These directors were also held responsible for the preparation of the material for the final bulletin. The chairman and the five directors as a report team met last year at the AIAA Convention in San Francisco and developed the tentative outline for the bulletin.

It was decided to develop the bulletin in three major sections. The first would deal with the overview of the space industry—its products and materials—and a study of aerospace occupations that were directly related to the basic areas of industrial arts. The second would attempt to show how aerospace activities would be applied to the basic learning units in each of the standard areas of industrial arts as they are commonly taught throughout the United States. Each director was responsible for bringing to the conference a list of learning units in each of the basic areas that are taught. The second section of the bulletin was developed in a parallel column format with the typical learning units in the left-hand column and suggested aerospace activities in the right-hand column. In this way, the teacher could use as much or as little of the suggested materials as he wanted to. It was pointed out in the bulletin that this was a resource unit and not a course of study in space technology.

The third section emphasized new directions in industrial arts. It shows how experimental type classes that make in-depth studies of industries, studies of materials, research and development of products, junior engineering, mass production and others could utilize the bulletin material.

The final publication will be available to all industrial arts teachers sometime in May. However, the bulletin will be of value only if it is utilized by industrial arts teachers, supervisors and teacher educators across the United States. It is interesting to note that this bulletin, developed in the relatively short period of about three months, is serving as a standard for others like it that will be produced by NASA in such academic areas as chemistry, biology, etc. To implement the bulletin, it will be necessary to develop many in-service education programs so that teachers can update their programs by utilizing material available from aerospace industries and from the National Aeronautics and Space Administration.

Several suggestions are listed in the bulletin on how teachers may make efficient use of this publication. They include:

1. A self-improvement program which involves collecting a variety of materials on space technology.

2. A school improvement program in which the teachers in industrial arts, science, math and the guidance counselors work together to improve the total school program in light of the scientific and technological program related to aerospace.

3. Through professional improvement programs including in-service workshops, NDEA institutes, research, etc.

Space is the new frontier of science and technology and, if industrial arts is to give students an insight into American industries, teachers must be much more concerned with space age technology. The image of industrial arts will be greatly improved in the eyes of students, parents, administrators and the lay public when the teachers utilize the bulletin "Industrial Arts and Space Technology."

Dr. Feirer is head of the Dept. of Industrial Education, Western Michigan University, Kalamazoo, Mich.

AEROSPACE ELECTRICITY AND ELECTRONICS

George H. Ditlow

The use of electricity and electronics in the space age has completely changed our technological society. So comprehensive has been this development that it can be compared to Franklin's initial discovery of electricity and its effect upon people who lived in that era. It has been said that the computer and data processing have been the culprits of this significant development. Nowhere but in our space program are we so completely dependent upon the electrical impulse to provide the power, control and communication necessary for man to achieve new horizons in the exploration of space.

The computer, with its ability to process data, has become a monster to technology. Some say we find it difficult to get to know, and yet we cannot do without it. The electrical concept behind the computer is so simple. It is really nothing more than a series of lights, switches and circuits which are either on or off. The application of the binary number system to this principle makes the whole concept function.

It is not the intent here to dwell upon nor immortalize the computer. It is most significant to note, however, that our society is experiencing a complete readjustment through the mechanics of the system. Let us examine a few of these:

1. We are all destined to be a Social Security number. Originally this was merely applied to our pay check and to the income tax statement. Some of us never received a number until we worked. Now the trend is to assign a number to all new babies as soon as they are born. This number will be used for identification the rest of their lives. Insurance policies, bank accounts and license numbers have suddenly included your Social Security number.

2. Production lines and machines are being controlled by punched cards. Quotas, quality and established standards are being cranked out by machines, with the talents of man being deflected from production of goods to production of cards and programming of the machines.

3. Transportation systems and vehicles are being completely automated so that pilots,

engineers, operators, etc. are becoming increasingly accustomed to reading and interpreting data from dials, meters and instruments, while spending fewer and fewer of their physical talents in manual manipulation of controls which were formerly lever- and cam-activated but now have become servo-hydraulic driven.

4. School curriculum changes are taking place to include electronics as part of the broad field of communications, which formerly included grammar, English and the traditional written skills. Today's programs include studies of intellectronics and astrionics, which are just as basic to communication as the written word. It is merely the means of reproduction or transmission which has been added.

These are but a few of the changes. With them have come an entire new complexity of job specifications and requirements. At the same time we are taking the electricity- and electronics-powered and controlled mechanisms for granted, there has arisen the need for technicians to design, construct and service them. Behind almost all industry today you will find a built-in core of technicians, all electronically-oriented to keeping the systems in a "go" or "on" position. Much of the thinking, analyzing and comparing of data is being done after dark behind closed doors, with few people involved in the process.

Yes, the space age is intriguing and mystifying; but at the same time it presents a real challenge. NASA has recently published two books of interest to those who wish to explore the relationships between programs in industrial arts and technology and the space age programs. I refer to (1) Industrial Arts and Space Technology and (2) Seven Steps to a Career in Space Science and Technology. May I suggest that they become a well-used portion of your school library, instructional materials and guidance centers?

Dr. Ditlow, Convention Manager of AIAA, teaches at Millersville State College, Millersville, Pa.

AEROSPACE DESIGN AND DRAFTING

Dr. John R. Lindbeck

The products used by people every day are designed, planned or invented by someone. They don't just happen all by themselves. The same can be said of the products of the aerospace industry. Much research and human effort must go into the careful planning of all the many intricate components used in space travel. The purpose of this presentation is to examine some of the kinds of drawing and design problems associated with space travel which might be utilized and examined in the school. Obviously, it will be difficult to engage the pupils in precisely the same kinds of research and development efforts as one would expect to find in the space industry. However, there are many aspects of these developmental programs which can make interesting related information topics and in some cases can provide the impetus for some valuable introductory designing experiences.

To begin with, the process used to plan a coffee table, a footstool or a transistor radio case is essentially the same as that utilized in the space industry. First of all, one must state the problem or establish a goal. The second step or phase of the work is to think very carefully about the requirements of this problem and to analyze it from all points of view. One must give prime consideration to questions of function. What exactly is the device supposed to do? How long must it be able to function? There are also questions of materials to be considered, and these are somewhat related to the matter of function. Must this be made of a very strong material which will last for a long time; or can it be a weaker, less expensive material? Must it be waterproof, antimagnetic or shockproof? Must it be heat resistant? Must it be pliable or firm, fireproof, odorless, tasteless, or just what? These are problems concerning materials from which the object is to be made and must be given careful consideration in the analysis phase.

A third question may or may not have any bearing on the problem, and this is very simply the matter of appearance. Does appearance play a very important part in this product? Generally, we think of appearance as being only important if we have to sell this product to somebody else. For example, a solution to a chair design problem might turn out to be very ugly. Now in order for this product to be a success—a salable success—one has to reconsider its appearance in order to make it more pleasing to the user. However, appearance may also be very important to an astronaut in a space capsule. If he is going to be confined to a cramped enclosure for long periods of time in travel through space, it would very probably be important for him to be surrounded by things that are pleasing to look at, rather than ugly. So it can be seen that appearance can become a very important factor in design analysis. On the other hand, however, the design of a weather satellite would require that absolutely no attention be given to its aesthetic appearance, since once it has been launched, it will never be seen again. Consequently, its design requirements are primarily functional and material. However, a purely functional design reflects some rather interesting and pleasing contours; the space capsule itself, as well as the Saturn flame deflectors, are two examples.

The next step is to prepare some sketches of possible solutions to your problem. Here, particularly, is where the matter of appearance comes into play, because one is sketching what the product is going to look like. One might also have to work out some problems of function in order to make it work properly, and also give some consideration to the ways in which components may be joined. Simple sketches are adequate here, but one can spend more time if desired in preparing some rendered drawings of the objects. The next phase of the work might involve some simple experimentation or trying out of some of the ideas and materials. Make a model of it or a mockup of a part of the apparatus, or make a full-scale working model. It should be understood that ultimately, in all design problems, it will be important for models to be made.

The last phase of the work is the final solution to the problem. These should be carefully done working drawings or sketches which will serve as a guide to the person or persons who might make this device. This very simply is what the design process entails, and it is obvious that it can operate in both the school shop and the aerospace industry. There are a number of ways of approaching this matter of design in aerospace work in order that the student may understand just what happens and can appreciate the magnitude of the undertaking. Two ways are suggested:

1. To have the teacher discuss and explain how some of the very interesting, complicated and sophisticated aerospace products were designed. He could make a very interesting story about the specific needs of the self-maneuvering unit for moving about in space and then set out to describe the problems faced in the design and the eventual product that evolved from this undertaking. There is a great deal of literature available from NASA which would serve as an informational resource for the teacher, covering a wide range of topics.

2. The second way is to have the student actually involve himself in some kind of designing activities. As an example, one student or a group of students could be given the problem of designing tools for repair or assembly operations on space vehicles during actual flight. Obviously, this would lead to a consideration of many sub-problems. For example, when energy is applied to components of a weightless space vehicle, such as turning a bolt with a wrench, the vehicle itself will react by turning if sufficient pressure is exerted. This problem can be likened to trying to drill a hole in a tennis ball while it is floating in a pail of water. Also consider the problem of collecting the chips. There is also the matter of tool slippage under excessive pressure. This, of course, could result in a serious problem, especially if it is released from the user's hand. Further, there is a variety of tools required for a single repair operation, and these must be secured by some method when not in use. Magnetism may be considered, as well as a number of other possibilities. One could also engage in the design of control panels for moon vehicles which will show dial indicators, operating levers, etc. They would have to guard against accidental switch engagement and the possibility of using different shapes of knobs and levers. Now, again, one could secure much related information from NASA. One could go on and list a number of other possibilities for space-age design problems, but these will serve as examples. Obviously, one of the points that has to be considered here is the age and intellectual maturity of the group. They may not arrive at any satisfactory solutions to these problems; or if they do arrive at some kind of solution, it won't be a very sophisticated or a very meaningful one. But one thing they could learn from it is the fact that a great many factors must be focused upon the nature of problems for travel in space, for photography in space, for living in space. And the reason for this is quite simple: much of this activity and research is a pioneering effort and a great number of the solutions to these design problems are based on theory, and it remains for them to be tested and practiced in space.

With respect to drafting as such, and its relationships to aerospace industry, there is little real difference between aerospace drafting and drafting done by any other kind of industry. There is still the matter of visually presenting and describing shapes of objects. And then there is the second problem or issue of describing the size of the various components. But where we can do a service to achieving aerospace literacy in the drawing course is to make use of some meaningful drawing experiences which would bring them into contact with parts of space vehicles. For example, many of the NASA Fact Sheets and NASA Technical Briefs illustrate interesting check valves and thermo-motors and special friction-locking devices and the crawler-transporter unit and hundreds of others which could be utilized as drawing problems. One could make a regular multiview, perspective, or isometric drawing of these objects rather than fractured blocks, or c-clamps, or special motor-mounting brackets. As stated previously, there are many kinds of illustrations available in the hundreds of NASA publications. Wisely selected and wisely used, they can provide a simple vehicle for involving the student in aerospace drawing.

In closing, it can be said that aerospace design and drafting provide a number of very stimulating and fascinating opportunities for the students in the school. We in industrial arts would do well to investigate some of these many potentialities.

Dr. Lindbeck is on the faculty of Western Michigan University, Kalamazoo, Mich.

A SPACE ORIENTED UNIT IN METALS

Dr. Ira H. Johnson

Industrial arts metals and Space Age metals are compatible technologies. I start with this statement because in many, perhaps most, instances the casual and uninformed person assumes that the Space Age has, of necessity, discarded the so-called "old fashioned" metals and the usual fabricating methods, and in their place has substituted new and exotic materials and super-secret production techniques.

Actually metals do play an overwhelming role and are basic to all phases of the Space Age. NASA (National Aeronautics and Space Administration) lists, for example, aerospace metals as a separate and important employable occupation. The VAB (Vertical Assembly Building) is the world's largest building (52 stories high, covering 8 acres and having 45-story high doors) and is where a totally new concept of Space Age assembly is emerging. It is essentially an all-metal structure. In addition to this building, many other ground support facilities—the mobile Apollo launch platform and its integrated crawler/transporter, the many gantrys and umbilical towers, the liquid fuel and purging gas storage tanks, the framework for the flame diverters and the literally thousands of other items required for a successful launch—are, for the most part, fabricated from a variety of metal components. Perhaps even more significant is the fact that the actual spacecraft and its expendable launch vehicles are, to a substantial degree, of metal construction. Even the light-weight and crushable pads that will permit the LEM (Lunar Excursion Module) to land safely on the moon are made of aluminum. Yes, metals are necessary in the Space Age and we can, with proper emphasis, use the concepts to motivate industrial arts students and enrich the content of our industrial arts metals classes.

This NASA publication which all of you now have available suggests a possible procedure for implementation of such a metals program. It was prepared by first developing an extensive and comprehensive outline of the metals area—materials and processes. Then after visiting the space center at Cape Kennedy, discussing with NASA personnel all possible facets that were pertinent and researching the wealth of NASA publications dealing with metals, concepts quickly emerged which permitted examples of appropriate Space Age metals to be "plugged into" their respective places in the outline. Without exception, there was an abundance of material for every phase of the metals technology.

One factor, however, did become increasingly evident, namely, the rather unique and stringent requirements of the Space Age which necessitate new techniques and materials and/or extensions of existing ones. This is an area where I think industrial arts must react, if it is to be more fully representative. And reacting it is. One of the exhibitors at this convention has available an EDM (Electrical Discharge Machine) designed especially for use in industrial arts. A year ago at the AIAA convention in San Francisco, an industrial arts student described his successful experiences with explosive-forming, and the testing equipment of a type that is basic to much of the "zero defects" program of NASA has been available for quite some time through distributors selling industrial arts equipment. Examples? Yes, but more than that, they represent concrete evidence that industrial arts is on the move, using techniques that are definitely Space Age-oriented.

Metals, as defined by NASA rather than by Webster, can, if properly promoted, provide each industrial arts student with real motivation as long as there is any space left to conquer. This, then, is truly the perpetual growth we can expect of industrial arts—Space Age-oriented metals.

Dr. Johnson teaches at Mankato State College, Mankato, Minn.

INDUSTRIAL ARTS AND SPACE TECHNOLOGY—POWER

Warren Smith

The group of teachers selecting "power" as their area of concentration chose to combine several existing courses of study in order to have a complete sequential list of learning units. It was agreed that our task was to relate space processes and developments to existing curricula; rather than to develop a new one.

It was further agreed that we would treat those processes that relate to existing high school curricula, rather than to go deeply into new and innovative areas of concentration.

Several texts and courses of study were used as guides in developing the list of learning units. Participants then were asked to find space related materials, processes and developments as they toured the Cape and the industrial support facilities. Each participant was asked to review the mass of NASA-printed material on hand and to make note of each as it related directly to one or more of the learning units.

First appraisal seemed to indicate very little relationship between the simple forms of power generally studied and the very complex power units of space vehicles, but as we visualized and imagined, many close relationships appeared. An example would be in assembly and disassembly. It was suggested that as a teacher was presenting the unit, he might have each student analyze his movements on the ground in loosening or tightening a nut and then imagine the task when suspended in space outside a space capsule.

One practical application led to another. The section on power includes only a few, but these should be sufficient to motivate the progressive teacher to visualize many others.

Many NASA publications are listed in the bibliography and short synopses are included in their relative position to the learning unit. It is believed this double system will facilitate usage of these very vital and valuable materials. The availability of these types of materials may prove to be the answer to the inquisitive, provocative youngster who quickly completes the "required" work and looks for additional horizontal material.

Several suggested demonstrations have been included, such as the one on the effect of reduced or increased oxygen in internal combustion engines. An attempt was made to keep such demonstrations limited to the materials and equipment readily available in the school laboratories. Again, one idea led to another, and I'm sure there are many additional ideas waiting to be explored. The manual should serve as a catalyst rather than as a Bible.

An attempt was made to accentuate the importance of problem-solving to the space program. Listed are several problems and the NASA solution. These should serve further to stimulate the teacher and the student to seek better means of understanding through analysis and conclusion.

Graphic arts was represented by only one participant. Its role in the NASA program fits into two main categories: printed instructional and informational material and support equipment in the telemetry program. The latter appears to be most appealing. In the manual, several unique uses and techniques for cameras are explained, such as their use during launch, to visibly record any slight deviation from expected performance. This evidence would be invaluable in case of malfunction. Launches are recorded at about 2,000 frames per second, which is ultra-slow motion.

Mr. Smith is at the Nova Education Center, Fort Lauderdale, Fla.

WOOD, CERAMICS AND PLASTICS IN SPACE TECHNOLOGY

Dr. Thomas J. Brennan

When one makes a trip around the space port at Cape Kennedy, he is immediately impressed with the lack of anything that resembles wood in any of its many forms. To be sure, there are the usual wood construction materials, such as cement forms, two-by-fours and so on. However, even these are not as much in evidence as one might suppose in an area where there is constant construction. Even the ladders are mostly aluminum or aluminum alloy. There will be only incidental equipment which will make the trip to the moon which can boast of wood components.

In searching at the space port for wood-working experiences which are typical both in industrial arts and space technology, one is bound to be disappointed. I remarked on this to our guide, and he pointed out one very important fact. This space port is the pay-off area. It is here that all of the space technology reaches its culmination in the actual blast-off. This is not a typical place to visit to see all of the technology which is necessary to get that great silver bird off the pad. In the matter of woodworking experiences, perhaps no other industrial arts area has as much duplication between typical industrial activities and space technology. Almost every piece of equipment has been developed, at some stage, through the use of wooden models. The space capsule itself has been duplicated literally hundreds of times in wood during the various stages of experimentation. Obviously it would be much too expensive to use actual capsules for many of the dry runs which are required before the model ever becomes operational.

Behind the space port are literally thousands of industrial enterprises utilizing wood and wood technology to the fullest. There isn't one woodworking experience common to industrial arts activities which isn't duplicated at some time in space technology. The text provides numerous illustrations showing this concept.

Just as one is impressed with the lack of wood in evidence at the space port, one cannot be unimpressed with the mammoth use of ceramics materials necessary to put a capsule into orbit. The launching pad is massive and made almost exclusively of concrete, a ceramic material. The fire run-off channels under the launch pad, designed to carry off the flames of combustion so that they will not destroy the launch mechanism, are constructed of millions of fire bricks. While these units are massive and overwhelming, still some of the smallest units in the telemetry system and in the instrumentation depend on ceramic components. Certainly the ceramic insulators required to bring the fantastically heavy electricity supply to the space port are a product discussed in the industrial arts ceramic laboratory. While there is little in evidence which seems to duplicate the typical pottery wheel, one is literally surrounded with ceramic materials, a knowledge of which will go a very long way in implementing the study of ceramics in the industrial arts laboratory.

The space age would probably still be limping along if it had not been for the ability of ceramic products to absorb intense heat and still maintain their original shape. The nozzles of certain missiles are still constructed of ceramic materials to withstand the intense heat of re-entry. Liners of jet engines, the forerunners of the hugh Saturn engines used on the Apollo space vehicle, were ceramic. Even today, ceramic materials are bonded to extremely tough metals to form the liners for some of our most sophisticated space power plants.

It is probably in the utilization of plastics products where the space industry has reached some of its most sophisticated development. Such prosaic uses as plastic eye protectors which are in evidence at every turn on the space port, plastic knobs on almost every piece of equipment, and plastic bezels on almost every instrument are commonplace. However, some exotic uses of plastics are in evidence as well. Take, for instance, the thin plastic coating which one finds on the ends of electricians' pliers in the typical industrial arts laboratory. At the space port, the same process of application, which can be performed in the industrial arts laboratory with very simple equipment and with very little outlay in either equipment or supplies, is utilized to counteract one of the most persistent enemies of the space team. Our space program early decided to use the vast expanses of the ocean as its potential landing area for capsules which re-enter the earth's atmosphere. In order to do this, it was necessary to locate the space port on the shores of the

Atlantic Ocean. This location has caused the worst enemy of the space program to be corrosion. At the Cape, everything must be protected from the elements, and particularly salt corrosion, which comes from the very moist air along the ocean. A whole army of technicians is constantly employed to search out places where corrosion is starting, to clean the area, and to add protective coatings to help eliminate a recurrence. The service towers are particularly susceptible to this corrosion, since they are located at the water's edge. One of the main reasons for the construction of the huge vehicle assembly building was to keep corrosion to a minimum during the servicing of the launch vehicles. Small nuts and bolts, which traditionally have been the source of much corrosion, are often coated with a plastic which is applied by the air diffusion process. This is the same process which is used to coat the electrician's pliers, to cover base metal with an attractive plastic coating and numerous other industrial applications. The process as done in a school shop consists of heating the material to be coated to a predetermined temperature, then immersing it into a bath of plastic particles which are being "floated" by passing a small current of air through them, usually from the bottom. The plastic is milled extremely fine, and the particles actually look as if they are a bubbling liquid. This gives the name to the process which usually identifies it—fluidizing. The heat of the article is sufficient to melt the plastic so that a thin coating adheres to the surface. This coating, when it completely encases the article, keeps it free from corrosion, since it completely seals off the electrolytic action of the salt water.

By far the most important utilization of plastics in space technology is in the heat shield which covers the end of the Apollo capsule, which bears the brunt of the forces created upon re-entry into the earth's atmosphere after a successful flight. The capsule will be exposed to temperatures of 200 degrees below zero in space, but will have to withstand heat as great as five thousand degrees Fahrenheit upon re-entry. The substance selected for this job is a phenolic resin, an epoxy, which is a plastic substance. It is held in place on the capsule in a honeycomb formation made of fiberglass, a combined plastics-ceramic substance. As intense heat is generated, part of the plastic-fiberglass substance burns off—ablates—carrying off with it some of the heat. This heat dissipation is extremely important, since it does not permit the heat to penetrate into the capsule to any harmful degree. As it ablates, it goes off into the atmosphere, where it is consumed. Perfection of the heat shield was the result of intensive research for a number of years. It possesses all of the features which make it an important area for study in industrial arts laboratories.

From what you have heard from my colleagues on this most interesting experience and the little I have been able to give you, I feel certain that you will agree with us that space technology is extremely important, that it can be relatively easily interpreted in the industrial arts laboratory, and that in the future it should become an important aspect of the industrial arts program in the schools.

Dr. Brennan teaches at the University of West Virginia, Morgantown, W. Va.

F-12.3 ACESIA
Special Panel Session
ELEMENTARY INDUSTRIAL ARTS—SHOW ME THE WAY
Gen. Chm., Eberhard Thieme; Chm., Al Wutti; Rec., Earl R. Zimmerman; Obsr., Vito Pace; Panelists, Franklyn Ingram, C. Huntley Hilliard, Elizabeth Hunt; Hosts, Harold Gilbert, John Nidzgorski.

ACTION RESEARCH IN INDUSTRIAL ARTS

Dr. Franklyn C. Ingram

This study sought to determine whether the introduction of elementary school industrial arts into regular social studies units, in grades four through six, would have an effect on social studies unit concept learnings. While social studies concepts were expected to improve, it was hypothesized that there would also be an improvement in silent reading comprehension and work study skills; these were not, however, a direct part of the social studies units.

There were three fourth, four fifth and two sixth grades participating in the study. Approximately 250 children in the Bald Eagle Joint School District, Centre County, Pa., participated during the school year 1964-65.

Each class participating studied two social studies units, one by usual methods, one incorporating elementary school industrial arts. All classes at each grade level studied the same two units for the same length of time. To control the influence of the independent variable on pre-test scores of each class, control teaching preceded experimental teaching. Fourth grade units were six weeks long, fifth and six grade units were four weeks long.

While engaged in experimental teaching, each classroom was equipped with necessary tools, materials and a portable workbench. The specific elementary school industrial arts activities incorporated into each experimental unit were developed during a twenty-five-hour workshop for participating teachers, prior to teaching either unit.

In addition to social studies unit concept tests prepared by the researcher, data for silent reading and work study skills were obtained through administration of the Iowa Every-Pupil Test of Basic Skills, Tests A and B. The Elementary Battery was used in grade four and the Advanced Battery in grades five and six. Alternate forms of each test were used for pre- and post-testing.

A questionnaire was developed to gather information relative to student attitudes toward each of the units studied. This questionnaire was a simple interest inventory, in two parts, each containing approximately 20 items. One form asked whether the student "Had no fun" or "Had lots of fun"; the other solicited responses as to whether they had "Learned almost nothing" or "Learned a lot" regarding the items presented. Appropriate forms were administered following each of the units.

A test of homogeneity of mental ability was made between groups at each grade level. Criterion used was intelligence quotient, measured by the Henmon-Nelson Test of Mental Ability. Adjusted mean square data was used for non-homogeneous groups obtained by technique of covariance. Raw score data using a "t" test were used for homogeneous groups.

Based upon the analysis of data the following conclusions were made:

1. The incorporation of elementary school industrial arts into four- and six-week social studies units in grades four, five and six did not prevent, as measured by social studies unit concept tests, significant learning in social studies.

2. All experimental groups studying the social studies units incorporating elementary school industrial arts improved their silent reading comprehension and work study skills during the period of the study, although silent reading and work study skills were not a direct part of the units.

3. Students studying the social studies units incorporating elementary school industrial arts indicated that they "learned a lot" and "had lots of fun". There was a highly significant difference favoring the experimental unit incorporating elementary school industrial arts.

4. This study indicated that learning can be fun, in the view of the learners, at no expense to achievement in unit concepts and in silent reading comprehension and work study skills when elementary school industrial arts is a part of a social studies unit.

Dr. Ingram is coordinator of Industrial Arts for Elementary Grades, Indiana State University, Terre Haute, Ind.

SIXTH GRADE MASS PRODUCTION ACTIVITY

C. Huntley Hilliard

For sixty minutes per week, from the opening of school until the beginning of Christmas vacation, the sixth grade at Gilman is busily engaged in the production of fifty toys which are given to needy children at Christmas time. The recipients of the toys are the nursery school children of a Baltimore community center which operates in a povertystricken area.

Limited working time imposes the necessity of a teacher-developed toy design. The design must provide for as many machine operations as possible, within the capabilities of sixth graders. It must also be possible to divide into numerous simple ones the operations involved in the manufacture of the toy.

As mass production of the toys is facilitated, each youngster works at a different repetitive task during each work period. This makes it possible for each boy to have a variety of experiences as well as to repeat one operation a number of times. Some individuals become bored with the repetition. This opens the way for discussion which is directed toward appreciation of the production worker's contribution to society.

The teacher makes a conscious effort to guide the participants toward observation of the following as production progresses:

1) the efficiency of collective effort.
2) the manufacture of interchangeable parts.
3) the advantage of executing simple operations on a repetitive basis.
4) machine tools speed up production.

The efficiency of the mass production procedure is readily observed by the pupils, because they have previously fabricated items on an individual basis.

Through readings, discussions and presentations, the historical development of mass production is generally covered. It is pointed out that the basic principles adhered to by pioneers in this development are still employed today. However, the complexities of procedures have increased considerably.

When the toys are completed, four of the sixth graders accompany them upon delivery to the nursery school children. They present the toys to the children and visit with them. It is then their responsibility to make a report to the class of their visit. They are also required to find out all that they can about the work of the community center and report this to the class.

These reports and the discussions which follow are an important phase of the activity. It is intended that the youngsters become aware of the circumstances of children who are economically deprived.

The activity, then, is a social studies as well as industrial arts activity. The purpose is twofold – hopefully to develop in youngsters some understanding of industry and consideration for fellow human beings who are less fortunate.

Mr. Hilliard teaches at Gilman School, Baltimore, Md.

THE INSTITUTE OF TECHNOLOGY FOR CHILDREN

Elizabeth E. Hunt

The Technology for Children Project began with the 1966 Summer Institute of Technology for Children held at the Helen L. Beeler School in Marlton, N.J.

This Institute was initiated through the Division of Vocational Education of the New Jersey Department of Education and was funded by the Department of Education.

The Ford Foundation and the New Jersey Department of Education are jointly funding the Technology for Children Project, which is a continuation of the work started in the summer institute.

It is continuing in this way: the twenty-two elementary classroom teachers who attended the summer institute are now in their own classrooms implementing, with the assistance of a project staff, the kinds of activities they observed during the summer. These teachers and the project staff constitute the nucleus of the Technology for Children Project.

The initiation of this project was born of a deep conviction that every elementary school should provide maximum opportunity for boys and girls to interact with tools and materials, or, to put it another way, to interact with those things which are of technology.

Why should every boy and girl have an opportunity to deal with tools and materials?

Three major categories of ideas may help provide an answer to this question. These categories might be entitled: 1) a theoretical base, 2) a rationale for a mode of operation, and 3) a focus on the output.

Let us look at some of the ideas which constitute the theoretical base for the project.

The first idea has to do with motivation. The human organism, according to R. W. White (9, p. 318) is motivated to "interact effectively with his environment". This is motivation which manifests itself in exploratory, manipulative and activity behaviors. The behavior is characterized as intense and persistent. The exploratory behavior manifests itself as a drive to respond to all kinds of stimuli—auditory, tactile, visual, kinesthetic, olfactory and gustatory. Montessori (7, p. 185) would include the thermic, baric and sterognostic (which is recognition of objects through feeling with the simultaneous help of the tactile and muscular) senses. This motivation appears to be neurogenic. That is, originating in the nervous system. It is an "unlearned" pattern of response. This theory, supported by research, is far more adequate in explaining some readily-observable behavior of children that could not be explained by the earlier models of motivational theory, which attributed all behavior to either painful stimulation, homeostatic needs, sex, or by acquired drives based on these.

J. M. Hunt (7, p. xxvii) proposes "a mechanism for motivation inherent in information processing and action". This mechanism (as explained by Hunt in several of his more recent writings) provides.... "a basis for continuous cognitive growth with joy. It also justifies the older notions that children have a spontaneous interest in learning."

The second idea is closely related to the first. As a result of this "spontaneous interest in learning", children show an impressive record of accomplishments before they ever come to school. What are their achievements? The human organism has learned, at the immature end of the growth continuum, to roll over, sit alone, crawl, pull itself to a standing position, walk, run, grasp objects, let them go, walk upstairs, eat with utensils, ride a tricycle and many other motor acts. One outstanding accomplishment is the mastery of the ground rules of a difficult natural language. Professor Omar K. Moore (5, p. 106) of Yale University calls this a "task of almost unbelievable complexity". We have further evidence that if a child happens to live in a multilingual environment, he will learn much more quickly and easily than adults to speak the languages involved.

The third idea is closely related to the second. Situations which restrict or otherwise deprive children of interaction with the environment (either concrete or abstract interaction) affect the development of intelligence adversely.

This concept recognizes that intelligence is not fixed, as was once assumed. J. M. Hunt (4, p. xxv) says:

"...relevant to the role of early experience in psychological development. During the earliest phases, the longer a developing organism is deprived of a given sort of experience, or to put it another way, the longer an organism is deprived of a given kind of informational interaction with the environment, the more likely is the effect of that deprivation to become permanent."

Glenn Doman (3, p. 37) puts it this way:

"It is during these not-to-be-relived years, these years of insatiable curiosity, that the child's whole intellectual being will be established."

George B. Leonard, (6, p. 24) Look magazine's senior editor, synthesizes these ideas so aptly:

"When a child, age five, enters school, he is a learner of awesome speed and staying power. Many of his reactions are quicker, his perceptions finer than yours and mine. He is a tireless explorer, a spontaneous scientist and a recent veteran of our species' most impressive feat of learning: the mastery of the spoken tongue. Some experts have called his attention span short, but they are wrong. The young child is learning practically all the time. He becomes impatient only because the traditional school situation is dull, unnatural, adult-centered and child-confining.... Today, a growing number of educators are rediscovering old truths: Education is not the process of filling a child's head with facts while restricting and reducing his activity. On the contrary, the moment of learning is active, intense and often joyful. To find it, you look not at what the teacher is saying and doing but at how the child is responding. Such responses, such moments are the real stuff of education. Through them, the child develops relationships with the world, not just the ABC's of it but all its tastes and textures."

It is interesting to note, Maria Montessori demonstrated over and over, that intellectual mastery is rewarding, joyful. The excitement of discovering relationships, or of discovering the key to control or mastery was evident when her children, ages four to five, without having been taught how to write, "burst spontaneously into writing". (7, p. 28) Extrinsic rewards and punishments become superfluous. This ties in with the first idea concerning motivation (9, pp. 317-318). Jerome Brunner (1, p. 89) says:

"I should like to add to White's general premise that the exercise of competence motives has the effect of strengthening the degree to which they gain control over behavior and thereby reduce the effects of extrinsic rewards or drive gratification."

The foregoing ideas form the theoretical base out of which the design for the 1966 Summer Institute of Technology for Children evolved, and this theoretical base applies to learning in general.

However, because this theoretical base so aptly describes and so closely resembles the learning situation created for a study of technology, with its ample opportunities to "interact with the environment", we should not be too surprised to find that we have had or will have an enormous influence on all areas of learning, including those of the established elementary school curriculum.

One purpose of the 1966 Summer Institute of Technology for Children was to explore the potential of this theoretical base, and, in addition, to try out the rationale we had developed for a mode of operation with the children. This is the rationale: The products of technology are the results of man's ability effectively to think about and deal with the physical, material world. It is verily a human endeavor. Our attempt, therefore, would be to help the child develop effective ways of thinking about and dealing with these materials. "Design" is an effective way of thinking about materials. Fundamental to being able to think about materials effectively or to develop a design, one must have some basic acquaintance with the properties of materials, the use of tools to extend the human powers and be able to measure things. These four items, then—design, properties of materials (macroscopic), the use of tools to extend the human powers and instrumentation— became the four themes for the Institute and our guidelines for developing activities with the children. This meant, for example, that the solutions to such problems as creating a better home for Noel, the hamster, were developed on the spot with the children. In developing the solutions they had to think about a design criteria. In the case of the hamster, he should be able to see out, and the children should be able to see in. He should have plenty of fresh air. There should be a convenient way to clean the cage. It should be large enough to contain the hamster with room to move around, hold the water and food. It should be enclosed and strong enough so Noel would not be able to get out. The children would decide on material, size in three dimensions, and how to proceed in putting Noel's house together. I must say, with very limited experience in the use of tools, with properties of materials and measurement, this was a difficult design problem for these children ages four to seven, and they needed much help in developing solutions.

Operating on the theoretical assumptions and rationale just outlined above, I opened the 1966 Summer Institute with these remarks to the Institute staff and the 22 observing elementary classroom teachers:

"We have no preconceived notions of what the children will learn here. We feel, however, we know how to enhance the learning environment and guide them in their interaction with the environment. In other words, we have no prepared curriculum, no specific content to be covered, we have named no specific skills or understandings to be developed, have no stated objectives for these children, no plans for motivating them (as if we could). We offer them, instead, a rich environment, and our guidance in interacting with it more effectively. We also reserve the right at all times to initiate ideas for interaction with the environment."

This is going at the "teaching-learning" process in reverse. That is, the "content" is developed uniquely with each child. His own sensory experiences, his own personal exchange of ideas, and his association with others become his content, to be revised, to be reorganized, to be categorized by him as a part of his developing intellect.

Some terrific studies have been and are now being carried out to identify industrial arts content. The results have been some fascinating conceptualizations of the whole body of knowledge as well as what has been delineated and labeled the content of technology or industrial arts. This is like refining ore and coming up with gold.

However, I believe this "gold" represents a point of arrival for the scholars involved in delineating the content – not the point of departure for teaching children. This is not to say a teacher can do without a map of the body of knowledge as a whole or of his specific field. Such a map is vital. This is "raw" content, however, and not ready for consumption.

During the Institute, when developing the designs for the playhouse, "the general store", the prairie schooner, etc., the solutions came much more easily. However, not all of the activities were presented as problems to be solved. They made paper, crystal radio sets, telegraph keys, printed by using ABC blocks, real type and the liquid duplicator, with which they ran off copies of their own stories with their own illustrations. They explored a cut-away model of a hydraulic braking system, the insides of a camera and clock, lifted each other with a two-pulley system, jet-propelled a piece of wood with a balloon, popped corn and shaped plastics into dishes for the playhouse. They were visited by a man from the telephone company who showed them the equipment used on the job, the inside of the telephone, explained the safety precautions he must take on the job, put on the spurs and climbed the pole.

Among other things, these experiences provided the children with opportunities to act upon a responsive environment, and/or provided them with a tremendous amount of sensory data input about the properties of the materials.

The children liked the Institute very much. They often came an hour before the Institute started and would hang around long after it was officially over for the day. The parents told us how much the children enjoyed it.

When I report this in a presentation, I always have the feeling that there must be some unrelenting academicians in the audience who are thinking to themselves, "Enjoyed it! So what?"

This is the "so what" – a focus on output. (May I say, parenthetically, we are all too prone to invest our energies on the input. The well-analyzed content, the carefully-thought-through lesson plan and a good presentation – and it ends there.) During the summer institute each observing elementary classroom teacher kept an anecdotal record of one child during his entire stay (22 days, 66 hours) in the institute.

I asked each teacher to choose some facet or area of the curriculum and to analyze his/her record in terms of the child's encounter with this facet or area. Remembering that the focus of the institute was primarily on "interacting with tools and materials", I submit the following excerpts (4) from the abstracts of the anecdotal records.

The first excerpt was analyzed in terms of vocabulary development from the anecdotal record of a four-year-old.

"Reading, reading, and re-reading Laurie's anecdotal record has been a revelation to me. While she seemed to be ever flitting about on high heels or changing shoes, occupying the doll corner, or coloring, it is surprising to see how her vocabulary has expanded.

"Here are some pertinent words that I have followed through to show how Laurie has grown:

"Handles – Laurie's idea was about handles on pots and pans. Here she made handles for a jump rope, learned where and how it is best to hold the handle of a hammer and a saw, the use of vise handles, the different shape handles on other tools and the long straight handle of a broom.

"Saw – Laurie's father being a carpenter and janitor, she no doubt knew a saw before, but here she learned about other types of saws: hack saw for cutting metal, jig saw for cutting different shapes on wood, and the sabre saw; more important, she used these saws.

"Circle – Laurie's concept of a circle was broadened. She knew that an orange and a ball were circles; here she learned to arrange chairs in a circle, that electricity travels in a circle (unbroken line), she traced a circle around a spool and drew a circle, she cut out a circle using a jig saw.

"Pulley – This tool seemed to be new to her. At first Laurie just looked at it and seemed content to know its name. Later, she had the opportunity to see it work and then actually to use it herself. A concrete block that she could not lift with her hands she lifted easily by the pulley.

"Electricity, conductors; batteries, dry cell – These seemed to be new words and new ideas to Laurie. When they were introduced she seemingly showed little interest: 'Laurie took off her shoes and felt inside. She put her shoe on the floor and wiggled her foot until the shoe was on.' Apparently, however, she absorbed more than I realized, for the next time electricity was discussed, Laurie knew the terms and uses of them. She made a light bulb work.

"Sawdust – Laurie did not seem to get the name for the dust made from sawing: Once she brushed some into a neat little pile and said, 'Don't step on that stuff.' Another time she referred to it as snow coming down, saying as she sawed, 'There's snow coming down'."

This next record was analyzed in terms of the mathematical concepts encountered by an eleven-year-old.

"The children's vocabulary of mathematical terms was enlarged by the use of dimensions in all of their work. Terms like circumference, angles, diagonal, bill of materials, tape, try-square, zig-zag rule, steel square, combination square, center-punch, T-bevel and protractor were introduced while the children were making a sun-dial. Hydraulic brake and pressure were discussed as the children studied the automobile brake and saw a spectacular experiment on what liquid pressure can do. Cost reduction, mass production, consolidation and cost versus profit were used at the refrigerator plant visited during a field trip.

"Measuring tools were introduced and used when the children were given articles of different shapes and sizes to measure the dimensions. They learned how to count the fractional parts of an inch on a ruler. They learned that the dimensions 'length' and 'width' mean 'with the grain' and 'against the grain' in wood. They learned how to use the measuring tape, the zig-zag rule, the steel, try, and combination squares when they measured to build their sun-dials, their prairie schooners, their radios and their telegraphs.

"The children learned about angles, their measurement and their application to the earth as a sphere when they made their sun-dials. They saw that forty degrees north latitude was a forty-degree angle on the earth and could be measured with a protractor and a T-bevel. They computed the fifteen-degree angle between each hour by dividing three-hundred-sixty degrees by the twenty-four hours in a day.

"Before they started any project the children made out a bill of materials stating what and how many were needed for the project. They multiplied to find how much and how many were needed for the whole class.

"The idea of estimating and design was introduced with the discussions about the prairie schooner. They discussed comparison of the length of the schooner with the height of the mast and the length of the boom. They estimated the area needed for the seat. Joyce refused to let them measure her to see how much room she would need. They discussed the comparative merits of a twin bed- and a double bed-size sheet for the sail.

"They learned about using standard width materials wherever possible to save time and trouble.

"Joyce got to solve the problem of how to take apart a tricycle. She thought about time passing when she realized she had gotten it for her second birthday. She tested various sizes of wrenches to remove a bolt. She organized the parts into 'sets' when she put all of the tricycle parts into one pile and all of Mr. B's tools back into the toolbox.

"The children were introduced to the concept of perpendicular when they had to square-up the cross pieces and the foot rest on the schooner.

"They cut the sail on an angle, and Joyce discovered the disadvantage of being left-handed. They measured carefully for the mast pocket.

"The children were exposed to many mathematical ideas during their field trips. The idea of more accurate and standard measurements with factory-made house sections was introduced at the housing development. They also heard about paying people on a contractual as opposed to hourly basis.

"At a refrigerator factory Joyce was exposed to the large numbers that were prices of many of the machines. She heard about the rising costs of material and the need of better mass production methods as well as material substitution if product cost is going to be kept down. The children came back to class and ran a mass production project, doing all of the mathematics involved in figuring the cost of each item.

"They heard about plant consolidation and the loss of profits due to the labor problems.

"Joyce understood the idea that products made in the specialty shop, by their very nature of being special, had to be much more expensive.

"The idea of fractions was discussed with the use of the ruler, changing fourths to eighths, etc. and tearing paper into equal sections. Joyce learned how to use the desk as a straight-edge when tearing sandpaper.

"The recipe for making paper had to be tripled when larger paper was desired. The children had to decide how much water, how many tissues and how much starch would be needed for the larger size. Joyce was not too pleased to find out she had to carry six gallons of water instead of two.

"Large numbers and relative speeds were introduced during a discussion about light, distance and sound when the crystal radio was planned. Joyce's remark, 'Wow! I'd hate to be riding on that', showed she was personally involved in the discussion when she was told that light travels 186,000 miles per second."

This represents only a small portion of the "content" developed this summer.

Time has not permitted sharing some of the other priceless data collected in these anecdotal records. However, about ten of the abstracts are now being readied for publication.

I should like to close with a poem written by the primary group following a field trip.

OUR TRIP
Big banging noises
The bulldozer pushing
Hammering
Steel coming up
Bumping
A motor starting
Dirt being pushed

The smell of smoke
And the smell of the river
Cement and rock falling
Wires falling
A lock falling
The banging of the crane.

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Elizabeth Hunt is the director of the Technology for Children Project, Dept. of Education, Trenton, N.J.

F.12.4 Ceramics & Plastics
Special Panel Session
WHICH DIRECTION IN CERAMICS AND PLASTICS—MACHINE MADE MEDIOCRITY OR HIGH LEVEL DESIGN?
Gen. Chm., Hugo Fiora; Chm., Gerald D. Bailey; Rec., Henry Ah Sam; Obsr., Armand G. Hofer; Panelists, Arnold C. Piersall, John B. Tate, Maurice Keroack, Edmund Cridge; Hosts, Allan Goodrich, Neal R. Ward.

LIMITING FACTORS IN THE DESIGN OF PLASTIC PRODUCTS FOR INDUSTRIAL ARTS

Arnold C. Piersall

The design of products in industrial arts classes is a continuing problem. As instruction in plastics turns toward the industrial approach, the design of products continues to present problems. While many factors have a direct bearing upon the final design of an industrial arts plastic product, this discussion will be concerned with four major factors which limit or restrict the design activities in the area of plastics. These factors are:

1. The materials that are available.
2. The equipment that is used to process the materials.
3. The tooling materials and processes.
4. The individual designer (student).

Of these factors, the materials are probably the one variable over which we have the least control. Generally speaking, we have no choice but to take the materials of the industry and use them as they are produced by the manufacturers. However, there is a great amount of worthwhile instructional information related to the characteristics of the materials as they apply to design. Design of plastic products is, of course, further restricted by processing limitations peculiar to the specific materials. However, the introduction of new materials and the development of new and improved processing techniques reduces the design restrictions which result from processing requirements.

The design of plastic products is also limited by the plastics processing equipment that is available. For the most part, this equipment is designed for industry. Frequently it does not meet the needs of an educational program, and frequently it is too expensive for wide-spread adoption in industrial arts programs. In recent years this situation has improved. Each year more manufacturers are introducing laboratory-sized processing equipment which is suitable for use in industrial arts programs. Part of the student's instruction in plastics must be aimed at developing an understanding and appreciation of the relationship between the capabilities of the machine and the design of the product.

Tooling has a very direct relationship to the design of the plastic product. In many instances there is a choice of tooling materials. In some cases the process that is used will dictate the type of tooling that may be used. This may become a factor in the development of the design of the plastic part or product. While the tooling material may, in some cases, restrict the efforts of the designer, it may also work in the opposite direction and provide a degree of flexibility through the choice of tooling materials that may be used to produce the product.

The last item listed as a factor which controls the design of plastic parts is the student or the designer. This is the one factor which is, to varying degrees, subject to the influence of the teacher. After the student has been introduced to the other design factors (material characteristics, equipment and tooling materials and procedures), he is then in position to start applying this knowledge along with the principle involved in the aesthetic design in an attempt to develop an attractive and functional plastic product.

Dr. Piersall teaches at Stout State University, Menomonie, Wisc.

DOES MACHINE TECHNOLOGY REPLACE THE NEED FOR CRAFTSMEN?

John D. Tate

Before we can answer this question, we would have to examine the objectives of industrial arts. What are these objectives? First of all, we would want our people in industrial arts, whether junior high, high school or even college, to develop an interest in industry, to develop an interest in achievement, to develop shop skills and knowledge, to develop an understanding of drawings and the ability to express ideas by drawing and design.

Industrial arts is a part of general education, and the students should be acquainting themselves with materials, craftsmanship and industry.

In the teaching of plastics and ceramics, we might consider two approaches. First is the industrial approach (which we might consider for high school teaching), in which we would teach the true concepts of industry with the use of large and small machines, using such methods of working with plastics as injection molding, vacuum forming, compression molding, mechanical molding, engraving and many other types of industrial methods.

Ceramics today is far beyond the making of a few clay flower pots or flower vases. Industrial ceramics are widely-used materials in the space industry and in other types of industry, such as the steel and electronics industries. The industrial approach could be considered as that part of industrial arts in which we teach about the industrial concepts of America.

The other approach, the teaching of plastics in industrial arts, is probably the more widely used in America. This would be the crafts approach or the artistic shop. In this shop the student would work directly with the plastic material, using individual designs and individual projects. The two concepts could be compatible. Craftsmanship in designing and making of objects and the use of machines to put these into a production-like situation could greatly enhance the education of our industrial arts students.

Skills and technical competence have always been and will continue to be an important outcome of objectives of our industrial arts programs. A need is evident to improve the status of industrial arts by upgrading or improving standards of attainment in all forms of shop work, in ceramics, woodworking, plastics, etc. Craftsmanship is a very desirable quality for any student to achieve. The needs of today are away from an untrained, uneducated person to a trained, highly-skilled person in all forms in industry in the United States.

We should start our students in plastics when they come into the seventh grade, and we should demand craftsmanship. In each case I believe the students will respond, have a better understanding, have a better appreciation for the course and for the subject.

I believe we can answer our question: Has machine technology replaced the need for craftsmen? Machine technology has not replaced the need but has enhanced the need. For as technology progresses in the United States, the need for highly-skilled craftsmen will continue to occupy a place in our system.

Mr. Tate teaches at Oklahoma State University, Stillwater, Okla.

HOW BROAD THE CURRICULUM FOR PLASTICS IN INDUSTRIAL ARTS

Maurice Keroack

The plastics industry may be an infant in comparison to the metal and wood industries, but it is growing by leaps and bounds. Our job in industrial arts is, in part, to develop in the coming generations an awareness of our technological environment. Therefore, we must include each new major industry as it develops.

We must draw from the industry those processes and materials which have a significant influence on the character of that industry. This is not always easy. Many times the process identified as significant involves the use of large equipment and very sophisticated procedure. It is then our responsibility to evaluate the best method for introducing this information into the course content. This might be accomplished through the use of audio-visual equipment or through a plant visitation.

On the other hand, many of the common processes and techniques can be successfully accomplished in the existing industrial arts laboratories. Much of the machinery and equipment can be purchased at reasonable prices; it can also be made locally to help keep the cost down. This method is usually very influential in helping administrators to see the need for expanding the program.

The challenge of developing curricula during the ensuing years in a relatively new, continually changing industry is never-ending. As new processes and materials are developed by more progressive members of the industry, we as educators must evaluate, develop and integrate them into our curriculum. This can be accomplished by keeping active in organizations common to the industry, reading the latest technical periodicals, and being in close personal contact with associates who work in varied fields of the industry.

Most suppliers of materials are anxious to furnish newly-developed materials to the schools. This helps them spread the news about their products and also helps us to evaluate the feasibility of using their material in our courses.

Several machine manufacturers are realizing the potential market for small, relatively inexpensive equipment for school use. As more programs in plastics are developed, the more available the equipment will become.

The breadth of the program is limited only by the ingenuity and determination of the instructor developing the curricula. The plastics industry is varied and quite unique; therefore, the educator can draw a wide range of programs which might depict the crafts aspect of the materials, or he can develop a very comprehensive, broad program which will give the student an over-all perspective of the plastics industry, its materials and how it falls into his technological environment.

Mr. Keroack teaches at State University College, Buffalo, N.Y.

HOW BROAD THE CURRICULUM FOR CERAMICS AND PLASTICS IN INDUSTRIAL ARTS PROGRAMS OF THE FUTURE

Edmund Cridge

Industrial arts is often discussed and considered in segmented form. Each segment is defined by a material and the industry which this material represents. This segmentation makes a very functional mechanism for developing courses of study, curricula, attitudes and approaches to industrial arts. This same mechanism, however, produces an image of the material so defined which can become greatly removed from the industry its title should suggest.

Industrial arts ceramics provides a good example of this. If the many existing programs of ceramics were investigated, it would be found that, according to industrial arts, the ceramics industry is an industry devoted to the creation of clay containers and figurines by hand or slip-casting techniques. Obviously, the material, ceramic, represents a much larger industrial complex than this.

The breadth of this complex is found in the definition of ceramics: "The study of the earthy materials which are inorganic and non-metallic and are usually subjected to an intense heat and any one of a wide variety of forming techniques as they are processed to usable goods"[1], and by consulting the abstract section of the Journal of the American Ceramic Society. The content of a curriculum enveloping this breadth should be organized into a sequential pattern which will permit gradual and perpetual development of the students' comprehension of the concepts of the ceramic industries from the simplest to the most complex.

To maintain the flexibility necessary to make this curriculum or refined course of study functional, the limitations of time must be considered. The recommended approach is to establish the total time available so that one can easily sub-divide his time to give appropriate consideration to each of the ceramic industries. To develop a curriculum or course of study, it is necessary to know the total time available for the presentation of the course and to allot time to each of the segments of the ceramic industries in relation to the total amount of time, as follows:

Raw materials and processing - 1/7 of the total time
Stone industry - 1/15 of the total time
Lime industry - 1/30 of the total time
Cement and concrete industry - 1/7 of the total time
Gypsum industry - 1/15 of the total time
Clay industries - 1/7 of the total time
Glass industry - 1/7 of the total time
Glazes - 1/15 of the total time
Porcelain enamels industries - 1/15 of the total time
Abrasive industries - 1/15 of the total time
The refractories industries - 1/15 of the total time

Continuity is maintained if each of these sub-topics is developed around a general outline of historical development, major raw materials predominately used, industrial processing, typical uses of the products, employment opportunities, and relative economic importance of the particular sub-topic.

If a comprehensive and industrially-oriented course or curriculum in ceramics for industrial arts is to be developed, it must give appropriate recognition to these sub-topics of the total ceramics industry. This recognition must be equally reflected in those experiences-activities which are designed to enhance the learning process that the industrial arts student will have.

FOOTNOTE

1. The Government Terminology Committee of the National Institute of Ceramic Engineers.

Mr. Cridge teaches at State University College, Buffalo, N.Y.

F-12.5 Design & Drafting
Special Panel Session
CREATIVE DESIGN AND DRAFTING IN THE SPACE AGE
Gen. Chm., Jay Helsel; Chm., James P. O'Shea; Rec., Ernest K. Gackenbach; Obsr., William E. Burns; Panelists, Frank L. Maraviglia, William E. Huss, V. L. Hoberecht; Hosts, H. Richard McClain, John Miller.

DESIGN: ITS IMPACT ON TEACHING GRAPHICS

Frank L. Maraviglia

As an industrial arts classroom teacher who has taught high school graphics and who is presently associated with a design profession, I would like to share some of the viewpoints that I have gained from both associations in the teaching of graphics. When I was teaching high school graphics, it was my belief that some revisions were needed not only in the content but also, most importantly, in the method of presenting the graphic language so as to be more beneficial for all students. I felt that under the present methods of teaching graphics, we were short-changing the total educational experience of all the students. I see high school graphics courses as an entree not only into the design and scientific field, but also for those students who seek employment directly from school. I believe that it is not only possible and probable, but very highly desirable, to teach the fundamentals of engineering graphics in a creative environment. In order to accomplish this creative environment, we as graphics instructors would have to re-focus our thinking in terms of the content and teaching of graphics. This refocusing of thinking would evolve around the emphasis of design as the modus operandi.

As a general observation, the present method of teaching the graphic language has been mostly copy work. This is not a creative environment. What can be done to illustrate the point that we should re-focus our thinking if we want to bring out the creativity of an individual? First, we must realize that the tools used and graphic presentation are techniques utilized by both the draftsman and the designer. To some draftsmen, they are the end in themselves, but to the designer they are only a means to execute his thinking in a graphic language to a client. Next, what is design? At one time it was a noun, but in contemporary use it is a verb, and because of this it has colored our whole way of thinking. The definition for design that we use in landscape architecture is: design determines the character of something or an object to someone for pre-determined purpose. In the creative graphics classroom, where design is emphasized as the initial step and basic motivation, not only will those students who continue their education benefit, but also those students who wish to remain as draftsmen, but even here creatively so, in industry.

The use of open-end problems as utilized by the design-oriented teacher brings out an interest and potential for creativity in his students. The possibility of a variety of solutions will, in my opinion, stimulate a greater sensitivity to the student's own environment. The student by himself not only learns, but also from his classmates. By providing this kind of creative environment, the student can select from many possibilities, choose from a variety of approaches, and not be forced into singular solutions to their problems.

This atmosphere aids those students who are considering a design profession, but does not handicap any student who terminates his formal education.

Graphics as a course – the course as involved with purpose and teaching technique – the purpose and teaching are things of lasting impact on the student. When graphics is taught as a technique or tool (or even when this aspect is overemphasized) the atmosphere for creativity is pre-empted and stunted. Design as an abstract understanding or as a purpose is validly, and I think necessarily, related to the greater value of the teaching and the learning of graphics.

When creativity is part and parcel of a course in graphics, the student is free to accept this challenge and add dimension to his potential, or he can rest on techniques learned through this environment which will aid him as a draftsman. This way, he is better educated, more versatile, and—I would selfishly point out—more valuable to design professions such as mine.

Mr. Maraviglia teaches in the School of Landscape Architecture at the State University College of Forestry, Syracuse, N.Y.

TECHNOLOGICAL BREAKTHROUGHS AND SPACE AGE DRAWING

William E. Huss

When man projected himself into space, he had to release his thinking. He was forced to change his ideas about the nature of knowledge itself. Knowledge was no longer fixed and static, but moving and dynamic.

Man found that in graphic communication and space visualization courses he was able to solve space problems only by conceiving of them in terms of a point moving in space. A point moving in space creates a line; a line moving in space creates a plane; and a plane moving in space creates space itself. Courses in drawing need to be organized around this concept.

Technological breakthroughs have led to changing emphasis in design and drafting. Design engineering concepts are gaining increasing attention in drawing courses. The consideration of design engineering as a process is reflected in many of the revised editions of engineering drawing textbooks. Attention is being focused on the increased use of computer drawing in industrial practice. Microfilm storage and reproduction is providing more efficient handling of the increased volume of drawings necessary in complex systems. Draftsman efficiency is being increased through the use of advanced tools, such as photodrawing and templates, which result in shorter lead-time in industrial production. And perhaps one of the more significant changes is an improved attitude toward and understanding of systems analysis and synthesis as it applies to design and drafting practices.

In our graphics courses, priority must be given to analysis over description, to abstraction over the concrete.

Graphic methods should be conceived as a means of solving space problems in design and industrial arts. Drawing then becomes a problem-solving course. The new look of drafting involves the use of planning, design engineering, graphical analysis and space visualization and relegates the communicative aspects of drafting technique to a role of concomitant learning. Students then take the initiative in solving problems, and teachers become directors of learning.

Drawing instructors, with their interdisciplinary knowledge necessary to understand complete systems, have the responsibility for helping the industrial arts profession optimize the simultaneous use of practical, theoretical and idealistic approaches to our problems.

We must make certain that our graduating students are skilled in the art of graphic communication at the advanced level appropriate for a mature cultural climate. They should have an understanding of and respect for graphic style . . . and it should be clearly reflected in the way they think as well as in the way they express their thought.

At both the high school and college levels, the concern of drawing instructors is with improvement, not duplication. The multiplication of this effort has the ultimate result of improving the over-all capacity of the industrial arts profession to face any eventuality in an ever-changing world.

The role of the teacher is changed from that of a dispenser of knowledge to that of a director of learning. The teacher creates a learning environment where students become involved with the process of design engineering and, hence, are seekers of knowledge.

Dr. Huss teaches at State University College, Oswego, N.Y.

COMPUTER AIDED DESIGN AND DRAFTING

V. L. Hoberecht

There are many facets to computer-aided design/drafting systems. I would like to address myself to three which I feel are relevant to this convention and this panel session. First, I would like to establish the fact that computer-aided design/drafting systems are a reality. Secondly, I would like to speculate about how such systems will change the roles of designers and draftsmen. Lastly, I would like to draw some conclusions about the educational requirements of the designers and draftsmen who will be using such systems.

First of all, what is a computer-aided design/drafting system? The central element of the system is a stored-program digital computer. A variety of devices can be attached to this computer. Of particular significance are XY plotters, numerically-controlled drafting machines, film recorders and graphic display consoles. The use of the XY plotter, drafting machine and film recorder provides a facility for producing hard-copy graphic output. The graphic consoles are the devices that the designer/draftsman uses to communicate with the system.

The computer contains two kinds of programs. It contains a system-control program and a number of application programs. The function of the system-control program is to supervise the activities of the computer to make sure that each designer sitting at a console gets the services he needs.

The equipment and systems programs have been developed, and systems are being installed. Numerous companies are busy developing and the implementing application programs. In particular, a number of companies are developing design/drafting applications today.

What effect will computer-aided design/drafting systems have on the role of designers and draftsmen? Some will become the programmers who develop the design/drafting applications. The designer or draftsman who has aptitude for programming and who is interested in programming is probably best qualified to develop these applications. The early applications will deal with simpler problems which require a minimum of imagination, judgment and creativity. These problems can be characterized as "cookbook" design problems. An example is structural steel detailing of standard beam connections.

Once the application programs are developed, other designers or draftsmen will be trained to use these new tools, that is, the graphic console supported by the application programs in the computer. Laborious routine functions such as calculating, drawing dimensioning and consulting standards will be done by the system. The designer/draftsman will be spending a greater portion of his time exercising his judgment, making design decisions and communicating these decisions to the system through the graphic console. The computer will relay new information, resulting from these actions, back to the designer/draftsman, and if the application program is properly designed, it will give him an opportunity to change his mind and allow him to make an alternate decision. When he is satisfied, he will indicate that the information is acceptable and proceed.

Let me emphasize that the user of the system need not be a programmer. To use the system properly, he must understand the engineering and design principles that have been built into the application programs. He must understand the significance of the design decisions he is making. He must have the training and experience which qualify him to make these decisions.

As more experience is gained by management, the designer/draftsman and the drafting application programmer, more sophisticated applications will be developed. The decisions to be made by the designer/draftsman using these programs will require more sophisticated understanding of the design problems being solved.

The ability for designers and draftsmen to carry more of the design load at the component level will free engineers to give more consideration to the design of the total product or system. The engineer will formulate design guidelines to be used in designing the product. He will make gross evaluations of price performance, reliability, etc.

The task of detail design will be given over to the new designer/draftsman, who will use the computer as his tool to do his job, and he will follow the general design guidelines set down by the engineer. Since he will be able to complete the design faster, several designs for a product may be completed and evaluated before a final selection is made or before a bid is submitted.

The educational requirements of the new designer/draftsman are fairly well implied by the remarks that I have just made. Let me discuss some of them explicitly:

(1) He will need to have a good working knowledge of algebra and two- and three-dimensional analytical geometry. A basic understanding of differential and integral calculus will be most valuable but may not be required for certain engineering or design disciplines.

(2) He will require a general understanding of computers, how they process data from a user's point of view, and how they are programmed. Training in this area should include coding, debugging and operating a few simple problems. The intent of this training is twofold:

(a) It provides a base for further training of the designer/draftsman who wants to become a programmer.

(b) It gives a general understanding of how the computer is instructed to perform the services he (the designer/draftsman) will be using.

(3) He will require a working knowledge of the basic principles of physics and engineering. I am not an engineer and cannot say explicitly what they are. I would expect him to understand the different analyses, for example, that can be made of electrical or electronic circuits. He should know what a shear diagram is and what it represents.

(4) He will require an understanding of what engineering and design information is and how it can be most effectively communicated, both to another man, and to a computer. His training will not require an emphasis on the mechanics of drawing. The mechanics will change with the new tools. He will need something equivalent to training in good sentence structure, not a heavy emphasis on how to write or print neatly.

The hardware and programming support for computer-aided design/drafting systems are available today, and systems are being used experimentally. Production applications are being developed.

Computer-aided design/drafting systems will have an impact on the designers and draftsmen who are working in industry today. Some will be affected directly; with others, the effect will be more indirect. The general effect of design/drafting systems will be to emphasize the judgment and creative abilities of designers and draftsmen. This, in turn, will be reflected in educational requirements to qualify them for this new level of responsibility.

Mr. Hoberecht is a specialist for Graphics Systems Planning at International Business Machine Corporation, Kingston, N.Y.

F-12.6 Electricity & Electronics
Special Panel Session

SPACE AGE AND COMPUTER ELECTRONICS TECHNOLOGY—ARE YOU PREPARED FOR THE COUNTDOWN?

Gen. Chm., Howard Gerrish; Chm., James S. Harmon; Rec., Harold Gilbert; Obsr., Lawrence F. H. Zane; Panelists, George Francis, David L. Jelden, Arthur Francis; Hosts, Donald Fitzner, W. Earl Watson.

AUDIO VISUAL COMMUNICATIONS IN ELECTRONICS

George H. Francis

The word "communications" is a significant one. To be sure, our whole civilization is dependent upon how well, or how effectively, we communicate with one another. In our society we use a wide range of media to implement the communicative process, and generally they fall into two categories, audio and visual.

As electricity- electronics teachers, our communication with students in the classroom needs to be as effective as we can possibly make it. The abstruse nature of the subject matter content demands a continuing teacher effort to raise the level of student comprehension through the use of effective teaching aids. I should like to report to you today on the results of my efforts toward this end.

The teaching media I present are, for lack of better terms, the magnetic plaques and the video projector. The plaques have been used with a great deal of success in the instructional program at Millersville State College, and I rank them as the most effective teacher-demonstration aids available for use in our program. Their development came about as the result of a need for demonstrations meeting these criteria: (1) demonstration circuits that operate; (2) circuit distributed over a vertical plane or surface, and, (3) coverage of an area large enough to provide good visual acuity from a reasonable distance from that surface. Criteria 2 and 3 are satisfied by a steel-backed blackboard. The plaques are made of 1/8-inch hardboard faced with white formica. Each plaque carries the electrical symbol and the actual component. Two to four magnets, or magnetic tape, is attached to the back of each plaque. Snap connectors are used to interconnect the plaques.

I have selected a series of slides depicting their use in the classroom. Some of the most common circuits demonstrated are: half and full-wave power supplies, voltage doubler, discriminator and ratio detector, light-, heat- and humidity-sensitive control circuits, voltage and power amplification. An operating two-stage audio amplifier can be demonstrated with relative ease. Although no statistical evidence is available on which to judge the effectiveness of this medium in terms of student achievement, student favorable reactions to their use and comparatively higher test scores during the two years they have been in use permit, I think, the generalization that they have contributed significantly to the objective of improving student-to-teacher communications at Millersville.

The relative merit of the second visual medium, the video projector, is not as easy to judge or predict. Essentially this is an electronic version of the overhead projector. I present it to you, not because I believe it to be a profound development, but as something that came about as the result of efforts to develop a demonstrator to be used in teaching television principles. The electronic principles involved in its operation are now new; the way in which the principles are utilized may be. Without becoming involved too deeply in the technical details of operation, a general overview of operation seems essential.

A modified television receiver is used as a light source. The modifications to the receiver were not too extensive, but somewhat complex in nature, and time does not permit a detailed analysis of these modifications. The light emitted by the cathode ray tube plays much the same role as the light from an overhead projector. Transparencies are placed on the face of the CRT just as they are placed over the light source on the conventional projector.

At this point the similarity between the two ends. Directly above the transparency and about eight (8) inches from the CRT is a video head amplifier. The most significant component in this section is the photo-multiplier tube. Light caused by the electron beam scanning the CRT phosphor surface, being interrupted during the scanning time, is converted into a voltage that varies in amplitude and duration. This voltage constitutes the video. Further amplification of this video is made through additional stages built into the CRT cabinet. Vertical and horizontal synchronizing the blanking pulses are obtained from the modified receiver circuits. The pulses are shaped, clipped and mixed with the video to become a composite television signal that will reproduce the original transparency image on a television receiver screen. For convenience, the composite signal is used to modulate an RF oscillator tunable from channel 2 through 6. This makes possible the use of a conventional television receiver as a monitor.

The applications for this unit are no doubt at present limited. It does, however, lend itself well to large and/or multiple class instruction where it might be difficult, for various reasons, to use the conventional projector. The electronics laboratory and classroom of the future might be envisioned as one where each student, or pair of students, has his own television monitor at the work station. Under such conditions, induvidualized instruction, individual testing and instruction involving graphic representations of related material could be presented with the video projector. Other applications are limited only by....your imagination. Should someone ask the question, "What good is it?"...may I borrow an answer given by Michael Faraday to a similar question and ask, "What good is a baby?".

Mr. Francis teaches at Millersville State College, Millersville, Pa.

LEARNER CONTROLLED EDUCATION FOR ELECTRICITY—ELECTRONICS

David L. Jelden

One of the problems of industrial-technical education has been that of teaching toward obsolescence. Skills and knowledge that make up today's world of work will all too soon be out-of-date.

In industrial-technical education within recent years, there has been considerable research done on course content and on the best "approach" to help the student meet an ever-changing industrial society. Hundreds of thousands of dollars have been spent by the Federal government and by private organizations in our colleges, universities and the public schools to determine what the content and/or method of instruction should be in industrial education. Each approach has advantages which develop understandings and relationships between school, industry and the individual. Each approach seems to have raised questions in educational circles as to the feasibility of teaching content which can become out-of-date in a short time. To answer these questions, various schools or groups have set about exploring certain possibilities on how a person, particularly in industrial arts, should be educated for the future.

Despite all of the adaptable and flexible ideas that have and will cause the industrial world to change, the basic problem of education does not change. The art and creativity approach, the technological approach, the experimental approach and even the conceptual approach all have one basic weakness. That is, as society changes and as business and industry develop new methods, new materials and new techniques, man will again have to learn and understand them. The quicker the change, the greater the frequency of relearning must be. An answer to this uncertain future of education appears likely. This answer is that man must be taught to teach himself and to make use of resources close at hand that contain the knowledge he will need.

If man, because of his very nature, could channel and guide his natural curiosity into avenues of demand, he might well be able to educate himself to meet the eruption of knowledge that is bound to occur. To this end the educational process becomes a matter of individual concern, and the schools can now embark on an individual instructional program that will teach the student to identify the possible sources from which he can get information, and to point out and develop those learning skills that will allow him to be self-instructive. We, as teachers, do this now with our scientific or analytic approach in the determination of course content.

It is believed that, under the right conditions, a student can be taught to analyze his own goals, determine his possible avenues of attainment, and set out on a path that will eventually lead him to the achievement of those goals. It is also a contention that possibly he can learn better in a shorter time in this informal directed-discovery program than he could in a "canned" predetermined lecture-classroom approach. For example: if we were to teach the fundamental concepts of electricity, the instructor's responsibility would be to secure or create within the learner a desire to want to know about this intriguing area. The teacher would help the student set up his own goals. He would ask the student, "What questions do you want to find answers to?" He would, as part of this motivating process, explain and show the student how to utilize all of the modern up-to-date devices and instructional aids which are at his disposal. The teacher would point out the possible places where some of these answers could be found. In addition, the teacher would point up that any concept, principle, or basic understanding, no matter how complicated, is made up of parts. The student's task would be to know himself, and to learn to teach himself. He should be able to identify and break down his understanding of the whole into its known recognizable parts as he sees it, and thus, by learning about each part and mentally reassembling them, to understand the relationship of the parts to the whole. In so doing, the student would have developed an understanding of the whole and quite possibly change his perception of it.

The "teacher" in this type of a "responsive environment" becomes a resource person. Each student achieves at his own rate. Because of a built-in success factor, which is understanding as you go, the students are likely to become more curious, and thus proceed further in a shorter period of time than they would in the traditional instructional methods. Learning, to be productive, must have meaning to the students. It is a contention that learning under this condition would be slower at first until the student learned to isolate his own goals and determine what his problems are or for what questions he needs to find answers. After this skill is achieved, however, it is likely that the learning process will be speeded up and that the learning system would be more efficient, meaningful and productive.

It would be the purpose of education to develop within each student the skills of how to learn, and to make him aware of how to determine what to learn. With this kind of a background which develops a thirst for knowledge, the problem of learning new facts and new skills becomes one of self-instruction. Motivation is the key to the success of self-instruction and must be fostered by success. The blessing of this theory is that it will work for almost all intellectual ability levels.

The process of learning is likely to change less than is the material being taught. It is conceivable that in some of the later stages in this type of program it would be possible for a student actually to write his own lesson materials to fit his individual needs.

As a result of experience and understanding which should come from a learner-centered instruction organization, each teacher may expect his students to have the following advantages:

1. course work designed for the under-achiever/rapid learner on a non-graded individualized approach. The student has a say in learning.

2. goals developed on an individualized basis as a result of diagnostic tests or established in a teacher-student discussion.

3. the development of self-motivation on the part of the student to use instructional materials as needed becomes apparent to him.

4. the instructor is always available for individual conferences and for directing the student who is confronted with a problematic situation. The instructor is merely a resource person.

5. the student enjoys learning because what he does comes as a result of self-direction. Reward of accomplishment moves him onward toward new goals.

6. a single unit of work is isolated by each student and pursued at his own rate. Goals are developed in consultation with the teacher. Upon completion of the unit, a student-teacher evaluation is made. This involves a performance test, an objective test, or both.

7. concentration is enhanced through the use of individual audio headsets or work stations.

8. local resources become meaningful. Field trips to industries and orientation to libraries point up the learning potential of a community.

9. copying and other forms of classroom cheating are discouraged by the organization of the program. Each student is on his own.

The procedure for changing the traditional or teacher-oriented method of instruction to a learner-centered or learner-controlled system involves much thought. It must be worked in and developed gradually. The student must be made aware of the change that is about to take place. If some do not accept it, provision must be made for them. Your present instruction program can be supplemented, and by giving the student more and more responsibility, he will probably accept it gradually.

The teacher must be aware of the capabilities of each individual student and not overlead him. This point is critical to the success of your system. A class size of 20-30 would be about all a teacher could handle at first.

There are some basic assumptions that the teacher must make if he is to use a learner-centered or responsive environment instructional program. Here are a few of these assumptions:

1. It will be improbable and maybe impossible to keep our schools up-to-date in a dynamic technological society.

2. The development of learning skills is as important to teach as the subject matter itself. Both can be taught simultaneously under a well-structured system.

3. It is unnecessary to send people back to school in a formal atmosphere for updating as often as some educators might think. If the student is properly motivated, self-instruction is a reality.

4. The student is capable of determining his own course of action once he is made aware of the possibilities that exist to finding answers.

5. Each student knows or will learn what his strengths and weaknesses are as they relate to how he learns best.

6. When an objective is set by the student, its attainment is more personal, the motivation is stronger and its achievement more rewarding.

7. More material can be covered better in a shorter period of time. The student will get better, more meaningful learning.

The success of any program can be evaluated only by the product it produces. Evaluation of the outcome of responsive environment learning or learner-centered instruction must also be examined. Here, basically, is how evaluation in this system is accomplished:

1. Based on individual—given when he indicates a readiness or a competence.

2. It takes two forms and is both manipulative-oriented (performance), and informational-oriented (objective).

3. A degree of proficiency must be met or the student must phaseback for additional information and skill until the desired outcome is achieved.

4. Final result is measured by behavioral change (attitude).

All in all, the learner-controlled educational system would have the following advantages and be operated within the limits of this criteria:

1. Throughout, the emphasis is upon the individual.

2. Course is designed for all levels of ability and is an individualized approach toward learning.

3. Goals are mapped out on an individual basis by the student with teacher's help.

4. Grouping of students varies and is pre-determined by the media used.

5. Purpose of course is to help students enjoy learning and to develop self-direction.

6. Students tackle one unit of work at a time and are graded after each unit is completed.

7. Individual learning stations with headphones where needed promote concentration and individualize instruction.

8. The self-direction approach allows for a better teacher-student relationship.

9. Grading is based on individual ability and grade level standards established by the teacher. Certain proficiency levels set up by the teacher must be reached by the student.

10. Discipline takes the form of removing the right to work as opposed to giving more work.

11. Cheating is discouraged by the organization of the program.

12. Special texts and programs have been developed for the course.

13. Papers, exams and all evaluative materials are returned promptly for valuable feedback to students.

14. The wide variety of instructional materials (media) is used to help the learning process. All, several, or none may be utilized by the students. We have eight basic media in use in our electronics program.

Dr. Jelden teaches at Colorado State College, Greely, Colo.

INTEGRATING SCIENCE, MATHEMATICS AND INDUSTRIAL ARTS THROUGH TEAM TEACHING OF ELECTRONICS

Arthur V. Francis

Let us, for the sake of clarity and understanding, take a closer look at a few of the above terms. Integration is by definition the bringing together of parts into a whole. Here, the parts are science, mathematics and electronics, which we will develop into a meaningful educational experience for the students—the whole.

Science is by definition a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws. So by this definition, electricity-electronics, as a subject, is a science.

Mathematics is the science that deals with measurement, properties and relations of quantities. This in itself, although not electricity-electronics, is used to such an extent that to remove it would be like creating a body with no bone structure.

These bodies of knowledge can be united by organizing instructors, students and facilities so as to provide the students with the benefits of instruction from the most capable teacher in a particular field, and so that they will receive the benefit of increased intellectual stimulation by contact with several personalities rather than with one individual teacher.

Within this framework we can readily identify three forms of team teaching:

1. the total faculty of an institution functioning as a team,
2. clusters of closely-related subjects, and
3. multiple-teacher classrooms.

The total faculty concept is very often overlooked by the teacher who is lost in the large faculty system of today. Faculty meetings are not looked upon as opportunities for the explicit purpose of integrating the curriculum. They have, in most cases, become an expediency for the administrators. For this reason, a person attempting subject integration might find more success at another level.

A greater possibility for creative integration of subject matter exists when teachers of closely-related subjects can communicate. The tragedy is that under the traditional department system of operation, it is very difficult and perhaps impossible for people to share the rule of their "domains" with others. On occasion, through personal contacts, a teacher may be invited into other subject areas for professional reasons, but in most cases it stems from an avocational or social situation.

The multiple-teacher classroom is a difficult form of integration because of the added cost, although it reduces the student-teacher ratio and improves instruction; under the economic philosophy that exists today it cannot be tolerated by the majority of schools. Compounding this problem is the inflexibility of the time schedule. Until educators accept programmed instruction, standardized evaluation and automated processing of records, this method of integration will be stifled.

Since mathematics, science and electronics are related subjects, perhaps the second method—team teaching—deserves a closer look.

Having been taught for many years in the science department, electricity-electronics has an inheritance and tradition heavily steeped in mathematics. Math was necessary for the understanding and application of electronics then, and this fact has not changed with its inclusion in the industrial education curriculum. Industrial education has been forced by technological development into league with the science and math fields.

The industrial educator may choose to be an isolationist by saying, "I will teach only that part of electricity-electronics which suits me," or that he will teach the math, science and electricity-electronics himself. Either approach can be unrealistic, because to try to select out of the traditional curriculum those parts that require no understanding of math and science reduces the subject to that of hardware—handling and knob-turning. To say that he can teach all of the math and science necessary himself would indicate naivete. In most cases, his educational background would not be adequate to prepare him for the task. Also, because of the rapid growth of knowledge related to the field, it is very difficult for a teacher as an individual to remain current. This is where the strength of a team-teacher approach becomes very obvious.

A point of fact is that the science educators have identified more basic content than they have time to teach, nuclear science and space physics being two examples. Recently I had occasion to observe a physics and an industrial education teacher who designed a curriculum for high school juniors that placed the responsibility for the electricity-electronics education directly on the industrial educator and allowed time in the physics program for the nuclear physics. On another occasion, a group of students were identified, while enrolled in an electricity-electronics course, as being deficient in math capabilities. Arrangements were made between the departments for a special math program, covering the math required in electricity-electronics. These are examples of integration of subject matter through team teaching.

We might accomplish another goal with team teaching. Because of a lack of cooperation and a failure to understand one another, a double standard has arisen. Electricity-electronics, when taught in the science department, has status. If taught in industrial education, it is second rate. To allow this to continue will be a waste of valuable time and effort, duplication of facilities, curriculum and a waste of the students' time.

Mr. Francis teaches at Eastern Michigan University, Ypsilanti, Mich.

F-12.7 Graphic Arts & Photography
Special Panel Session
GRAPHIC ARTS EDUCATION AND THE TECHNOLOGY OF THE FUTURE
Gen. Chm., Philip D. Wynn; Chm., James E. Lindstrom; Rec., John W. Crowther; Obsr., W. Carlisle Anderson; Speaker, Frederick D. Kagy; Interrog., Harold Padelford, Sanford Rich; Hosts, Robert Swerdlow, Norman Ashbaugh. Mr. Rich's manuscript was not provided.

GRAPHIC ARTS EDUCATION AND THE TECHNOLOGY OF THE FUTURE

Frederick D. Kagy

What will tomorrow's printing be like? This seems to be the question that all of us involved in the industry and graphic arts instruction would like to have answered.

Before looking at the changes that are affecting our industry, we need to have a framework of thinking as to the pace of change—innovation—in our modern technological society.

Anthropologists are not in total agreement relative to the first appearance of man on earth, but estimates range from a quarter of a million to one million years. Wilson Wallis, in an effort to structure the evolution of man and his technology in some meaningful frame of reference, has suggested that, for mathematical convenience, we consider man as having been on this earth 240,000 years, and then equate this to one hour. Within this context, he states, man then spent 55 minutes of the whole period in the stone culture, the cultivation of plants, the domestication of animals, the making of pottery, weaving and the use of the bow and arrow. Three and one-half minutes ago he began the working of copper; two and one-half minutes ago he began to mold bronze. Two minutes ago he learned to smelt iron. One-quarter of a minute ago he learned printing. Five seconds ago the Industrial Revolution began. Three and one-third seconds ago he learned to apply electricity, and the time he has had the automobile is less than a second. Ninety-eight percent of the technological change has taken place in 2% of recorded history.

At this rapid rate of change, almost all information that we can talk about today is already obsolescent, and the research and development departments are looking for better ways to combat that obsolescence.

Time magazine, several issues ago, said the presses that will print Time ten years from now are not even on the drawing board. Recent innovations may prove that those presses will never be developed, and whole new systems of information handling will replace printing as we now know it.

Let us just discuss some of the changes made in the past 10 years in this field. Are we as teachers using this material in our classes?

In the field of composition, operatorless tape-operated hot metal equipment is common, "idiot tape" is punched on a typewriter-style keyboard, sent through a computer, which justifies, divides words correctly and produces a new tape which is sent to the hot metal machines. Greater advances have been made in phototypography. Machines already common are the Linofilm, photomatic, photosetter, photon and others. Machines of tomorrow's composition include the Merganthaler's Lexical-Graphical Composer Printer System, Harris-Intertype's Fotronic System, and RCA Character Generation System. Machines such as these will read typewritten copy and convert this to tape that will produce complete type pages in either hot or photographic type.

Electronics have invaded the graphic arts with control devices on most of the machinery: exposure control devices exist for both the process cameras and enlargers; sensiometric devices for density measurement of continuous tone copy and negatives assure constant results. Instrumentation of all kinds has become available to help control the quality of the printed piece.

Electronic engraving machines for letterpress plates have been on the market for several years. Scanners have been developed that separate and color-correct transparencies and reflected copy for process printing.

Other changes in the letterpress plate field include powderless etching, magnesium plates, plastic plates, laminated electrotypes, backless mats for stereo and plating processes for stereotypes for long-run and newspaper work.

Electronic registering devices to maintain color register, and completely automatic roll-changing equipment is available for high-speed web-fed equipment.

Make-ready, a time-consuming operation in letterpress work, has also been systematized.

Changes in printing from a relief surface have been introduced with wrap-around press equipment; dry offset or indirect letterpress process has been improved. Several shallow relief plate systems have been introduced to the trade.

In the field of rotogravure, important advances include ink viscosity controls, and the use of a special film to replace carbon tissue. This gives a pre-cylinder-making quality control.

The field of offset lithography has probably advanced further and faster than most of the processes: pre-sensitized, bi-metal and tri-metal plates; wipe-on coatings have changed platemaking procedures; uniform platemaking results have been helped with the use of sensitivity guides.

Improved dampening systems, faster presses, improved register systems from the negative to the press, web-fed offset equipment are all rapidly changing the offset picture.

Changes in photographic procedures and equipment are some of the most radical: improved cameras, some completely automatic; new contact screens, autoscreen films, improved chemicals, development controls, to complete automatic film processing are just a few innovations.

Innovations in the field of copy preparation are also changing the printing field. Dry transfer letters, strike-on typesetting equipment, inexpensive photohead setters and clip art, just to name a few, are making every office its own advertising agency and art center. In continuous tone photography, ten-second pictures, stabilization processing and variable contrast emulsions have all helped to increase the use of pictures in printing.

The use of photomechanical methods for plates in all printing processes has changed the over-all look of the printed page. Flexibility of layout, bleed pictures and abundant use of illustrations are all the results of these innovations.

The things we have discussed so far are already here with us and in use by good graphic arts shops all over the country. What are some of the innovations that are going to be with us before we know it, that will further change man's methods of storage, retrieval and dissemination of information?

A scientist in Cambridge, Mass., has conceived a photosensitive crystal about as big as a lump of sugar that is capable of containing the images of about 100,000 pages. Office copying devices have already turned mailrooms into publishing houses.

NASA is already using a system that feeds individual information on a selected or interest basis directly to the recipient's office. A Japanese newspaper has already tried this system to selected homes.

The cathode tube is being used to edit copy; a special electronic pencil can be used to move words and illustrations on the tube. When all is correct, an instant negative is made ready for platemaking. Experiments are being conducted to place an image on a pile of sheets—thus printing thousands of copies at once.

Completely made-up pages can be transmitted electronically across the country for printing at a variety of stations, completely eliminating shipping or mailing of large amounts of printed materials.

Electrostatic printing on any surface is possible because it is pressureless. With this process, plates can be changed without stopping the equipment.

Photochromic dyes have made possible supermicrofilming that reduces images 1/40,000 of original. The Bible, 1,245 pages, can be stored on a two-inch square.

Viewing equipment has been developed so small that pilots can carry 50,000 pages of navigation charts with them for use in a unit the size of a portable radio.

Man is on the verge of pocket-sized libraries.

But so far we have only answered part of the problem raised by this meeting—the technology of graphic arts in the future.

The second part is, "What are the implications for us in education? How does the teacher of graphic arts incorporate these changes into his daily instruction?"

I think the most important thing a good graphic arts teacher can do is to change the direction of emphasis in his teaching. I think we would all agree that there will probably be more change in the next ten years than there has been in the past ten years. First and foremost, we must help our students to adapt to change.

We should concentrate on teaching basic processes—what are the basic ways man communicates en masse, how does man communicate with man, man with machine, and machine with machine?

I believe at this point I should clarify in your thinking the level of instruction to which I am referring. I am speaking of the introductory level of instruction. When we get into depth instruction and the development of salable skills, we will need more sophisticated equipment and a different emphasis of the instruction. This kind of instruction is important to a select group of students and should not be classed as general education. (This gets us into a discussion of philosophical thinking and could be the topic of another meeting.)

Let us return to our thinking about the introductory level and the concentration on the teaching of basic processes. Most of us are well aware of the costs of many of the recent machines, tools and devices that our industry has developed. Because of this, many of the newer items will not find their way into school shops. Innovation and a changing emphasis on the part of the teachers will be necessary to up-date instruction.

The best way to explain my thoughts on this will be by example: Let us start with the preparation of copy for one of the printing processes. This usually implies some method of assembling words into meaningful statements. Should we continue to stress the idea of skillful hand composition? Most shops are equipped with banks and cases. I say no! Yes, we can continue to use the California job case for manipulative experiences, but emphasize the fact that it is a storage device for characters, just as the IBM punch card is. We must have a system for storing and retrieving characters. Teach about the many systems the printing industry uses in this operation. Dry transfer letters and wax down letters can be substituted for much of the hand-set metal types. The regular office typewriter and the IBM Selectric can teach about strike-on composition, while we use illustrations of industry's more advanced body- and text-composing machines. Most of the new composers use the typewriter keyboard.

On this level, industrial arts, the understanding of the basic process should be foremost in the instructor's mind.

Use slides, the overhead and pictures of the machines of industry as you progress with the lessons. The idea of composition should take on new meaning for the students.

This same idea can be carried on in press work. Should we be teaching platen press work—we all have these machines—or should our teaching be giving emphasis to an understanding of ink transfer from a relief surface? Great skill on this level should be secondary to understanding. We can, by the use of illustrations, point out that rotary web-fed newspaper presses printing from stereos are simply curving the chase, the platen and feeding the paper from rolls instead of sheet by sheet.

Most shops, except some junior high's, have offset duplicators. Fine quality work can come from this equipment, but stress the understanding of the process of offset lithography and the grease-and-water principle. Expensive equipment is not imperative in order to make this understanding possible.

For those shops without duplicator equipment, hand lithography accomplished on an etching press can display the principles involved.

Photography, the creation of continuous-tone material, is not being covered, because dark rooms are not provided. Printing today depends upon this process. A small tank, a changing bag, and you are in business. The rest of the operations can be carried on in a lighted room. To make prints, you could use ROP type paper. The understanding of the use of sensitized materials can easily become a part of your program.

Today, many shops do have dark rooms, and a much more extensive program can be carried on. Photostabilization units are now on the market for less than $100. This, too, can be included in more programs.

In the area of half-toning, instruction is a must. All students want to know why and how a picture prints. If a process camera is available, this is not a problem, even if a vacuum back is not part of your equipment. Auto screen film makes this instruction possible.

If you are buying your negatives outside, pre-screened prints made with an enlarger will give the students the understanding of this basic process. As these operations are being performed, stress the understanding of the process, and not the development of half-tone making on this level. Skill in the performance will come with understanding and practice. During this same time, reference should be made to half-tone making for all processes. The use and function of the electronic engraving machine can also be discussed.

With the great emphasis on the use of color in all forms of printing, this field must receive some attention. Ansco's three-color preparation process can be carried on with a minimum of equipment. If you have an enlarger in your dark room, Kodak's ROP color is also well-suited to the school shop. Both of these processes give excellent results for pleasing process color.

The principles covered in these operations can be related to the most modern of scanning systems. It is true that a class experience in this will not make color separation experts, but a great deal of understanding can result; those that plan for a career in graphic arts can build upon the foundation which you have laid.

If you do not plan to run these separations, several excellent proofing systems can demonstrate the printing of color process work, such as color mats ozachrome, technifax and color key.

We could continue with many other examples of incorporating the modern technological innovations that characterize graphis arts today and in the future, but time limits this subject at our meeting.

I believe that we have looked at only one phase of improving graphic arts instruction. We should give serious thought to the uses of our products, the service we give to other industries, the package and its impact on impulse-buying, distribution, marketing, the source of raw and converted materials, idea visualization, the organization, management and financing of the graphic arts industry, but these are topics for another meeting.

To sum up this session, technological changes have been taking place in the graphic arts area at a rapid rate. The changes and the rate will accelerate in the years ahead. The graphic arts teachers on the general education level of instruction will have to keep informed of these changes and incorporate them into their teaching programs. Because of the high cost of much of the modern equipment, much of the instruction will, of necessity, be carried on with a minimum budget.

The emphasis in our programs must be on understanding and concept development, so that the students can adapt to the technologies yet to come.

Dr. Kagy teaches at Illinois State University, Normal, Ill.

RESPONSE: GRAPHIC ARTS EDUCATION AND THE TECHNOLOGY OF THE FUTURE

Harry Padelford

I would like to enlarge upon and emphasize several points made by Dr. Kagy and then ask several questions.

Dr. Kagy cites the problem of obtaining up-to-date and sophisticated equipment for our industrial arts laboratories. We may always lag behind, but it is a situation that can be improved upon. Supply houses are now offering materials and equipment which were unavailable a few short years ago. He mentioned the basic processes and concepts we can teach, and he placed a de-emphasis on skills. I believe skills are important only insofar as the student feels a particular need for a skill. Skill applications change; basic concepts do not.

Let there be no doubt in your mind that printing is a large and important industry. At one time the word "printing" was synonymous with books, pamphlets and newspapers. Now printing is truly a universal art. Printing is done on everything: wood, metal, plastic, cloth, laminates, rubber, glass and more. In a recent Heidelberg advertisement, they, with a slight hint of humor, advertised their presses' ability to print on anything but bricks, and only because there was no known market for printed bricks. Printing is available to everyone. There are firms in our area who will print one thousand copies of anything for ten dollars while you wait!

What technologies do we want to teach today's students who are tomorrow's technicians and consumers? My list would include etched plate printing, raised surface printing, lithography, stencil printing (mimeograph and screen), dry ink on a surface (ditto), carbon and "inkless" carbon and photography.

We have been using ink and paper almost exclusively in printing. I know paper is cheap, has been available for a long time, and, surprisingly, is still made by much the same process the Chinese first discovered. Maybe paper isn't the final answer. Is there a possibility that a new medium is being sought, one that will not require ink?

Photography is basic to the printing industry today. Almost all processes depend upon it. I am sure it will be one of the necessary technologies of the future. Most junior high schools, however, are lacking darkroom facilities. The question then is, how can photographic processes be demonstrated and work done without adequate facilities? Are there portable darkrooms on the market? Are there processes that do not need flowing water? Is there any way to demonstrate photographic processes without a darkroom so that the whole class could observe?

Although technology will shape our future in yet-undetermined ways, most of the processes we have today will be used for some time to come. We must, however, help the student adapt to an ever-changing world. In the graphic arts area, how do we specifically help the student to adapt to change?

Three short questions then: Is there a possibility of "paperless printing"? What can we do if darkroom facilities are not available? How can the teacher help a student to be "changeable"?

Mr. Padelford teaches at Capitol View Junior High School, St. Paul, Minn.

F-12.8 Mechanics & Power
Special Panel Session
NEW PROJECTIONS FOR MECHANICS AND POWER TECHNOLOGY IN THE SPACE AGE
Gen. Chm., Paul Wighaman; Chm., Norman W. Frye; Rec., Austell O. Sherard; Obsr., Paul E. Waldrop; Panelists, Louis G. Ecker, Robert D. Nesbitt, Lloyd Paler; Hosts, Arlen Saunders, Richard B. Beadle. Mr. Nesbitt's manuscript not provided.

THE PROJECTION OF A PUBLIC SCHOOL PROGRAM IN POWER TECHNOLOGY

Dr. Louis G. Ecker

The discussion which follows will endeavor to provide you with: 1) an historical perspective revealing the evolution of our present concept of power technology; 2) the extreme philosophical positions which affect industrial arts curriculum development;

3) proposals from which to organize the body of knowledge to be included in industrial arts; 4) a theoretical basis for curriculum development; 5) a definition of power technology; and 6) the content and organization of the power technology program.

The newly-emerging power technology program may be traced back to developments which took place in the 1930's. Research studies and other professional literature make reference to two distinct programs emerging from this decade. The transition from the traditional automotive program to a broader program of transportation was evidenced in the Prospectus (Ohio, 1934). An article by Smith (1934) and theses by Bowers (1937) and Crow (1938) represent the earliest developments in the power program.

The major theme of the 1940's revolved around the further development of the transportation program. The most significant developments of this era are described in A Curriculum to Reflect Technology (Warner et al, 1947) and Klintzes' (1947) thesis, entitled A Transportation Program in Industrial Arts. The former publication divided the content of this phase of the industrial arts program into separate divisions of power and transportation. The power division was conceived as involving a study of sources, generation, transmission and utilization. The transportation division contained major areas of study under the classifications of land, sea and air.

The decade of the 1950's saw the continued development of the power and transportation programs with several research studies being devoted to an analysis of either the total program or an aspect thereof. Olson's (1957) dissertation accepted the previous divisions of technology advocated by Warner, while adding divisions of research and service. Thus, the content of the original power and transportation program was further fragmented into three parts. The lack of acceptance of these divisions is in part related to the fact that appropriate textbooks have not been developed, as well as the failure of those who advocated these changes to establish pilot programs designed to determine the validity of their approach.

A marked change from the power and transportation concept to a broad program in power has been evidenced in the past decade. No less than six textbooks, 30 articles in professional journals, ten state curriculum guides and four research studies have been written in the past six years directly related to the power technology program. The earlier publications placed emphasis on instructional units relating to small gasoline, the automobile and outboard engines. The more recent literature advocates the expansion of this program to include a study of all major energy sources and machines which convert energy into useful work, such as the diesel engine, jet engines, rocketry, atomic power, solar energy and future sources of power.

Having briefly reviewed the historical development of the power technology program over a period of 30 years, let us turn our attention to an examination of two extreme philosophical positions affecting industrial arts curriculum development in an effort to further clarify the confusion which exists within our profession.

Two extreme philosophical positions regarding curriculum development have a direct influence on the breadth of program offered within the field of inquiry. It is of utmost importance that these philosophical positions be recognized if one is systematically to organize the body of knowledge to be included in the power technology program. These extreme positions are best understood when plotted on a continuum and examined in terms of leaders, purpose, source of content, subject matter areas, methods and instructional media.

An attempt has been made to describe these two philosophical positions graphically in Table I. These positions have been labeled as traditional and progressive for lack of better terms. The traditional position advocates the automotive program as an outgrowth of our vocational counterpart. This group contends that "all we need are bigger and better automotive mechanics programs." The logic of their argument may be based on the fact that 90 percent of the energy derived from prime movers comes from the automobile. Furthermore, one out of six businesses and one out of seven people employed in the "work-a-day" world are directly employed in the transportation industry. Those who accept this position would restrict the instructional program to a study of the manufacturing and servicing of the automobile. The confusion generated from this position stems from the fact that a course previously entitled "Automotive Engines" may be changed to "Power Mechanics I" in an effort to be in tune with the times. Specific examples exist to verify the unfortunate fact that such confusion exists in some of the public schools and teacher education institutions.

The progressive position fragments the content of this instructional program into divisions of power, transportation, service and perhaps manufacturing. The newly-emerging

Table I

PHILOSOPHICAL POSITIONS AFFECTING CURRICULUM DEVELOPMENT

	Philosophical Positions	
	Traditional	Progressive
Leaders	Fryklund, Friese, London, et al.	Bonser, Warner, Olson, et al
Purpose	Training in the use of tools, materials and processes - skill development	Understanding of industrial technology
Source of Content	Trade and job analysis	Industrial technology
Content area	Automechanics	Power, transportation, manufacturing and service
Method	Four Steps - Preparation, Presentation, Application, and Evaluation	Problem-solving, experimentation, research and development
Project	An end in itself	A means to an end - a vehicle for learning

power technology program accepts neither of these extreme positions, although it tends toward the progressive end of the continuum. The former program tends to be vocationally-oriented, while the latter is more consistent with the general education function of industrial arts.

Swanson (1965, p. 47) has provided a rather perceptive analysis of those groups of proposals which have attempted to define the "body of knowledge" from which the content of industrial arts may be drawn. These groups include the following approaches: (1) life's needs, (2) crafts and trade, (3) applied science, and (4) a study of industry. An examination of each of these proposals for the derivation of the body of knowledge to be included in the industrial arts program reveals that the study of power sources has to a large extent been drawn from the applied science approach. One need only examine Duffy's (1964) book, entitled Power-Prime Mover of Technology, to verify this fact.

The effect of the applied science approach to curriculum development is readily apparent in the adoption of units of instruction, such as the fundamentals of electricity, fluid power, atomic and solar energy, etc., into the power technology program. The resulting effect has demanded that an increasing amount of time be devoted to teaching theory. Swanson (1965, p. 53) states, "Of all the efforts which have achieved widespread acceptance in practice, this (the applied science approach) probably comes closest to drawing its content directly from a well-defined and established body of knowledge." Thus, it may be rather conclusively established that the applied science approach to curriculum derivation has provided the basis for the newly-emerging power technology program.

It would seem imperative that an enterprise as complex as curriculum development must be guided by some kind of conceptual framework. In this regard, Bruner's (1960, p. 16) book, entitled The Process of Education, may serve as a guide for the field of industrial arts education. His major hypothesis states that "any subject can be taught effectively in some intellectually honest way to any child at any stage of development." This revolutionary concept has been rather widely accepted in the fields of science and mathematics.

It is the writer's belief that the concepts of curriculum development advocated by Bruner are appropriate to the field of industrial arts education. For example, Bruner (1960, p. 17) believes that "school curricula and methods should be geared to teaching fundamental ideas in whatever subject is taught." Understanding of these fundamental ideas or principles makes a field of inquiry more comprehensible. Four general claims which can be made for teaching fundamental principles include the following (Bruner, 1960, p. 23):

1. ...understanding fundamentals makes a subject more comprehensible.

2. ...it insures that memory loss will not mean total loss, that which remains will permit us to reconstruct the details needed. A good theory is a vehicle not only for understanding a phenomenon now, but remembering it tomorrow.

3. An understanding of fundamental principles and ideas appears to be the main road to adequate "transfer of training".

4. Emphasis on structure and principles in teaching... allows one to narrow the gap between "advanced" and "elementary" knowledge.

In essence, Bruner is saying that there is a logical structure which must be followed in curriculum development. This structure may be likened to a never-ending spiral stairway evolving from simple to complex. The construction of each step in the spiral stairway is based on the development and understanding of fundamental principles which facilitate the learning process and assist in reconstructing knowledge previously acquired. This theoretical basis can provide the foundation for the organization of bigger and better programs in the field of industrial arts education.

Why "power technology"? The writer is convinced that the term power technology should be used in preference to the previously-used terminology of power, or power mechanics. The bases for this conclusion are several. First, the term "power" used to describe an educational program tends to lack specificity in a society which is presently embroiled in a struggle for the equality of human dignity. This term connotes a wide variety of meanings. Therefore, without modification, the term "power" is most apt to be misunderstood by members of the profession as well as by the lay public. Second, the term "mechanics" is frequently considered to be somewhat synonymous with "mechanic". The former term (mechanics) is defined by Barnhart (1956, p. 755) as: "(a) that branch of applied science which treats the effect of force upon bodies and the motion they produce". The latter term (mechanic) is properly defined as: "(a) a skilled worker with tools or machines;" or "(b) one who repairs machines." The terms mechanic and mechanics are frequently considered as singular and plural rather than as previously defined. The resulting effect is confusion with the automotive mechanics programs and overwhelming orientation toward the service aspect of industry.

What does the field of power technology encompass? The term "power" is herein defined as "the energy or force available for application to work." It may further be distinguished as a mechanical energy rather than human labor. Technology is defined (Barnhart, 1956, p. 1243) as "the branch of knowledge that deals with the industrial arts or the science of industrial arts." Thus, the writer would advocate the acceptance of the term power technology defined as that phase of the industrial arts curricula which pertains to a study of the operational and scientific principles involved in energy sources as they are applied to prime movers. A prime mover is considered to be a device which transfers energy of one kind to that of another with a resulting motion. Prime movers must be distinguished from secondary movers, which depend upon another source of power. An electric motor is an example of the latter classification. This proposed definition of power technology tends to delimit the body of knowledge to be included in this phase of the industrial arts curriculum. Furthermore, the emphasis on scientific and operational principles is consistent with the previously-established theoretical basis.

Risher (1960, p. 47) develops a rather logical case for the inclusion of the power program in the public schools. He states that a fully-developed mechanical power area of industrial arts would include, among other ramifications, a study of:

(1) each of the various energy forms;
(2) the development of energy forms into various types of power;
(3) the historical development of each type of power;
(4) methods of utilization, distribution and control of power;
(5) transmission, measurement and future prospects of power; and
(6) the social and economic problems involved, etc.

A distinctly similar discussion may be found in the preface of our most recently published textbook on this topic. Considerable progress has been made over the past six years in the development of such a program.

Pritchett (1964, p. 39) has indicated that the technical content representing the scope and sequence of a good power mechanics program would include:

I. Introduction to Power Mechanics
II. Power Generation Through Prime Movers
III. Power Measurement
IV. Power Transmission
   A. Mechanical
   B. Hydraulic
   C. Pneumatic
   D. Electrical
V. Fuels and Lubricants
VI. Internal Combustion Engines
   A. Small Gasoline Engines
   B. Outboard Engine

C. Automotive Engine
D. Diesel Engine
E. Aircraft-Reciprocating
F. Reaction
G. Rocketry
H. Gas Turbine
VII. Steam
VIII. Atomic and Solar Energy
IX. Experimental Power Sources

Pritchett's outline of the technical content tends to be consistent with my beliefs, although we differ in the terminology used to describe this program.

The organization of the content to be included in a study of each energy source may give consideration to the systems approach, which would include a study of the mechanical, fuel, ignition, cooling, lubrication and exhaust systems. This approach allows the learner to examine the parts in relation to the whole.

In conclusion, the following points should be emphasized:

1) The power technology program was conceived in the 1930's, although the major growth and refinement of this program has taken place since 1960.

2) The traditional and progressive philosophies concerning curriculum development have had an influence on the development of the power program.

3) The applied science approach to curriculum derivation is readily apparent in the power technology program.

4) The power technology program involves a study of the operational and scientific principles involved in all energy sources utilized as prime movers.

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Dr. Ecker teaches at Eastern Michigan University, Ypsilanti, Mich.

POWER MECHANICS FOR THE SPACE AGE

Lloyd Paler

Power mechanics has been defined in a variety of ways. One instructor may classify the disassembly and assembly of small gas engines under this title, while another may place a program in auto mechanics in this category. These programs may be an entity in themselves but are entitled power mechanics. There will also be variations in the time allotted for theory, and that which is allotted to manipulative activities. After a study of the phrase "power mechanics for the space age", I have arrived at the following definition: the study of power mechanics for the space age will constitute the body of knowledge concerned with the transfer of energy. This includes the physical aspects of this transfer as it relates to the practical and theoretical applications of forces. It is expected that these forces will move in all directions and be of boundless dimensions of position and direction in a particular period of time in our culture. This body of knowledge as it relates to industrial arts must incorporate the historical and social aspects of the maturation of power as a prime mover in our technological society. The study of power must move in all directions and explore all principles of application.

Space age power is, of course, much more complex than the study of power as we have known it from the past. Our technologies have carried us above the earth's atmosphere as well as below the land and seas. Many terms, such as MHD generator and laser, were unknown in early studies of power, but are now commonplace. This new body of knowledge does not necessarily give us license to delete all of the older methods used in teaching power and merely grasp new terminology and concepts. Rather, the basics must be incorporated into and built upon to produce a worthwhile program for present and future generations. The present foundations which we lay will again be modified and reinforced in the future. If a few basic concepts are understood thoroughly, the new technologies will not tend to become nearly so overwhelmingly complicated and confusing for the learner.

In order to organize a study in space age power, we must first define the basic content of a particular unit of work in a certain program in a given society. Considerations must be given to facilities, time and personnel available. If we are to teach the mechanics of power as it relates to industrial processes, a thorough study of the industry must be undertaken. As we look at space age power in the more remote areas, a different view meets our eyes when compared to a highly-industrialized area with all of its elaborate refinements concerning power in a particular phase of the space industry. Nevertheless, the fact remains that certain elements of the more modest forms are closely related to the higher products of specialization.

If the laboratory experiences are centered around the modest small gasoline engine and its component parts, scientific principles of its construction and operation must be incorporated into the learning activities. Dimensions larger than merely disassembly and assembly must be sought. Technological development concerning processes of fabrication as well as the scientific analysis of materials must be included. The study of the basic elements of the electrical phenomenon must be related to activities of a more refined nature. Comparisons of the four-stroke cycle and continuous cycle, as well as the study of direct as compared to indirect prime movers, should be observed.

Transfer of learning is an important phase of the learning activities in power mechanics. Students must be able to understand the underlying principles of mechanics in order to be better prepared to cope with a changing labor market. In the assembly and disassembly phase a person can be taught torque values as they pertain to size and material as well as the fittings of component parts. The individual involved in the study of power can gain insight into the chemistry of fuels, physics of heat, metallurgy and force as well as other physical phenomena while using the small gasoline engine as a basis of activity. This does not mean that we stop with the study of the small gasoline engine, but rather we use this as a steppingstone into the exploration of the other facets of power.

Social values, such as labor relations, production line, and research and development, must not be overlooked.

In determining the content of power mechanics for the space age, the teacher will research the needs of his particular area, then make a complete analysis of the various elements of industry connected with power. From this study he will draw the content for his program. As time progresses he will reevaluate this program and incorporate the necessary changes which will make it more meaningful and clear.

Mr. Paler teaches at Ellendale Center, University of North Dakota, Grand Forks, N. Dak.

F-12.9 Metals
Special Panel Session
METALS TECHNOLOGY OF THE FUTURE
Gen. Chm., Kenneth R. Clay; Chm., J. Richard Steinmetz; Rec., Carl H. Hubachek; Obsr., Douglas T. E. Foster; Panelists, James Warner, John J. Sladicka, Jr.; Hosts, Otto Furphas, Carl V. Dreisbach, Jr.

NUMERICAL CONTROL TECHNOLOGY

James C. Warner

The Industrial Revolution, which began in the last half of the eighteenth century, resulted from the invention of power-driven machinery. Many believe we are now entering a second Industrial Revolution, the result of a developing technology wherein machines are made to respond automatically to symbolic instructions. In this new technology, limitations of the human operator no longer impose serious restrictions upon the design or operation of machines. Precise control of complex fabrication processes can, therefore, be achieved, and parts can be designed that more nearly approach the optimum and at the same time are practical to fabricate. The introduction of numerical control into the manufacturing process also implies a new way of thinking about the uses of machines, inviting management and education to reassess their own planning in control functions in a new era of man-machine cooperation.

Numerical control is a technique of automated operation of machines by means of instructions expressed in code. These instructions, commonly called a program, are prepared in advance and consist of a sequence of numerical codes which specifies the desired action of the tool. When recorded on punched cards or magnetic or paper tape, these coded instructions can control the sequence of machining operations, that is, the machine positions, its speed, distance, direction of movement of the tool or work piece; flow of coolant; the selection of the proper preset cutting tool for each operation; or the movement of the stylus of a plotter to make graphic representation of a piece part. The control tape is placed on a reading unit—a system of electronic interpreting devices which, when activated, causes the servo units to drive the machine tool through the programmed operations and movements without human intervention. The machine operator's role is largely limited to starting, stopping, loading and unloading stock and observing the cutting action of the tool. The operator can change instructions easily after each job by replacing the roll of tape on the reading unit with another containing a different program.

The concept of automatic control systems is not new, nor does it have its origin in modern machine tool design. There are many excellent examples of automatic control systems in nature, probably the best being those found in the human body. The well-regulated temperature and physio-motor controls of the body serve as good illustrations.

An early example of industrial use of automatic control is found in the completely automatic flour mill built in Philadelphia by Oliver Evans in 1784.[1] In this mill no human labor was needed from raw grain to finished flour. Also, numerical machine tool control systems are not the first example of the use of cards or tapes in machine-control systems. In 1807 Joseph Marie Jacquard used punch cards to control his textile looms.[2] The chemical and petroleum industries have used these techniques for many years. Unfortunately, the exchange of ideas between industries has often been slow and has tended to delay the application of numerical controls to machine tool operations.

As in the case of the development of other metal working machine tools, the invention of numerical control as a manufacturing process was based upon the need for a particular type of machining operation. For example, it has been shown the boring mill was invented because James Watt needed a more accurate method of boring steam engine cylinders;

the invention of the cross slide and the lead screw for the metal cutting lathe permitted the accurate machining of screw threads; and the milling machine was invented by Eli Whitney to enable him to mass-produce muskets for the army. In the case of numerical control the need was associated with the construction of high speed jet aircraft by the aerospace industries. Because of the complexity of the parts to be produced and the large size of these parts, production by conventional methods was almost certain to introduce human error. In addition, as the workman drew closer to the completion of the job, his productivity decreased by a geometric ratio. This was due to the repeated checking and testing of the part while in production so as to avoid human error. Paradoxically, this testing and checking very often contributed to additional human errors. Upon examination of the problem it was concluded that if the human operator could be removed from the control of the manufacturing process, the vast majority of errors would be eliminated. Therefore, the United States Air Force, in conjunction with the aerospace industries, contracted with MIT (Massachusetts Institute of Technology) to conduct a series of feasibility studies to ascertain if it were possible to build an automated metal machining machine tool. This research began in 1949. The initial phase of the feasibility study was completed in February of 1952. It was at this time that numerical control was proven feasible to solve the problems of the complex production of aircraft parts.

In spite of the early developmental work done by MIT, industry in general did not recognize or accept the potential of numerical control until the US Air Force machine tool procurement program in 1955 further demonstrated the substantial gains possible through the use of numerical control systems.[3]

It is interesting to note that the development of numerical control manufacturing proceeded somewhat differently from normal evolution of processes. Usually a process in its development will progress from the relatively simple to the more complex. In the case of numerical control, however, the need was for the control of extremely intricate piece parts, which, of course, required a sophisticated control system and machine tool. Only after industry began to recognize the advantages which might be attributed to numerical control did they begin to look at their own manufacturing problems and how they might be helped by this new manufacturing method. After analyses were made, it became evident that the vast majority of metal removal is done in the production of holes; therefore, the kind of equipment that would be most advantageously applied would be of the hole-producing variety, namely, positioning systems. As was mentioned earlier, the developmental work carried on by MIT was a result of the necessity for the production of complex piece parts prompted by the high probability of human error in conventional production. As the feasibility study progressed, it soon became evident that the human error factor was going to be transferred from the machine operator to the man who prepared the control tape for the machine tool. The reason for this was the programmer had to identify a vast number of X Y Z cutter locations in space and a faulty calculation would produce the same error as a faulty turn on a hand crank. Fortunately, at this time there was a concurrent development of computer technology, and the problems associated with numerical control programming lent themselves to the use of a digital computer. Therefore, MIT also undertook the development of an English-like language which would assist the part programmer in preparing the control tape for the machine tool. This language is now known as APT (Automatically Programmed Tools).

The Air Force must be credited for providing the impetus necessary to bring numerical control to American manufacturing. It was begun in 1955 with the Air Force awarding some $35 million for the manufacture of approximately 100 numerically-controlled milling machines. Since that time the growth in the use of this type of equipment can probably best be described as tremendous. In 1960 there were approximately 600 numerical control machine tools in the country. By 1964 there were something over 3500 such machines in use. In 1966 there were approximately 8000 in use. Of that number approximately 70% were of the hole drilling or positioning type. To look at it in another way, in 1965 numerical control machine tool sales were approximately $160 million. In 1966 they were approximately $270 million, and in 1967 it is estimated by the Numerical Control Society that it will probably pass $300 million in sales.[4] Major machine tool manufacturers have indicated that their current machine production consists of between 70% and 85% with numerical controls. In a relatively short time a conventional machine tool will probably have to be ordered much like a manual transmission automobile has to be specially ordered today. I have attempted to give you a brief look at the historical development of NC and an indication of its rate of growth. Obviously, the rate of growth is based upon real manufacturing advantages. I would now like to take a look at a few of these.

1. Lead time is reduced. The time period which normally must be allowed between the period when a product or part comes off the planning table and when it is completed is drastically reduced by this method. The storage media, be it punched cards, punched tape or magnetic tape, can be produced much faster than fixtures, models or cams. This potential is just beginning to emerge in the automotive and appliance industries and offers the possibility of revolutionizing both production and marketing in these industries. It is estimated that current automotive production lead times might be reduced to approximately six months as compared to eighteen to twenty-four months currently.

2. Tooling costs are reduced through elimination of auxiliary tools such as cams, fixtures or templates. One major consideration in this age of high cost buildings and limited floor space is the amount of labor, time and supervision that must go into maintaining such auxiliary equipment. The first cost of this tooling is high; to keep it in operable condition is expensive, and if the tooling is properly designed. there is a very good chance that the equipment will be re-used at a later date. This necessitates storage, which increases costs. Added to this is the amount of possible damage involved in moving and removing these fixtures. In the case of numerical control these conditions are eliminated.

3. Using numerical control allows designing and dimensioning the part to minimum tolerances. This results in savings in weight of parts and costs of castings.

4. Parts scrappage due to random errors is reduced, since each part is reduced in a given lot to an exact sequence on the same equipment, and once a tape has been proven, the machine will cycle in exactly the same way time after time.

5. NC is advantageously used where the part is complex but must be made in short runs with variations. It is much easier to modify a program than to make new or modified tooling and fixturing accessories. If a program is contained on either punched or magnetic tape, modifications can be made by duplicating the unchanged portions of the tape and inserting changes only where necessary.

6. NC is advantageously used where a part is so complex that human error is likely to occur. Once a program is made and checked to insure its accuracy, it will work indefinitely without error, barring a malfunction of the machine tool or control unit. Today, both are manufactured with a very high degree of reliability, and in many units, should a malfunction occur, the machine will stop before damage takes place to the part or to the machine.

7. NC is advantageously used where design problems are such that an adequate inventory of parts would be costly. It is much easier to store a series of programs in the form of tape or cards than it is to warehouse a quantity of parts and the necessary jigs and fixture components to manufacture them.

8. NC is advantageously used where the situation exists that the machining time is low in relation to setup time. When lead time and setups are reduced, the whole production cycle is compressed. As less time is spent in setting up a machine, it means that the machine utilization is higher and the required number of machines is decreased.

9. NC is advantageously used where the machining operations are complex and involved. With the resources of program preparation and the capabilities of modern machines, the complex operations can often be done more quickly with a programmed tape, and precise electronic or mechanical controlling, than by physical effort.

These are just a few of the proven advantages which can be attributable to NC manufacturing. Are there any disadvantages to NC manufacturing? I have been working with numerical control since 1959, and I am hard-pressed to identify any significant disadvantages to this manufacturing process. There are a number of apparent disadvantages which are not directly attributable to numerical control manufacturing. Probably the most significant problem at the present time is that of acquiring skilled workers in the area of numerical control, principally in the area of NC part programming for positioning and contouring work and in equipment maintenance personnel. One of the first questions the potential user will raise is that of the availability of competent workers in this area. The second area which might be categorized as a disadvantage is the apparent high initial cost of NC equipment. What is often overlooked, however, is that because NC equipment is many times more productive than conventional equipment, comparatively it is actually cheaper than conventional equipment. In addition there are many piece-part configurations which cannot be produced in any way other than with numerical control equipment.

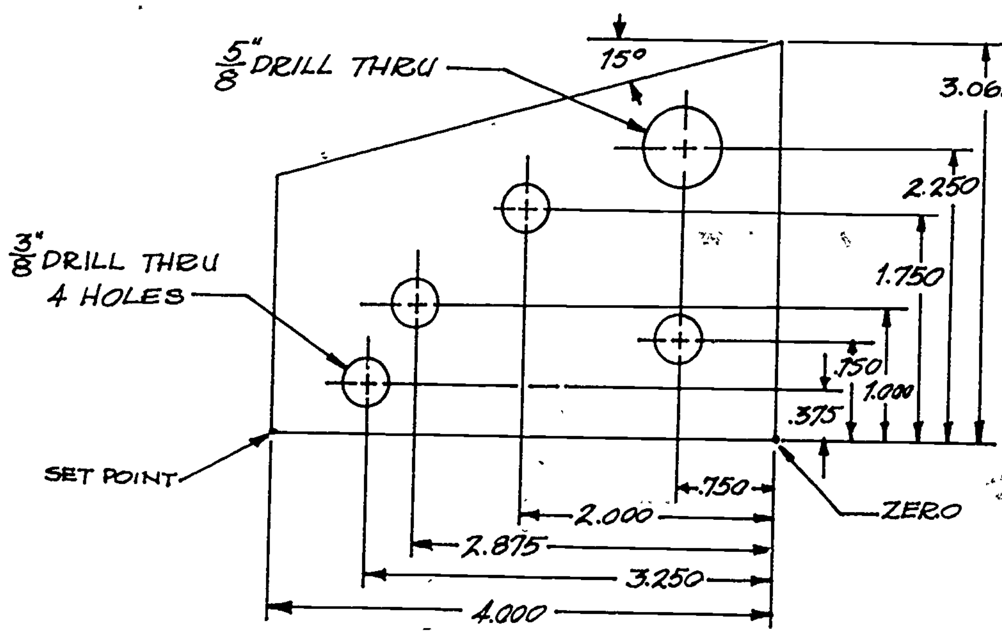
Currently, numerical control systems are classified under two basic functional types, that is, positioning and continuous path or contouring.

Positioning systems are used to control machine tools, such as the drill and jig bore, which perform operations only at a specified point on a work piece. In drilling, for example, the drill spindle is positioned at a single specific point; the proper drill size, speed and feed selected; the drill advanced to cut a hole to the proper depth; withdrawn when completed; and repositioned to cut at the next point of work. Calculation of the required instructions for operation of the positioning system, and by this I mean programming, can usually be easily performed by a programmer with the aid of a manual desk calculator.

There are basically two types of numerical control positioning systems: absolute and incremental. The majority of the systems are "absolute", but a significant number are "incremental". As can be seen from the slide, the absolute system requires each of the machine positions to be established in relation to some specific reference point. In the case of the incremental system, however, each succeeding position is established in reference to the preceding position. There are many other differing characteristics to be found in positioning systems, such as floating zero versus zero offset, differences in control system accuracy, differences in machining accuracy. All of these factors must be understood and taken into account when programming for a positioning system.

The contouring system is used to control such machine tools as the lathe, milling machine or machining center. Such tools remove metal continuously over the surface of a work piece as in milling a propeller blade. The problem is to control continuously a cutting tool which requires frequent changes in movement along two or more machine axes simultaneously and which is in constant contact with the work piece. The contouring system is more complex and requires a far greater input of detailed instructional information than a positioning system. Therefore, the use of an electronic computer has become practically indispensable as a computing tool for a programmer preparing instructions for machine tools controlled by a continuous path or contouring system.

POSITIONING EXERCISE (ABSOLUTE)

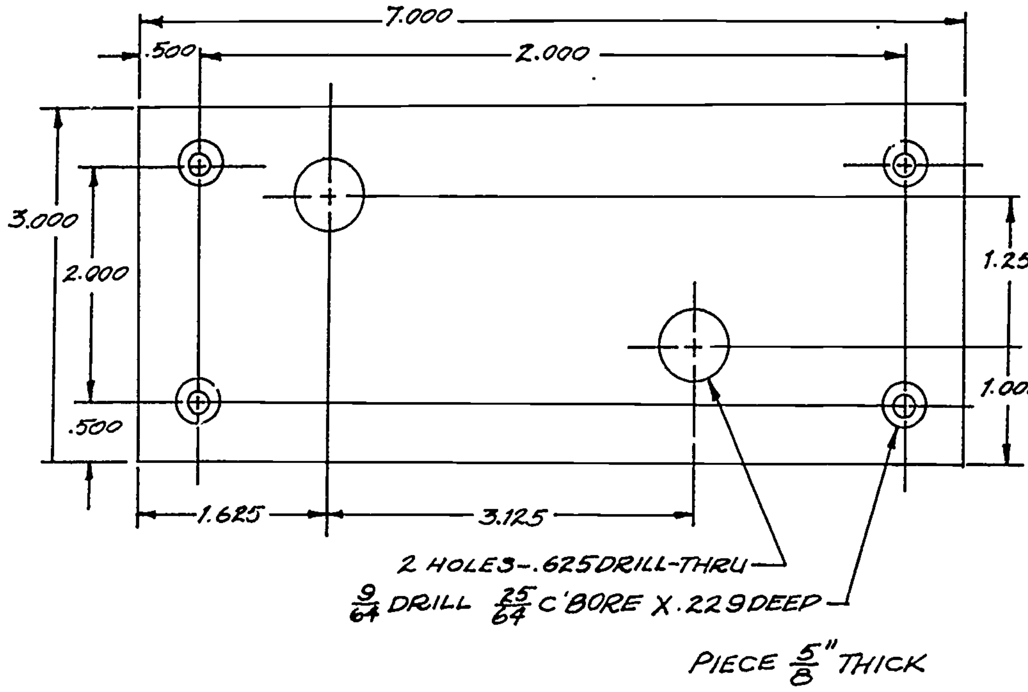


PIECE 1/2" THICK

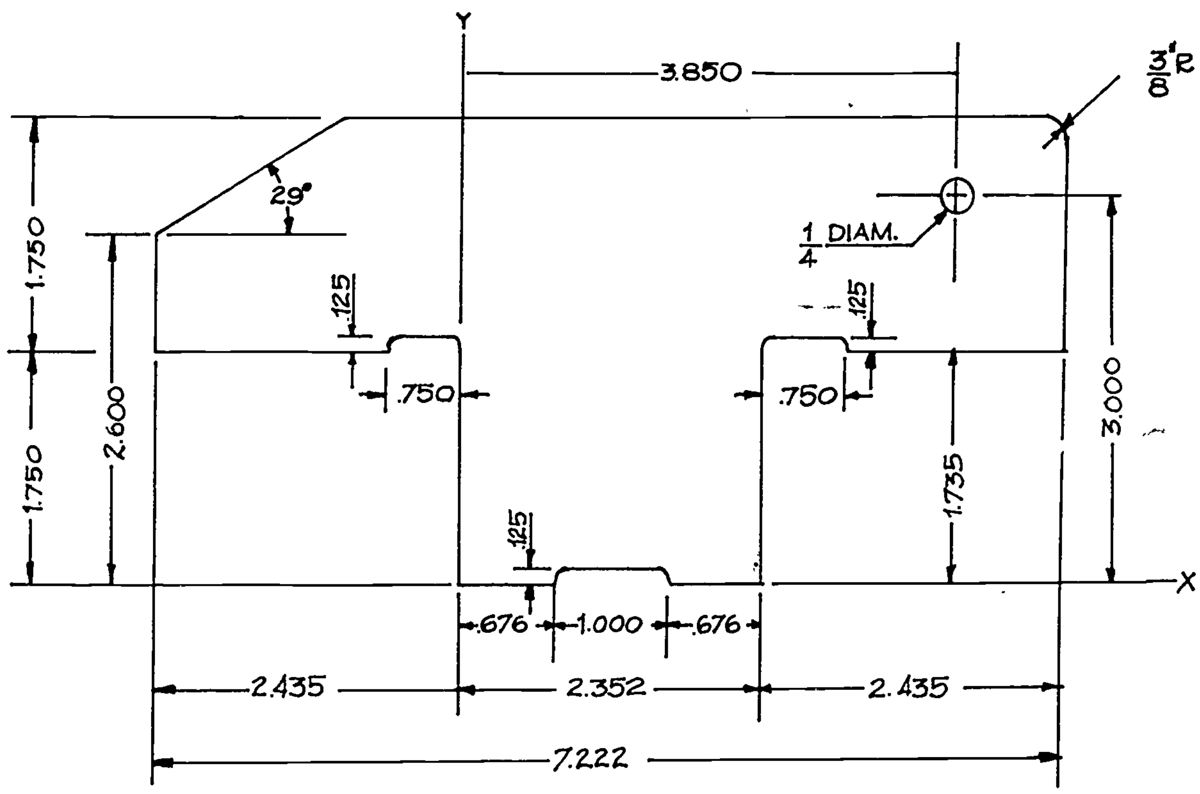
If you will notice, I have provided you with a sample part program for a positioning system using the absolute dimensioning procedure and a floating zero control. In addition, I have provided you with a copy of an APT part program together with an explanation of the meaning of each of the program statements. Rather than take the time to explain the meaning of the statements in these programs, I call your attention to them, and I will make myself available to you at the conclusion of this meeting to answer any questions that you might have.

In order to provide a clearer picture of all of the activities involved in NC manufacturing, I call you attention to this slide. As you can see, when the product design has been completed, it is sent on to the engineering department where an engineering drawing is made. The engineering drawing is sent to both the part programmer and to the production planner. The production planner will be responsible for such information as setup and

POSITIONING EXERCISE (INCREMENTAL)



DEPTH GAUGE



operation instructions, tooling and any fixtures that might be necessary. The part programmer, on the other hand, will examine the engineering drawing and decide if it is to be run on a positioning system or on a contouring system. Usually, if it is to be run on a positioning system, the part programmer will prepare a manual part program. The program will look very much like the positioning example that you have in front of you. Once the part program has been written, the manuscript is given to a clerk-typist who will type out the part program and at the same time cut the tape for the NC machine tool. If, however, the part programmer must prepare a contouring program, he will require the assistance of a computer. Using the appropriate language, he will prepare the part program manuscript, which then will be converted to punched cards. These punched cards are then submitted to a computer processor for processing. In the event the part programmer has made an error in spelling, punctuation, formats or logic, the computer processor will issue an appropriate error diagnostic, and at that time processing will cease. The computer operator will then return the part program, together with the error diagnostics, to the programmer who will correct the errors, rewrite the part program and resubmit the program for key-punching and computer processing. This cycle continues until the computer processor no longer finds errors in the program. At the conclusion of computer processing, the computer will output either a control tape for the NC controller or a deck of punched cards which will then be converted to punched tape or magnetic tape and submitted to the NC controller. This control tape is what activates the servos on the machine tool and in turn causes the cutter to produce the desired part.

One of the major deterring factors to the establishment of NC education programs in the various schools throughout the country is the lack of trained instructional personnel. Many teachers, while they are interested in learning more of this new and developing technology, find it difficult to identify central sources of information or locations of schools providing such instructions. Unfortunately, there is, to my knowledge, at the present time no agency which has assembled and keeps current this kind of information. I will, however, attempt to provide you with the names and addresses of those agencies and schools which are providing some instruction in NC technology. I believe I would be remiss in my responsibility to my university if I did not first mention the programs we offer. At the present time we are offering three curricula which lead to either a Bachelor of Science in Education Degree or a Bachelor of Science in Industry and Technology Degree. I have included within the information presented to you copies of these three curricula. If you have any questions concerning these, I will attempt to answer them at the conclusion of this meeting.

There are two additional agencies which provide significant materials for an individual desiring to learn more about NC. The first of these is the APT education program provided by IIT Research Institute in Chicago. IITRI presently holds the contract for the maintenance and development of the APT system. Therefore, the materials available through that institution will be the most current available. All that is necessary to receive this information is to write to Dr. Shizuo Hori, 10 West 35th Street, Chicago, Ill., and request the APT Education Program Agreement. When this agreement has been signed by your school administrator, all APT documents will be made available, including the APT Language Dictionary, the APT Encyclopedia, and the APT Part Programming Text. Further, members of the APT education program will be eligible to attend the specialized APT part programming courses conducted by IIT Research Institute. In addition, free admission will be provided to the semiannual APT technical meetings. All of these materials can add significantly to one's knowledge of NC technology and systems.

The second agency which provides a significant service is the Numerical Control Society, which is an international organization, the purpose of which is to promote the advancement and diffusion of knowledge about and application of numerical control. The Society headquarters at 44 Nassau Street, Princeton, N.J. The various chapters around the country hold regular meetings to which members are invited. In addition, a publication known as NC Scene is mailed out monthly. Many valuable articles and pieces of information are available through these.

A third source of material requires a little more work. I have included among your materials a list of articles, books and magazines which contain a number of significant articles concerning NC technology and various phases thereof. The true student of NC can gain a great deal from reading these; however, you will find much of the material to be redundant. Nonetheless, I think a great deal can be done toward self-education by reading these.

The last item I will present is in terms of the schools which are providing some instruction in NC technology. Obviously, I cannot make an estimation of the quality of instruction nor of the content of the various programs. For that information I suggest you contact the institutions which are nearest you or those which interest you.

Finally I would like to call your attention to the summer program which is being offered at Northern Illinois University in DeKalb, Ill. Two courses will be offered, each running four weeks. The first course begins June 12, and runs through July 7 and concerns itself with the introduction to numerical control systems. The second course begins July 10 and runs through August 4 and covers advanced numerical control part programming.

These courses are being offered for three semester hours each, for either graduate or undergraduate credit. For further information I suggest you write to me at Northern. Since enrollments will be limited, I urge you to do this as quickly as possible. Thank you for your kind attention.

FOOTNOTES

1. Guide Book of Numerically Controlled Machine Tools, (Detroit, Michigan): The Ex-Cello-O Corporation, 1959), P. 3.
2. Stocker, William M. "Numerical Control," American Machinist, Volume 101, (July, 1957), P. 134.
3. Cooney, John D. "A Status Report on Automatic Metalworking," Control Engineering, Volume VII, (September, 1960), P. 158.
4. Metalworking News, Fairchild Publications, Inc., New York, N.Y.: (March 6, 1967), P. 1.

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U. S. Department of Labor, Outlook for Numerical Control of Machine Tools, A Study of a Key Technological Development in Metalworking Industries, Bulletin No. 1437, Washington, D.C., March. 1965.

Hori, Shizuo. "Symbolic Control", Frontier, Volume 26, No. 3, Chicago: 1965.

Dr. Warner teaches at Northern Illinois University, DeKalb, Ill.

FULL MOLD CASTING

John J. Sladicka, Jr.

This process entails the ramming up of a one-piece polystyrene pattern in sand. The pattern remains in the sand and is vaporized upon contact with hot metal during the pouring process. The metal completely replaces the cavity which the polystyrene had formerly occupied.

The invention of the full mold process by Harold F. Shroyer in 1958 was a boon to industrial casting. The process is totally unique to foundry practice—the lost wax process being the closest casting rival of the full mold process. However, lost wax is prohibitively expensive for large heavy castings. The full mold process has proven itself indispensible for the production of single, heavy coreless castings. Smaller complicated castings can be produced at a premium, due to the coreless nature of the process.

The fact that the pattern remains in the mold eliminates any design limitations, such as draft and parting line, which are inherent in conventional molding. Structural design is also facilitated by the ability to imbed materials into the pattern before molding. This provides for a more economical production of castings which would normally require special cores, weldments or other methods of production.

It was found that the full mold process can be adequately adapted to industrial arts programming; much of the equipment and supplies available in an industrial arts laboratory are suitable for preparing polystyrene patterns. Machines and tools which are uncommon to industrial arts can easily be constructed or inexpensively purchased.

The rapidity with which patterns can be constructed, gated and molded was found particularly desirable. The molding of polystyrene in dry sand is believed to be unequalled for use in an industrial arts program, since the time and preparation necessary for molding is negligible.

Polystyrene patterns can be designed, changed if need be, fabricated and finished with relative ease, and almost immediate returns are evident in subsequent castings.

Creativity can be cultivated and made apparent through the use of the many unique characteristics of the full mold process. Pattern finishes can be as varied as the imagination through the use of textured wax-coated patterns. The imbedding of refractory materials in polystyrene offers an endless number of opportunities to test the ingenuity of the gifted and offer the less capable an opportunity to work in a media which is most unusual and easily worked. As a result, learning is greatly facilitated by the interest generated in the process and can be used as a vehicle to the understanding of related material.

It was not the intent of this program to promote a full-scale adoption of the full mold process in industrial arts. The process should not be substituted for conventional casting methods but should supplement them and also be used where its unique characteristics can produce a product superior to that which can be produced by any other available means.

Mr. Sladicka teaches at Newark State College, Union, N.J.

F-12.10 Woods
Special Panel Session
IS THERE WOOD IN SPACE—IS THERE SPACE FOR WOOD?
Gen. Chm., David A. Rigsby; Chm., J. Russell Kruppa; Rec., James Thompson; Obsr., Wiley G. Hartzog, Jr.; Panelists, Russell L. Gerber, Donald F. Hackett, L. V. Ebenhack; Hosts, Melbourne P. VanNest, Frederick Draves.

NEW TWISTS IN MANUFACTURING FURNITURE

Dr. Russell L. Gerber

The information for this presentation was secured by interviewing management representatives from wood furniture companies which specialized in the manufacture of household furniture and case goods. These were located in North Carolina, Virginia and Wisconsin.

The material used most in the manufacture of this type of furniture involved various types of veneer plywood having either a veneer core, particle board core, or lumber core. The wood species used primarily on the outer surfaces of these plywoods, in order of frequency of use, were: walnut, pecan, maple, cherry and mahogany.

The glues used were predominantly of a synthetic resin type and were mainly applied by a glue-spreading machine which rolled the glue onto the surfaces. In most instances, these pieces were then left to cure in hot presses.

Construction practices have varied little through the years and for the most part are similar to those used in woodworking classes. All of the companies were, however, using bent wooden parts in their furniture. Some purchased these parts, while others made their own.

The following joints predominated in usage: end butt with dowels, back panel rabbet, rail to leg butt with dowels, plain edge, plain dado, lap dovetail, edge miter with dowels, flat miter with dowels, and blind or simple mortise and tenon.

Newer materials and methods of application were found to exist in finishing than in any other construction process. All applications in the finishing process were sprayed on, using predominantly an air spray- or airless spray-type gun. The liquids used were ordinarily applied at room temperature, but in the case of finish top coats, these were in some cases heated to 120-140°F. This tended to speed up drying and also to allow application of a thicker coat.

The bleach used most often was that of hydrogen peroxide. This was mixed with a catalyst at the gun nozzle and sprayed on the surface in one application. In most cases water was then applied as a neutralizing agent, but about one-half of the manufacturers used no neutralizer.

Stains used were predominantly of the NGR (non-grain-raising) type. Sealers and finish top coats used most extensively were of nitrocellulose types; shellac or oleoresinous varnish was never used in finishing.

In regard to the shine produced on a finish, the most popular type of finish was that of satin. To achieve this, the surface is rubbed and polished, using both hand and machine methods. The materials usually used were either rubbing oil and "wet or dry" abrasive paper, steel wool, rubbing oil and pumice, rubbing compound, or combinations of the above. The final polishing was done mostly with the use of liquid wax. In one instance, a company had developed a process where various abrasives were mixed with a rubbing wax, whereupon they could complete the rubbing and final polishing in one operation. Afterwards, the residue was wiped off, and the furniture piece was considered to be completed.

Among the finishes being used a great deal today are the glazed, distressed, or antique types. The only imitation wood finishes used to any extent were the wood-patterned plastic laminates, and these were used more extensively on commercial types of furniture.

Dr. Gerber teaches at Wisconsin State University, River Falls, Wis.

MODERN WOOD TECHNOLOGY FOR THE SPACE AGE

Donald F. Hackett

If wood were discovered today for the first time, it would be hailed as the most important discovery of man, because no material is comparable in degree of work ability, beauty, strength, durability and versatility.

Today, trees are used to make over 4,000 different products. In addition to lumber and wood products, there are such items as paper, charcoal, acetic acid and other chemicals, various oils and solvents, plastics, adhesives, foods and a host of other things.

Industries that use wood in one manner or another employ approximately 1.5 million men and women. The pulp, paper and allied products industry is the largest in terms of number employed and value added in manufacture. The lumbering industry is in second place, followed by the furniture industry.

The largest companies employ men and women in hundreds of different occupations. In addition to administrative and clerical personnel, there are designers, scientists, engineers, managers and foremen, salesmen, skilled craftsmen, machine operators and many other specialized, semi-skilled and unskilled employees.

The construction industry provides employment for approximately 800,000 carpenters and for thousands of architects, engineers and technicians. Since World War II, the manufactured house industry has grown impressively. Today more than one of every five single-family dwellings is mass-produced. Predictions are that by 1975 the ratio will be one in every two.

Industrial arts may be defined as a study of the origins and development of industry and of the tools, materials, processes, occupations and problems involved in converting natural resources into useful products.

While several objectives may be claimed for this study, the following are unique:

1. To develop an understanding of industry and its technology.
2. To develop an understanding of the occupational opportunities, requirements and working conditions in industry.
3. To develop the ability to use tools and materials to solve technical problems.

A course in modern wood technology designed to implement the above definition and objectives should be organized along the following lines:

Origin and Development of the Wood-using Industries
The Material Wood
Product Design
Process Engineering
Manufacturing (industry related to school).

Measuring	Routing
Sawing	Turning
Planing	Fastening
Shaping	Finishing

Manufactured Products

Lumber	Particle board
Plywood-Veneer	Furniture
Insulation board	Houses
Hardboard	Paper

Other chemically-derived products

Such a course should involve the students in a study of the history, development and organization of the wood-using industries, the methods and techniques by which wooden products are designed and engineered, and the activities involved in preparing a product for manufacture. This study should also deal with the nature and properties of wood and with the people who make their careers in this branch of industry.

The study of manufacturing should deal with the industrial processes by which wood is sawn, planed, shaped, routed and the like. This knowledge should then be related to and applied in the school shop.

Student activities should be adapted to the capacities of the students and would include the following:

Organize into two or three companies and mass produce a product.
Construct a working model of a saw mill.
Make paper from wood.
Write a paper on the history of sawing machines.
Make six sample joints.
Design a tool to cut wooden spheres.
Ascertain the moisture content of a wood sample.
Compare the strength factors of several wood species.
Design and construct a piece of furniture.

This course is called "Modern Wood Technology" because it introduces the student to the technology by which wood is converted into various useful products. It is designed for all boys and girls. It provides for the needs and interests of the college-bound as well as those of the vocational-technical-school bound and the terminal student.

Dr. Hackett is chairman of the Industrial Arts and Technology Division, Georgia Southern College, Statesboro, Ga.

IMPLEMENTING SPACE AGE WOODWORKING PROGRAM TO THE CLASSROOM

L. V. Ebenhack

Changes in the nation's occupational structure and developments in wood technology provide exciting challenges that must be met by changed curriculum and teaching techniques. The woodworking program can be developed to include the most relevant, beneficial and contemporary facts and skills for the space-age students of various levels and abilities. "Implementing" is defined as giving practical effect to and ensuring actual fulfillment by concrete measures. With this in mind, let us examine possible program developments that will ensure actual fulfillment of the educational needs of our students in the wood shop.

Research is developing an endless variety of new products in glues, abrasives, finishes, wood and wood composites; new tools and production methods are being introduced – all increasing the versatility of wood. We must make available to the student those suited to our facilities. The marriage of wood products and other materials is also a growing trend. New methods and designs can be utilized with these new developments. There is a constant unfolding of new ideas as we investigate these advances in wood technology, and as the student becomes infected with the spirit of enterprise and creativity as we introduce him to the vast current possibilities of woodworking.

The ideal space-age woodworking program will relate to wood industries specifically and to other industries generally in a manner the student can understand and appreciate as preparation for life. Job opportunities are of concern to the student. Industrial visitors, field trips, and audio-visual aids help bridge the gap between the classroom and the world of work. A shop library with current wood-related material and job description and listings, etc., increases fulfillment of the student's education.

One of the most practical contributions the woodworking program can make to a student's education is the development of good safety habits. This has a carry-over to all areas of industrial employment as well as to the home shop; it is truly pertinent to space-age woodworking curriculum.

To enable our woodworking program to maintain its proper place in the space-age educational program, we, as educators, must constantly strive to strengthen our understanding of woodworking, its related areas and their technological developments. Our local, state and national industrial arts meetings provide an excellent interchange of educational and industrial ideas and news. Industries and AIAA packets offer a wealth of material. We need to read industrial articles and magazines as well as our fine school shop magazines. Industrial and school shop visitations, workshops, in-service training and additional courses contribute to the fullness the teacher brings to the program.

Mr. Ebenhack teaches at Garfield Heights High School, Garfield Heights, Ohio

F-12.11 Special Interest Panel A
<u>FEDERAL SUPPORT—ITS EFFECTS AND OPPORTUNITIES UPON INDUSTRIAL ARTS PROGRAMS IN THE FUTURE</u>
Chm., Edward R. Towers; Rec., Rex A. Nelson; Obsr., David H. Soule; Panelists, Bill Wesley Brown, Bruce Hammersley; Hosts, Joseph Devilbiss, Roger C. Lasswell. Mr. Hammersley's manuscript not provided.

WHAT CRITERIA FOR FEDERALLY SUPPORTED RESEARCH IN INDUSTRIAL ARTS?

Bill Wesley Brown

Our title implies that there are several criteria for supporting research in industrial arts. In the normal course of events, it is assumed that the administrative unit which will pay for research will determine the criteria which will be used in evaluating the research document. Those who wish to meet or exceed these criteria will be looked upon with favor when the money is being passed out; those who fail to meet the minimal expectations—either by design or by accident—will be overlooked.

One set of criteria would apply for Federally-supported research, another set would apply for privately-funded research, another set for research sponsored by state departments, another for university-oriented research, and still others for research undertaken at the local elementary and secondary levels.

Is this really what we mean? Let's listen in on what some of these people would say to someone asking for support and interested in research which would affect them in some way:

1. <u>Federal Review Panel:</u> Here is $75. It is not quite what you asked for, but we are confident that you will be able to manage nicely on this. Consider it a challenge. If the voucher for this money arrives at your institution on a Monday, Wednesday or Friday, be sure to complete twelve copies of OER-7-665092-XYZ in quadruplicate. The pink copy is sent to the address noted, unless that form was superseded by Change Order dated (and that date is obscured by poor typing and even worse mimeograph work).

If the voucher arrives on a Tuesday, Thursday or the weekend, send us the . . . unless . . . and so on.

2. <u>University Administration:</u> Take about four weeks and investigate this problem in depth. Don't spend more than $75, and for goodness' sake, don't neglect your classes, committees and counseling.

3. <u>Those who are going to use the research:</u> Go ahead and find out whatever you want to, just don't make my program look bad.

Do you know any of these people?

It is a reasonable assumption that the same criteria for supporting, proposing, establishing, conducting, evaluating and disseminating any research should apply to all research. Sound research is sound because it is planned, conducted and reported according to accepted methods, principles and practices.

If this is true, how can we justify research within a given discipline, including history, English or industrial arts?

Any discipline has unique characteristics which distinguish it from other areas. These characteristics may be curricular, methods, techniques, and so on. The key is to know how, when and where these unique and identifying features can be investigated so as to extract maximum usefulness from research in the area in question—in our case, industrial arts.

If we attempt to describe the objectives of industrial arts to someone who knows little if anything about the subject, stressing objectives which we share with other disciplines, we will accomplish very little.

On the other hand, if we stress the unique features and objectives of industrial arts—those aims and objectives which we and we alone strive for—we will accomplish a great deal.

So it is with research in industrial arts. Our research criteria should first meet the rigid requirements of scholarly endeavor; secondly, the research effort should be based on a sound understanding of those things which set us apart from all other disciplines. It goes almost without saying that these criteria should be thought of as in addition to, not in place of, or anything less than, scholarly endeavor. Searching for ways and means of extending our knowledge within our sphere of influence, we have only one standard to meet, that of excellence.

We have many ways of assuring excellence in industrial arts research. We need:

(1) a clearly defined problem
(2) to conduct and document a comprehensive search of the literature
(3) an unimpeachable plan and procedure for attacking the problem
(4) to execute the research effort according to the plan
(5) an objective analysis of the resulting data
(6) a report of the findings in usable form.

So far, what we have said applies equally to English, history, biology and so on. What is unique for industrial arts?

It is reasonable to assume that philosophical and disciplinary concepts transcend geographical boundaries. A student can attend Northern Arizona University and earn a master's or bachelor's degree in industrial arts education. If he wishes to migrate to some alien atmosphere, he is free to do so. As he leaves, he takes with him the concepts acquired. We rely on our universities, conferences and journals to move ideas and concepts with impunity across artificial boundaries. From a practical point of view, we also recognize that existing administrative structures regulate public education at state and local levels. These structures will either assist or resist the movement of these ideas and concepts.

Let us make one key assumption at this point. Let us assume that X number of dollars for research in industrial arts is about to be granted to the several states by a Federal funding agency. How will the several states acquire and then expend the funds so as to insure maximum return on the dollars spent?

Those of us familiar with the research efforts authorized under the Vocational Education Act of 1963 are aware of the funding practices of the Division of Adult and Vocational Education. Very briefly, the researcher seeking funds prepares his research document in the proper number of copies, in the proper form, and sends the proposal to Washington. Much time passes. Ultimately the documents are sent to "readers" who recommend funding or non-funding. They may recommend minor or major revisions in the proposal and note: Resubmit. After more time passes, the researcher is finally notified of these decisions. One of the most glaring weaknesses of this system, aside from the fantastic time-lapse between research idea and some kind of decision—is that in the case of a "Resubmit", the Bureau of Adult and Vocational Education makes no effort to see that the original readers get the revised proposals. Again with the time-lag in mind—and possible changes in the amounts of money available—our would-be-researcher has invested heavily in preparation of a proposal that now starts the whole laborious routine all over again, only to have it rejected by the new set of readers. This is not an isolated instance.

At the risk of being presumptuous, the following idea is submitted to this group as a possible criterion for Federal fund of research in industrial arts. The concept seeks to avoid the time-consuming and other less-desirable features of other Federal areas of participation.

"Research Authorities" in industrial arts within the several states are proposed. These authorities, which would have the power to grant funds for industrial arts research, would be composed of:

(1) the state supervisor of industrial arts (at least one)
(2) specialists in industrial arts, who also have an interest in and a capability for research, from one or more institutions of higher learning (these could be on a rotation basis)
(3) specialists in research from institutions of higher learning
(4) specialists in research from the chief state school officer's staff.

In addition to these permanent members, the authority could ask others to meet as deemed necessary. These people could well be research specialists from an elementary or secondary school district, or a representative from a local industrial arts association.

Proposals whose concepts would cut across several state boundaries with regional and/or national implications might ask a representative of the AIAA (American Industrial Arts Association) to sit with the authority.

The Research Authority in industrial arts in a given state would meet monthly to consider proposals for research in industrial arts.

A state plan designating the office of the chief state school officer as the recipient of Federal funds and outlining plans for disbursing approved monies to school districts, universities and the like would would be of considerable importance. The state plan would also indicate the minimum requirements that authority would recognize in order to consider a request for research funds. The state plans should make provisions for accepting funds for supporting research in industrial arts from Federal, state, local and private sources.

Would a national organization of the several Authorities be necessary? Yes. The organization would be necessary from a communications point of view. As such, the national organization would not need to be a massive structure; in fact, an agreement and plan to maintain communications between the several Authorities, ERIC (Educational Research Information Center), and possibly the AIAA (American Industrial Arts Association) for Journal purposes, is all that would be necessary.

The value of these communications is obvious. Each state, through its Authority, would know what research in industrial arts has been proposed and approved. Unintentional duplication of effort would be avoided.

It is not unreasonable to request that the recipient of research funds provide an abstract of his problem in sufficient quantities so that each Authority, ERIC, and the AIAA would be aware of research efforts in industrial arts within the several states. It is also not unreasonable to assume that each state Authority would be responsible for in-state dissemination of these kinds of data.

Research in industrial arts should meet the same rigid requirements that any discipline should meet. "Research methods" as a separate study has its own unique standards of excellence. Our criteria need to measure up to and, wherever possible, to exceed these standards.

A dramatic departure from past practices in Federal-state participation has been recommended. These recommendations center around the creation of state Authorities for Research in industrial arts.

It is anticipated that such Authorities would reduce the time lag presently found in some areas of Federal-state educational participation, and would ultimately reduce the gap that now exists between the producers of research and the consumers of research.

Dr. Brown teaches at Northern Arizona University, Flagstaff, Ariz.

F-12.12 Special Interest Panel B

SPECIALIZED FEDERALLY FUNDED RESEARCH GRANTS—HOW, WHY, WHERE ARE THEY CHANGING INDUSTRIAL ARTS?

Chm., Richard D. Kain; Rec., Edgar Tulloch; Obsr., John K. Mikush; Panelists, Richard J. Vasek, James Hastings, Harry Hawkins, Howard Faulkner; Host, Herbert B. Downs.

PREPARATION OF PROPOSALS FOR SMALL-GRANT FUNDING

Richard J. Vasek

Because of the time limitation, I will precede my presentation with a brief discussion of published information pertaining to this topic. The following three sources give a good explanation of the how, why and where of small-project proposals:

1. General Suggestions for Writing Research Proposals, by W. G. Findley, director of R & D Center in Educational Stimulation, College of Education, University of Georgia. (In this paper, Findley discusses significance, related research, design, personnel and facilities and economics of proposal submission.)

2. How to Prepare a Research Proposal, by D. R. Krathwohl, dean, School of Education, Syracuse University, Syracuse, N.Y. (A copy of this report, which is available for $1, includes a discussion on problem statement, related research, objectives, procedure, personnel, facilities and budget.)

3. Small-Project Research. Bureau of Research, US Office of Education. (This document discusses the place to apply, the title page, the abstract, the body, personnel and facilities, the budget and appended items.)

The United States is divided into nine regions. Anyone living in Region IV, which includes Alabama, Florida, Georgia, Mississippi, South Carolina and Tennessee; or in Region V, which encompasses Illinois, Indiana, Michigan, Ohio and Wisconsin, will submit his proposal directly to the Atlanta or the Chicago regional office. Those living in regions other than the two just mentioned must send proposals to the Bureau of Research in Washington until other regional offices become functional.

The proposal must be submitted through some sponsoring agency. This may be an institution of higher learning, a state department of vocational education, or a local educational agency. All research grants require sufficient cost-sharing by the grantee institution.

To qualify as a small project, the proposal must meet two basic requirements:

1. The total investment by the Office of Education must be $10,000 or less.
2. The project must be scheduled for completion within a period of 18 months.

A definite format must be followed to enhance the chances for project approval. Details are as follows:

1. The cover page must include the title, the cooperating agency (institution, state department, or other), the initiator (applicant or principal investigator), project director (if different from principal investigator), the transmitter (dean, research coordinator, or other), the contracting officer (president, director, or superintendent), the duration of activity (time) and the total funds requested.

2. The abstract occupies a single page, identifies the proposal and concisely and simply summarizes the contents.

3. The body of the proposal communicates the project director's plan and its probable effectiveness. It describes the objectives, procedures and use to be made of the findings.

4. Personnel and facilities describe the availability of people and things that will play a major role and will be utilized to bring the research project to successful completion.

5. The budget, through tabular presentation, indicates reasonable estimates of expected costs. It should indicate Federal and local contributions toward salary, travel, supplies, communication, services, equipment, final report and indirect costs.

6. Appended items supply information, such as instruments to be used and whether the proposed project has previously been submitted.

Mr. Vasek teaches at Mississippi State University, State College, Miss.

A DIRECTED FIELD EXPERIENCE FOR THE PREPARATION OF INDUSTRIAL ARTS MAJORS

James R. Hastings
Harry M. Hawkins
Howard M. Faulkner

Ever since the term "industrial arts" was conceived as the identification for that segment of the school curriculum which is concerned with acquainting students with one of the dominant elements of our society, namely, industry, teacher educators have been concerned with how to prepare a teacher to fulfill his role properly.

Various leaders, such as Wilber, Hornbake, Olson and DeVore, have properly pointed out that there is insufficient justification for this curriculum area if it is to be concerned only with the manual and manipulative processes and skills related to this field of study. Justification can be made only on the basis of the contribution made by the curriculum and the teacher to lend intelligibility and understanding of the major organizational elements of modern industry and the technological aspects of our society.

During the last few years, numerous studies and articles have been directed toward the identification of the major elements of industry which should constitute the structure for the content to be taught by the industrial arts teacher.

While considerable attention and study have been directed toward the identification of new content for the field of industrial arts, comparatively little has been written concerning the type of preparation which the future industrial arts teacher should receive in order to teach the content effectively.

It would seem logical that the future industrial arts teacher will need to be exposed to those experiences which will aid in identifying those concepts and insights of modern industry which will extend his understanding beyond the purely technical and manipulative. He will also need to understand the related fields of industrial management, economics, industrial sociology, industrial psychology, research and marketing in order to implement a new curriculum structure and content.

The Directed Field Study Program for the preparation of industrial arts majors, which is currently being carried on at State University College at Oswego with the cooperation of approximately 25 industries and with financial support from the Cooperative Research Branch of the United States Office of Education, has been conceived as a professional laboratory experience for providing future industrial arts teachers with a broad orientation and first-hand contact with the major elements of industry.

The program was developed as a result of the several staff members' interest in this type of pre-service experience for industrial arts majors and from the recommendation of several industrial representatives serving as an advisory committee to our division that we do more about acquainting our students with the organization and operation of industry.

Several other research studies, such as those by Olson, Stadt, Blomgren and Stern, and a review of the literature in the related fields of industrial management, industrial psychology, industrial sociology, economics and industrial relations were instrumental in the final selection of the basis for the Directed Field Study. This structure and organization were carefully reviewed by a panel of industrial managers and recommended for use within the second nine-week period of the student teaching semester.

As the framework for this experimental program was being developed, we were concerned not only with the content and insights to be gained by the students as they had opportunity to study industry, but also with the very important process of identifying concepts and utilizing them to develop curriculum units for eventual teaching use. More than ever before, curriculum development and teacher preparation must be recognized as an inseparable and important aspect of pre-service preparation.

The importance of developing a unifying structure for a field of study has been enunciated by Brunner, and this principle has been followed extensively in other subject matter fields by organizing the content around key concepts, themes and generalizations. Involving the students in this program in the process of searching for and identifying key concepts as a basis for developing curriculum study is in keeping with current curriculum development theory.

The objectives of this experimental curriculum development research project are as follows:

1. To develop, refine and spell-out in procedural form a curricular model for a directed field experience in industry.

2. To develop the necessary curricular guides and manuals to be used by teacher educators, students and industrial personnel for their use in conducting a program of this type.

3. To identify those central unifying concepts related to industrial technology which industrial arts teachers need to be aware of to guide their teaching.

4. To conduct a pilot program on an experimental basis.

The organization of the field study program is designed to provide a type of learning experience whereby the student can be introduced to a topic; he can then study the topic and observe industrial personnel engaged in work relative to the area of study and form, from this experience, more realistic concepts about the topic.

The objectives developed for the operation of the program reflect what are believed to be realistic goals which can be attained by the participants. These objectives are as follows:

1. To provide future industrial arts teachers with a broad understanding of the function and organization of the major common elements of industry for interpretation in their classes.

2. To develop a fundamental understanding of the history and development of industry and labor and of the relationship and responsibilities of labor and management in our industrial society.

3. To develop an understanding among future industrial arts teachers of the principles of industrial sociology, industrial psychology and industrial economics.

4. To give future industrial arts teachers an opportunity to identify the important concepts about American industry which need to be taught at the public school level and to prepare curriculum resources for developing these concepts with public school students.

The operation of the field study program is organized into three major divisions, referred to as phases. Phase one consists of one week on campus and is devoted to introducing the student to the program and to giving him a background in subject areas relative to the content of the program. Topics in industrial psychology, industrial sociology, industrial economics, organization of industry, history of labor and history of industry are presented to the class by staff members and by selected speakers who are generally considered experts in their particular fields. Research assignments are given to develop a better acquaintance with literature current to the subject under study. Selected films are also used during this week. Students are assigned to particular industries, and information regarding how they may function in the industrial setting is also given at this time.

The next six weeks, phase two, follow a pattern of weekly events scheduled to give the student an introduction to the topic under study each week; time to observe and study with the industrial personnel in industry; and an opportunity to review the experiences he has had during the week and to exchange information about his experiences with other members of the class. The nature of the student's work while assigned to an industry is not of the work experience type, but, rather, he is to study and observe under the guidance of selected industrial personnel. A schedule is usually arranged by the industrial contact person so that the student can arrange to discuss particular subject areas with industrial personnel who are currently engaged in work relative to the topic under study for the week. A typical weekly schedule follows:

Each Monday the class meets at a host industry where the topic for the week is introduced by an industrial speaker. Films and discussions are also employed for the purpose of introduction at this time. The host industry provides a plant tour following lunch. Each Monday, a different host industry is used so that a total of six industrial tours in different industrial plants is experienced by the students.

Tuesday, Wednesday and Thursday of each week are scheduled for each student to be at the plant where he is assigned. Using a specially-prepared field manual as a guide, activities are observed and information gathered about the topic under study. One day of the week in which labor is under study is devoted to a seminar where a panel of labor leaders present selected topics regarding organized labor. This seminar is held outside the industrial plants.

Each student is visited at least once during this six-week period while assigned by staff members to an industry. These visitations are scheduled for the purpose of discussing any questions which the student or the industrial personnel may have regarding the program and to make observations for seminar discussion.

Each Friday during the phase-two period is devoted to seminar sessions in which the students discuss the topic of the week in terms of their experiences in the various industries. Opportunity is provided for exchange of information among students, so that particular experiences of individual students may be shared by the rest of the class. This sharing of experiences serves the purpose of synthesizing concepts which are common to most industries. Concepts identified are then extracted and used as a basis for selecting developmental activities appropriate for use in industrial arts curriculum content. Films and speakers are also used on Fridays to round out information on the topic under study for the week. A seminar session is devoted to discussion and identification of the major concepts each student acquired during the week. Additional discussion is centered on exploring the possibilities of various activities which may be suitable for teaching the concepts developed in a junior or senior high school industrial arts situation.

The material and information accumulated during the week by each student are written into the special field study manual and turned in for review and evaluation.

The third and final phase of this program consists of a curriculum seminar workshop for the purpose of developing resource units for future use in curriculum construction, unit planning and lesson preparation.

The participants prepare the resource units by committee effort of two individuals per committee, each working on a major topic that has been under study during phase two; e.g., industrial relations, production, finance, etc. One committee may prepare resource units from the first phase of the program with emphasis on industrial economics, the function of profit, and industrial organization and management. Each committee usually develops between three and five units.

As a guide to an acceptable framework of unit development, the participants are given a format or structure which sets some limits on the level of development, approximate quantity of material that is to be developed, and the layout by major categories. This in no way, however, limits the creative potential of any individual or committee. In fact, every effort is made to encourage creativity, especially in unique presentation of lessons, laboratory activities and evaluation.

More specifically, each committee is asked to develop their units using the following example format. The layout and format suggested include:

1. Area (e.g., Industrial Relations)
2. Category (e.g., Employment)
3. Conceptual statement of objectives
4. Sub-concepts and facts
5. Lesson topics
6. Activities
7. Resources

From this point of development where the sub-concepts and facts, lesson topics, activities and resources have been generally established in brief outline form, each point is discussed in more detail on the following pages in the order listed above.

Each sub-concept is individually expanded and supported with additional facts to give the reader better understanding and definite limits. Usually this is approximately a half-page expansion in either outline or paragraph form.

The lesson topics are developed to include broad objectives, logical presentation of subject matter, suggested evaluative techniques and specific references pertinent to the topic.

All suggested activities are outlined with definite information as to how the activity might be used to augment the lesson and develop the desired concepts in the minds of public school students. Emphasis is on imaginative and creative activities that are most appropriate to the industrial arts laboratory.

A complete list of resources is developed in proper bibliographical form, which will allow the user to select and secure the necessary materials to present the unit adequately.

The level of development of all units is for a senior high school program of high-ability students. The reasoning here is that it is better to prepare the material at this "complete level", which will allow the user to select or adjust the content to make it appropriate for a somewhat lower level as the need seems to dictate in an actual teaching situation.

During this workshop period, the complete resource facilities of the college are at the disposal of all participants. These include industrial arts curriculum laboratory;

specialized and selected text reference material; previewed film lists; resource packets of selected brochures and pamphlets; participants' individually-completed Industrial Field Study Guides; tape recordings of industrial speakers; college library and reproduction facilities.

Each committee produces enough copies of its work for distribution to all participants and several copies for staff and study use. The total time allotment for this seminar is approximately two weeks of full-time operation with a critical review and presentation of selected units, by each committee, to all participants for their reaction at the end.

It is hoped that materials and guidelines developed in this program may be used by other industrial arts teacher preparation programs for further experimentation, development and evaluation.

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Dr. Hastings, Mr. Hawkins and Mr. Faulkner are on the staff of State University College, Oswego, N.Y.

F-12.13 College Students
Special Panel Session
TECHNICAL AND PROFESSIONAL DIRECTIONS
Gen. Chm., Rex Miller; Chm., L. H. Bengtson; Rec., Gregory Weber; Obsr., Barry McNew; Panelist, Wade M. Anderson

TURNING TECHNIQUES

Wade M. Anderson

Wood turning has always held a fascination for the beginning student in woodworking. However, since most shops are equipped with only three or four wood lathes, it is hard to instruct a number of students at one time because the lathes are in use, and the continuity of the instruction is lost. A fast, simple project must be used.

One of the most successful projects that I have used in wood turning has been housings for the Olde Thompson salt and pepper mills. A project of this type has many advantages.

It has great student appeal, it is a "natural" for the slow student, as it allows him to compete with the faster student, and the finished project is one which he is proud to take home. In our shop there is a big demand for the project at Christmas-time.

In the past, the principal drawback to such a project has been the difficuity of chucking the wood in the lathe. Usually, home-made finer chucks had to be constructed and, at best, these would last only a few days. By accident, I discovered that using a 1-1/2 inch spindle from an oscillating spindle sander, State Model B-4, was a perfect way to chuck the wood for the salt and pepper mills and, so far as I know, this technique has not been used elsewhere.

This spindle has a #2 Morse taper which fits most lathes and, being made of rubber, allows the wood blocks to slide on easily, and, when the nut is tightened, the rubber compresses in length but expands in diameter and will hold the blocks tightly. This also has the advantage of allowing the blocks to be removed any number of times but still be centered. By using several spindles which can be portioned between classes, students can do the turning without losing any time in the process of chucking.

Another advantage of this method is that the staining, filling and application of finish can be completed with wood still on the spindle. We have found that the best way is for the student to keep his project right on the spindle until all the steps are complete: filling, rubbing and polishing. He can take the entire spindle to the spray rooms for spraying, then return to the lathe for his rubbing and polishing.

It is possible for a student to finish a set of salt and pepper shakers in one period, and to turn out a very attractive project.

Mr. Anderson is at Gonzales Union High School, Gonzales, Calif.

F-12.14 Student Clubs
Special Panel Session
INTERPRETING INDUSTRY THROUGH MASS PRODUCTION AND THE BOY-GIRL EXCHANGE PROGRAM IN HIGH SCHOOL
Gen. Chm., W. A. Mayfield; Chm., Daniel H. Malia; Rec., Betsey Eschner; Obsr., James L. Boone, Jr.; Panelists, Ned B. Sutherland, Fred Rusk.

INTERPRETING INDUSTRY THROUGH MASS PRODUCTION

Ned B. Sutherland

The concept of interpreting industry through mass production is receiving more attention in the industrial arts program today. Still, because of lack of knowledge and experience, only a few teachers are presenting this unit.

We know today more products are being produced by mass production. A large percentage of our economic way of life today depends on mass production methods; therefore, the need to understand industry and the significance of mass production is of great importance to our youth.

The majority of our students have completed three semesters of industrial arts, and this unit is offered in the 9th grade. It has been our experience in the past to start the unit after the fourth week, because the student is then familiar with shop facilities, study design and drawing, and has started or completed basic products. This also gives the instructor time to become better acquainted with the students.

The following are procedures that have been effective in our school system:

To stimulate or motivate the class for this unit, bulletin board displays, films, speakers and field trips are highly recommended.

The next responsibility of the instructor is to direct the class discussion on the five divisions of industry. They are capital, personnel, research and development, engineering technology and sales.

Since this is to be symbolic of industry, the students should have the major responsibility for organization. The class becomes the stcokholders, and they buy stock to finance the industry and in turn they will receive one of the manufactured products. The stockholders will elect the officers of the company.

The five-man production committee is composed of a president, production engineer, design engineer, business manager and factory manager. Some of our instructors have incorporated a three-man committee, which is ideal for a small class. Following the election, the production committee spends two weeks in the organization of the class industry. It is recommended the committee meet with the instructor five to ten minutes per day for guidance.

The product should be one which can be easily produced in the general shop and has the following points: simple construction, two or more materials, several operations, good design and low cost.

After the product is chosen, the president must work with any or all of the other members of the committee to see that their job is coordinated with the others. When all the work is completed, the class meets for reports and a training session on the line.

The evaluation of the students should be to determine how much each student understands about industry. Daily grades will be an incentive to stimulate the students to work to their capacity and keep the students in an industrial atmosphere. Finally a test on the objectives is given.

The key to this unit is having a production committee with a broad knowledge of industrial arts and leadership quality. All levels of economic life have been included, with favorable results.

Mr. Sutherland teaches at Kokomo High School, Kokomo, Ind.

AN EXCHANGE PROGRAM FOR INDUSTRIAL ARTS AND HOME ARTS IN THE JUNIOR HIGH SCHOOL

Fred D. Rusk

Our society is in a state of flux, and our educational programs should be continually evaluated and revised in order to meet the changing needs. With increased productivity and a resulting shorter working week, we find men spending more time in the home; and women, with a multitude of timesaving devices in the home, are now working or involved in community activities, which results in their spending less time at routine household duties. Women have assumed some maintenance and do-it-yourself projects in the home, and men have taken over cooking on the barbecue and other assorted domestic duties. Thus, it becomes readily apparent that skills and knowledge in home and industrial arts can benefit both boys and girls alike.

It was with this reasoning in mind that a program was set up to trade the home arts and industrial arts classes for a three-week period of time. The content for the program was composed of useful and necessary information that was not presented in any other school work.

The girls were given a tour of the shop, and the various areas were correlated with local industries. Student projects were displayed, so the girls could see something of the type of work that the boys do. They were given information and some project work in the following areas:

Home planning – lot selection, house styles, room and furniture arrangement and electrical layout.

Home mechanics – hanging of pictures and mirrors, fastening devices, use of hand tools, faucet repair.

Plastics – applications of plastic materials and a small project.

Woodworking – wood identification, design and furniture styles, care of finished surfaces, use of hand and power tools on a small project.

Graphic arts – methods and applications of the printing industry, hand composition and press work.

Electricity – uses of electricity, safety, wiring an appliance.

The boys in home arts learned how to improve their appearance and personality, how to care for their room and clothing, and how to prepare meals and snacks. A brief breakdown of material covered follows:

Personality development – self-evaluation, rules to develop a good personality, courtesy.

Becoming a better family member – grooming and personal hygiene, clean clothing, care of shoes.

Care of clothing – use of sewing machine, ironing, spot removal, laundering, mending, sewing on buttons.

Buying clothes – quality, style, color and matching, sizes.

Care of bedroom – arrangement of drawers and closets, cleaning a room, providing a study area.

Know your kitchen – equipment and utensils, operation of oven and range, washing dishes, safety and sanitation.

How to prepare the table – table setting and dinner courtesy.

Nutrition – effect of nutrition on appearance, balanced diet.

Food preparation – planning the meal, preparing the meal, preparation of snacks and sandwiches.

This program has been used in several schools in Kokomo and has been found satisfactory to both teachers and students. The girls prefer those areas in which they work or operate power tools. The area most preferred by the boys was food preparation, and they rated ironing as the least preferred area.

Mr. Rusk teaches at Maple Crest Junior High School, Kokomo, Ind.

F-13.1 ACIATE
Evaluative Symposium
NEW DIRECTIONS FOR INDUSTRIAL ARTS?
Gen. Chm., Charles Porter; Chm., William R. Erwin, Jr.; Rec., Rutherford E. Lockette; Panelists, Daniel L. Householder, Robert E. Blum, Jerry C. Olson, Alan R. Suess; Hosts, Earle Davison, William Hanks. Mr. Olson's manuscript not provided.

NEW DIRECTIONS FOR INDUSTRIAL ARTS

Daniel L. Householder

The primary value of the current controversy in our field is that it is forcing a continuing examination of our beliefs and purposes. The unexamined point-of-view cannot be considered a worthwhile guide for any profession. Basic tenets must be continually shaped and re-shaped in the interplay of dialogue among practitioners. Only then can an effective involvement be attained.

Historically, industrial arts has experienced periods of ideological ferment and examination; at other times there has been little questioning of basic beliefs about the purposes of practical education. Probably the most significant period of ideological decline in industrial arts occurred after a standard "party line" had been developed by the professional leadership. Undergraduates were trained to implement a uniform doctrine; teachers became technicians who followed the rules their superiors had derived from first principles. Attempts were made to specify the boundaries of content and activity selection; the intelligentsia even developed appropriate projects to help insure that secondary school students would master a common body of subject matter in each phase of the discipline.

Classroom teachers of industrial arts are now quite cognizant of the urgent need for a major change, overhaul or revolution in their programs. They do not need to be told that we must change; they are face-to-face with the problem every period of every day. However, most teachers feel that they are in no way properly prepared to participate effectively in re-examination of a basic position or in the formulation of new guiding principles for industrial arts. Similarly, they are insecure about personal involvement in the implementation of curriculum innovation and in the evaluation of the effectiveness of new patterns of organization. In short, they have not been adequately prepared to operate as independent professionals participating in the evolution and improvement of their profession.

One of the most positive sources of hope for industrial arts education at the present time is the presence of several well-organized philosophical positions. We seem to be moving away from a standard point-of-view in a number of separate geographical and ideological locations. Not only are these foundational positions well-developed; they are now being used as effective guides to practice—the "ivory tower charge" can hardly be leveled against the individuals and groups involved in contemporary intellectual inquiry in industrial arts.

It is imperative that a questioning outlook be maintained, and that practitioners be prepared to engage in the continuing quest for acceptable philosophical bases. Whether or not we have four philosophical poles, we must avoid unquestioning acceptance of any one position and maintain a multi-faceted philosophical exploration, continuously recreating the foundations of our profession.

Dr. Householder teaches at Purdue University, Lafayette, Ind.

A COMPARISON OF THE AMERICAN INDUSTRY PROJECT WITH THE MARYLAND PLAN

Robert E. Blum

It was my understanding that this evaluative symposium was to grow out of the ACIATE meetings which were held earlier in the week, and that each observer was to report on a particular session and make editorial comments regarding that session. I will attempt to compare two of the four "poles" which were presented earlier this week, namely the American Industry project and the Maryland Plan. Many aspects of the two projects could be compared; however, I will focus on the two aspects which I believe to be the most important. This discussion will be limited to (1) the scope of subject matter content and (2) the approach to teaching and learning.

The Maryland Plan includes as a part of industrial arts the development of tools, machines, power, transportation and communication (7th grade). In addition, the Maryland Plan would have students study all facets of contemporary American industry, including organizational activities and production activities (8th and 9th grades). Study of extractive activities, communication activities, transportation activities, financial activities and marketing activities may also be included, providing a particular class identifies these as important sub-topics under the major unit, "Contemporary American Industry".

The American Industry Project includes the study of contemporary industry as defined by its thirteen major concepts. The evolution of industry would be given less emphasis by the American Industry Project than by the Maryland Plan.

The Maryland Plan is definitely a student-centered approach to teaching and learning. The teacher gives the major unit (the development of tools and machines and their contribution to the growth of civilization), and the students identify, plan and develop the sub-topics. There is no basic text; information is drawn from all possible sources. The teaching methods employed are primarily the unit, the line production and the group project. Role playing is an extensively used technique. Contemporary industry is studied through example, i.e., a single industry is studied.

The American Industry Project is a subject-centered program. The major concepts have been identified and each concept has been divided into sub-concepts. Text materials are being developed and tested, and instructional activities are being designed to lead students to an understanding of the concepts of industry. Teaching methodology is being recommended and is based on the nature of the topic to be covered. The American Industry Project is an attempt to present a generalized picture of industry. No specific industry is studied.

Three principal concerns seem to be apparent concerning one or both of these contemporary curriculum projects:

1. With the student-centered approach, there is no certainty that important concepts will be studied.

2. Allowances for individual differences, both student and teacher, are not readily visible with the subject-centered approach.

3. Teachers may not be prepared to handle the subject matter or the teaching methods and techniques.

Even though there are differences in scope and approach between these two developmental efforts, they have at least one important commonality; each is attempting to represent industry as an institution rather than as a few isolated trades. If we extend beyond the two "poles" just discussed, we can see that all curriculum effort is being directed at industrial rather than trade analysis. This shows direction for industrial arts.

Mr. Blum teaches in the Industrial Arts Curriculum Project at Ohio State University, Columbus, Ohio

NEW DIRECTIONS FOR INDUSTRIAL ARTS?

Alan R. Suess

Change in industrial arts is obviously pervasive. We have spent an entire convention discussing the impact of change on the content, purpose, methods and contextual base for our programs. Several presentations have dealt with the major curriculum projects, both funded and unfunded, which are having, and will continue to have, great impact on our future programs. There are, however, additional change factors, generally based outside the profession, which are having direct, immediate and long-range impact on the content and direction of industrial arts.

Industrial arts, like all American education, is increasingly coming under the influence of outside agencies. Business, industry, government, special interest groups and individual entrepreneurs are involved in influencing the direction of industrial arts. Time and space do not permit an exhaustive discussion of these influences, but a brief summary of developments in several content areas will support this contention.

The study of electricity/electronics provides a classic case-in-point. As teacher educators, we have reacted to, rather than provided direction for study in this technical discipline. Pressures from public schools for adequately-prepared teachers have forced us to upgrade our courses to better prepare prospective and in-service teachers. Program development in electricity/electronics has been influenced by several external factors. Electronic kits, amateur and citizens band radios, high fidelity sound systems, and similar high-interest areas in electronics made practitioners in the schools painfully aware of the inadequacies of housewiring and tin-can motor-making. Since teacher education was not providing the direction, electronic equipment manufacturers and others filled the void with packaged programs designed to make it possible for anyone with the ability to read to present the material in the package to the students.

Special interest groups are also influencing the direction of industrial arts. Our literature is not particularly dominated by the theoretical and philosophical justifications for the inclusion of fluid power as an important part of industrial arts programs. Yet, a recent research study[1] conducted by a special interest group with Federal funds justified its study with the following rationale:

"Since only a half-dozen schools included fluid power in their curricula, and since no teacher-education institution in the country included fluid power in the curricula for students taking their degrees in vocational, technical and industrial education, it was apparent that the first step necessary to solve manpower shortages was the development of teacher education programs."

Similarly, industrial arts supply firms which were formerly content to provide the tools and materials suggested by the profession are now designing and marketing packaged instructional units which react to external rather than to professional pressures.

Less dramatic, but equally profound, change has been the result of enlightened self-interest on the part of publishers of industrial arts textbooks. Anyone who has scanned both a ten-year-old and a recent edition of a woodworking or metalworking text has seen the change. The older edition will probably stress hand and machine skills, while the newer edition will stress industrial processing and technological innovations. Although the development has been generally within the traditional materials processing and/or technical disciplines, the results certainly have been in the direction of achieving a better understanding of industry.

There are both positive and negative aspects of the influences of external pressures on the direction of industrial arts now and in the future. As teacher educators our job becomes one not only of personally evaluating the developments, but also of preparing our prospective teachers to evaluate and judge these and the inevitable pressures which will continue to shape the future of industrial arts.

FOOTNOTE

1. Baysinger, G. The Fluid Power Institute - a pilot program for introducing emerging technologies. Voc. & Tech. Educ. Grant No. OE -5-85-039, Voc. Educ. Act of 1963, Section 4(c). United States Office of Education, Washington, DC, 1966.

Dr. Suess teaches at Purdue University, Lafayette, Ind.

F-13.2 ACIAS
Evaluative Symposium
HOW DO WE BUILD FOR ACTION?
Gen. Chm., Leonard Glismann; Chm., Donald J. Ingraham; Rec., Menno Stucky; Panelists, Kenneth L. Schank, A. E. Pagliarini, Richard A. Froese, G. Wesley Ketcham; Hosts, Thomas P. Cowie, Bernard Kurland.

BUILDING FOR ACTION: A MULTI-LEVEL APPROACH

Dr. Kenneth L. Schank

The city supervisor of industrial arts builds for action on several levels. He has concerns and responsibilities for curriculum design and innovation as well as design and planning involving steel-brick-mortar levels. Building curriculum and building buildings can be viewed on several levels and in multiple dimensions, all inter-related and to a large extent interdependent, each placing demands on the skills of the supervisor. The supervisor appears to be faced with the paradox of the "chicken and the egg" in trying to decide which comes first; however, since an acceptance of the fact that our changing technology demands constant re-phasing of curriculum, it seems that content should come first. Radical curriculum changes do influence buildings—remodeling as well as new construction. In view of the varied problems, how does the supervisor build for action?

We must assume that the supervisor has various skills which will enable him to function successfully in his role. We must also assume that his frame of reference will continue to be flexible and ready for change. The supervisory skills needed for a multi-level approach to building for action will be considered as analysis, leadership and communication.

The supervisor builds for action through the use of analysis: his skills in observation, questioning, diagnosing and even listening enable him to analyze trends in curriculum, thereby acquiring information which may or may not be applicable to the school system in which he functions. In his analysis of a current curriculum, now in operation, he tends to make a feasibility study as to what changes are within the realm of possibility. Usually these decisions are not entirely his alone, but rather are worked out in conjunction with interested staff. As the curriculum change builds from an idea to a functioning course, he must analyze the budget allowances to determine the amounts to be applied to the operation of the new program. He is also concerned about the remodeling or new construction to house the new program as well as equipment which might be necessary to make the new curriculum functional. Consideration of the selection of machinery and equipment is not to be taken lightly, because one has to live a long time with capital outlay items even though they are good or bad choices.

The supervisor builds for action through leadership: democracy is a fine institution, but even institutions require leadership. Curriculum change does not "just happen"; somebody has to do some leading or initiating and will follow-through to a satisfactory completion. Good leadership is not an entity but rather a community approach. In this case, the community is composed of those people most vitally concerned with industrial arts: the industrial arts teachers. Because the leadership in curriculum development is an ongoing program, other skills are also needed, such as coordination: coordination of the ideas, skills, hopes and talents of all concerned. Two other important factors are those of organization and delegation. It is not an easy task to organize for change, nor is it easy to delegate responsibility without the corresponding authority, as we build for action. Both are important and need to be incorporated for effective leadership. Leadership is extremely important in the origination of in-service teacher development programs which are basic to curriculum success. Too often, innovations in subject matter areas occur after teachers have lost the habit of going back to summer school. The next best approach is a challenging and invigorating in-service program which provides pertinent information with a minimum amount of extraneous material.

The supervisor builds for action through communication: communication is an integral part of all educational functions. Consideration at this point would be how the supervisor communicates with his staff on the person-to-person level, small group inter-action, larger group presentations, and last (and least desirable) written communications in the form of memos and directives. Too often communication is viewed as a one-direction action, when in reality it should be interaction. The supervisor needs to develop an open-mindedness to new ideas, the ability to listen and develop an empathy with his staff, because quite often the teacher is communicating a two-fold need: one of need for change and one of reassurance to support his ego. Curricular change is founded on communication, oral as well as written, so the supervisory skill in this area should be one of winning rather than alienating support. In addition to staff communication, we must consider communication with the total community as a part of our public relations. We must keep them informed as to our interests, objectives, experiments and tests in the industrial arts programs. Our communities are or should be cognizant of national trends in curriculum. It is our responsibility to keep the staff and the community informed. We can build for action with a dynamic program of communication, reporting honestly and involving the community wherever possible.

In summary, we view the skills of analysis, leadership and communication as essential basics with which we build for action; however, we would hasten to add that there are many more to be found among the conceptual, human and technical skills. Analysis, or taking stock of the situation, is an important function whether we look within ourselves or at the world around us. We need to know where we stand in relation to our own knowledge and experiences. Leadership and the exercise of vested authority, as well as earned status, has always been important. We must recognize that the fellow running at the head of the pack is not always the leader; he might be the one being chased! And last, the skill of communication, as a medium, is too often abused, misused and technically neglected as an art. A new look at our communication skills might provide an opportunity to try some new ways of dealing with people. These three items might give us a multi-level approach to building for action.

Dr. Schank is consultant in practical arts for the Unified School District No. 1, Racine, Wis.

HOW DO WE BUILD FOR ACTION?

A. E. Pagliarini

Government funds are awarded subject to the eligibility of applicants, schools, subjects and projects. The Vocational Education Act of 1963 allocates some $285 million for support of public vocational education programs. Under Title III of the NDEA funds, industrial arts for the first time has been allocated a certain amount of money. This money is to be dispersed according to state plans, and it is apparent that although the amount is not staggering, we have at least put our foot in the door.

Average expenditures for industrial arts programs in a high school are $1,220 for supplies and from $1,200 to $2,500 for equipment. It would be safe to assume that the industrial arts programs are among the most expensive in the high schools. Thus, cost becomes a big factor. At present, the cost of supplying schools with even a limited amount of hardware, complete with the necessary software and technicians, is almost prohibitive.

It is significant that hardware is only the vehicle for insurance of an overall program. We must recognize other observations and conclusions that make a total and whole program. Funds used to enrich students and teachers create an incentive for personal development. The fact that industry has been turning more and more to formal education would indicate the need for improvement of programs.

Out of a total of 493 institutes, industrial arts has been assigned 29. Every effort should be made to increase this so that more participation will be encouraged. Industrial arts has twelve research and development centers located in all areas of the states, at universities; more should be instituted.

Many areas of importance should be established and thorough studies made. The following are some fields of studies for promotion:

(1) New Curriculum Promotion and Development. A need should be recognized for developing programs covering a wider range of areas.

(2) In-Service Teacher Training. A good working arrangement for schools and universities should be established to provide off-campus services.

(3) Teacher Recruiting. A plan for teacher recruiting by schools and administrators should be worked out for effective and equal opportunities by all concerned.

(4) Teacher Education. Adequate numbers of qualified teachers for an ever-expanding educational program is one of the greatest problems facing schools.

(5) A Program for the Disadvantaged. The responsibility of training the disadvantaged is being more accepted by schools. Research in methods of instruction and provision of programs have to be provided.

(6) Leadership Development. The constant drain of qualified persons for administrative and supervisory positions has become critical. Intensive programs in leadership training within the state framework should be encouraged.

Close communication with our people in the Office of Education should be constantly observed. It is important that information on every facet of our programs should be circulated at state and local levels. Every effort to participate in these programs should be made available to all schools. Guidelines should be set so that exact procedures can be used. It would seem inconceivable to use money in hiring personnel to administer programs when no funds are available on a local level.

Programs that are funded by public money are dependent on Congressional relationships. It then becomes imperative that communication with members of this body be kept at a close and constant level. Make known your needs and programs and urge an increase of appropriation on monies for industrial arts. If you firmly believe in your program, sell it.

Mr. Pagliarini is with the State Department of Education, St. Paul, Minn.

HOW DO WE BUILD FOR ACTION?

Richard A. Froese

During Friday morning's session on "Industrial Arts in Space Technology", a very bountiful presentation was made by the men responsible for a booklet of the same name that is to be published by NASA. The presentations will be found in the published proceedings, so I will not dwell on this, but rather on the implications it can have for our industrial arts programs.

In some cases we will have to modify our present programs to some extent, and in others almost completely replace existing content with new concepts of the space age. In any case, it means some degree of change of direction.

As supervisors of industrial arts education in both large and small school districts and states, we have a challenge confronting us in how to implement this space technology along with other new and modern innovations in industrial arts. Some ideas on how this can be done and how it is being attempted at present are described in the main body of my presentation.

In the Phoenix Union High School District, as in all large school systems, there is a great need to communicate and coordinate efforts in order to provide the best possible instruction for the students. The Phoenix High School system consists of 10 high schools ranging in size from 2400 students to 3600 students. We have approximately 7400 students taking industrial arts in 269 classes under 57 teachers. The number of industrial arts students varies from a low of 450 in one school to 1105 in the largest.

As students learn best when directed, so does the instructor when he is aided in his direction. All of the efforts on the district level are geared to help the instructor do a better job in the classroom or lab.

Some of the methods used to fulfill this purpose are in-service training seminars, subject area meetings, industrial arts councils and joint meetings with allied groups, to name a few.

In our in-service program this year, we have conducted one seminar and are ready to begin another. The first one was on "Numerical Control" and consisted of four classroom sessions of three hours each (3:30-6:30), one day a week, plus a last session in the numerical control department of the General Electric plant. One of our metals instructors, who had attended an institute last summer on NC taught the class. Much information was gained by the participants, a booklet was developed, and sets of transparencies and slides will be made available for classroom use. This certainly seemed to fill a need for instructors to be up-dated on one of our modern production control processes.

The second seminar will be on the topic of "Design", will follow about the same format as the first, and will attempt to develop in the industrial arts teacher a better appreciation of good design and methods which he can use in the classroom to help teach this to his students. This seminar will be directed by a popular local man who is an artist, designer, jeweler and teacher. Like the first one, this seminar will afford the participant one-half credit hour on the salary schedule, with no cost to him other than time spent.

We also have subject matter or shop area meetings several times a year. At these meetings teachers of like areas, such as automotives, electronics, etc., get together to review new equipment and teaching aids and to discuss curriculum and equipment problems. These same groups have also met in summer workshops where they have developed curriculum guides and worked in such special areas as design.

We also have an Industrial Arts Council. This is made up of the department heads from each of the 10 high schools plus the district industrial arts consultant, who chairs the meetings. This group meets on a regular monthly basis to discuss the problems confronting the area of industrial arts. These problems involve such things as curriculum development, equipment-buying guides and specifications, relationships with vocational education and other subject areas, audio-visual and instructional materials selection, budgeting supplies and equipment, class sizes and grade requirements, maintenance, instructional improvement, etc. Recommendations of this group go via the district industrial arts consultant to the assistant superintendent for instruction, or other appropriate district office.

During some of our past improvement-of-instruction days, we have made industrial tours and visited other shops. This day, which has been four half-days per year and next year will be two full days, gives administration and teachers an opportunity to work together on the unit district levels in developing methods of improving instruction.

We also encourage our instructors to attend classes for graduate credit at Arizona State University in Tempe, Ariz. and extension courses offered by Northern Arizona University at Flagstaff. We particularly stress courses in areas where stronger and more thorough preparation are needed.

In the central area of Arizona we also have a major professional organization entitled "Central Arizona Industrial Education Association". This group meets once a month for a dinner meeting at different schools in the "valley of the sun". The meetings consist of various programs, demonstrations, industrial tours and school shop tours. The group also provides scholarships to needy students graduating from both high school and elementary school, sponsors a large project exhibit in the spring of the year, and makes other professional contributions.

You cannot identify any one of the above methods used to build for action as the most important or only one. It really is a combination of all these types of activities to the fullest extent possible that will separate a program which is mediocre from a program attempting to be outstanding in the field.

Mr. Froese is industrial arts consultant for the Phoenix High School System, Phoenix, Ariz.

HOW DO WE BUILD FOR ACTION?

Dr. G. Wesley Ketcham

A ten-minute resume of the highlights of the General Session meeting on "How and Where We Can Develop Content for Teaching Industrial Arts from Technologies of the Past?" must of necessity be brief and to the point; but to add, within that ten minute time allotment, an indication of direction and action makes for a rather challenging assignment.

In resume, it can be stated that Dr. Earl M. Weber's presentation dealt with technology of the past as history pure and simple, and the justification of its inclusion as a part of an industrial arts program. He stressed the rapid changes that take place and emphasized that the technology of today is the history of tomorrow's technology. In a sense, a boy studying contemporary technology is in reality studying the history of technology in the making.

He stressed the importance of realizing that each generation views and interprets the events of the past from an ever-changing vantage point. He pointed out that the task of the historian was to:

1. Collect facts and information,
2. Organize them in some order (logical, chronological, geographical, etc.)
3. (and most important) Interpret the material in terms of significance, impact and influence.

He then indicated some of the reasons for the study of the history of technology:

1. The importance of knowing how our institutions, whether economic, political, social, religious or technological, came into existence and what historical forces are at work modifying them;

2. The history of technology helps interpret current events – the what and why on a world-wide basis;

3. The value of such a study as background for other courses;

4. Such a study tends to sharpen one's critical faculties and provides opportunities for making comparisons;

5. And, as a final reason, such a study tends to develop a sense of sympathy and toleration for other classes, nations and religions. It helps an individual place himself in the shoes of others – the arts, crafts, industries – the technologies of other people.

He further stated that the study of the history of technology stimulated a greater interest in the finer things of life by introducing us to the discoveries of famous inventors, scientists and builders; in short, it acquaints us with our cultural and technological heritage.

As a way of direct application, he indicated that DeVore's proposals at Oswego emphasized history as an essential element of our field of study, that Maley's University of Maryland's Research and Experimentation, as well as the anthropological approach, were especially suited to an historical study. While he questioned the limitations of the Stout proposals through the use of the word "contemporary" and "American", he felt that here, too, history might be included.

His reference to their plans intended to give further emphasis to his belief that the history of technology should be a part of the total structure of industrial arts regardless of the proposed plan of organization.

He completed his presentation by interpreting the history of technology as the beginning – "the past is prologue."

A program of action and direction can be developed and justified from Dr. Weber's presentation; but some concern for such inclusion relates directly to the approach or methods to be used for its inclusion. Certainly one of the most critical factors is the actual amount of time available for industrial arts programs at the various levels.

It would seem that within the time remaining, a single suggestion would be appropriate.

Considerable attention is now focused on the importance of the inter-relationships of the various disciplines of the total offerings of a school. What better time could there be for interdepartmental planning of cooperative units of work evolving around the history of technology through enrichment programs in conjunction with the areas of mathematics, science, social studies, art, English and home economics? Such an approach would enrich other areas, provide greater consideration for the interests, needs and abilities of individual students, and place the industrial arts in a new light and role in the eyes of the other areas of the school program.

If such an approach stressed outside preparation as an integral part of the study of industrial arts, then the problem of enrollment on the time allotted for actual laboratory experiences would be greatly reduced regardless of the over-all plan for presenting the industrial arts program.

The cognitive learnings (things to know) proposed for industrial arts are dependent upon first-hand experiences with tools, materials and processes used in conjunction with the solution of functional and practical problems of concern to youth.

Dr. Ketcham is consultant in industrial arts for the Connecticut State Department of Education, Hartford, Conn.

F-13.3 ACESIA
Evaluative Symposium
KALEIDOSCOPE—WHERE DO WE GO FROM HERE?
Chm., Eberhard Thieme; Rec., Albert Squibb; Panelists, D. D. Nothdurft, Norton E. Lownsbery, Vito R. Pace, Paul Kuwik; Hosts, Gahrad L. Harvey, Jere R. Rentzel. Mr. Kuwik's manuscript not provided.

AMERICAN COUNCIL ELEMENTARY SCHOOL INDUSTRIAL ARTS

D. D. Nothdurft

Denmark and Switzerland have outside playgrounds for the children to use and build during leisure time, which fulfill many of the desirable developmental characteristics of elementary children from ages kindergarten to sixteen years. The Danish children did most of their own planning and building. The children in Switzerland had more adult guidance, and the projects were more the result of adult ideas.

These outside playgrounds are important to the habit development of children, who can participate in plant life by planting and raising vegetables and learn the feeding and care of animals. All the materials are salvage materials. When a house is torn down, it is disassembled with care and the materials taken to the play lot; the children take it from there. Should a child lose interest in his project, it will be reassigned to another child.

The tool for this outside playground has some organization but not what we feel would be acceptable for industrial arts in America.

The city of New York has a similar project in the Rice Playgrounds.

I. Curriculum Resources for Elementary Industrial Arts
   A. Library Materials.
      1. The booklet "Division of Surveys and Field Services," George Peabody College for Teachers, Nashville, Tenn. 37203, with over 4,000 instructional aids, will give a good start in curriculum resources.
      2. The booklet from the ACESIA entitled "An Annotated Bibliography of Books, Pamphlets, and Articles for Industrial Arts in the Elementary School" is available for $1.50.
   B. People and Places
      There were three main types of information blanks used to gather this curriculum resources.

1. Community resources, alphabetical and grade level.
2. Resource persons were listed by topic.
3. Audio-visual materials were classified into: films, filmstrips, records and tapes.

Should you be interested in the three information blanks above, you may secure them from Arthur Stunnard National College, Evanston, Ill.

A special mimeographed letter was used to send to the prospective firms and resource persons to request them to fill out the information blanks. It looked very professional and was said to do the job very well, with a great deal of time saved by not having to type so many personal letters.

C. Teachers Must Believe This
1. Resource materials are very important to elementary programs.
2. More time is needed, and a release time should be in effect.
3. A wide variety of instructional materials makes a balanced program.
4. Verbal concepts are better with perceptual experiences.
5. Visualization alor^ is still the least effective means.

D. Key Points in Selection of Instruction Materials
1. Establishment of clear aims, objectives and goals before selecting curriculum materials.
2. What contributions these instructional materials are to make.
3. Easily understood standards to help make discriminating judgments.

II. Elementary Industrial Arts Enrichment in Grades 5 and 6 in Kansas City

A. Organization

Full class in the laboratory equipped for industrial arts or in the gym with portable equipment. Full laboratory equipment $3,000, portable equipment in gym $850 and small committee groups in the self-contained classroom $150. Materials cost 30 cents per child.

B. Flexible Scheduling

Scheduling is made at the beginning of the year with one hour, twenty minutes per class per week. These may be scheduled so a teacher may have one block of time. The consultant secures all the materials and sees that it is ready.

C. Units of Instruction

Mathematics, science, social studies, health and art have been taught in units successfully in the past. Literally hundreds of different projects were made, from math aids to weather instruments.

Dr. Nothdurft teaches at Missouri State teaches College, Kirksville, Mo.

KALEIDOSCOPE—WHERE DO WE GO FROM HERE?

Norton E. Lownsbery

Since the fundamental purpose of the elementary school curriculum is to produce effective citizens in a democratic society, and our society is a technological society as well as a democratic one, we have no choice but to integrate industrial arts with our present elementary programs.

Elementary schools have been criticized for not presenting life-like problems to the student. Industrial arts can present more life-like problems, create interest and give the elementary school child a much more meaningful insight into the society of which he is a part.

This can be accomplished through the unit method of instruction, integrated with all units of study, or through a unit devoted to technology which would provide more opportunities to learn by doing.

Industrial arts can be taught by the elementary classroom teacher, with the aid of an industrial arts specialist to provide guidance and materials.

In the secondary school the industrial arts program must evolve at a much more rapid pace than it has in the preceding decade. Since industrial and technical knowledge is doubling every seven years, we have no choice but to progress at least as rapidly.

The changes taking place in industry, such as automation, numerical control, fluid power, new materials and computerization, must be reflected in our programs. This change must include a national commission for curriculum development, instructional materials centers and a meaningful program for in-service training of teachers on an annual and continuous basis.

Our society is rapidly becoming more homogeneous, and our curricula must reflect this change in our society. Six years ago at the AIAA convention this problem was presented and discussed, and as yet no national commission for curriculum has been established. Now is the time that we must stop talking and start doing. Technology is not going to wait for education to catch up; it is here and changing every day.

Our primary area for concentration must be the creation of a desire for knowledge, since by the time the student completes high school, the technological skills he may have learned may be obsolete, but it can form a basis for him to adapt to the changes if he has the desire.

Therefore our national commission on curriculum must consider a program that has variety, includes the general, the academic and the occupational student, with emphasis concentrated on concepts and principles.

Mr. Lownsbery teaches at Downingtown Junior High School, Downingtown, Pa.

A STUDENT PARTICIPATION PROGRAM—INDUSTRIAL ARTS FOR THE ELEMENTARY GRADES

Vito R. Pace

Generally speaking, the industrial arts program in many elementary schools has not been accepted as a necessity for a complete program of general education. We in the area are fully aware of its potential contribution to the development of the total child, through a creative experience using tools and materials. The value of these experiences is also becoming more and more appreciated by those in education who are not happy with a curriculum based primarily on verbal expression. Current studies on creative thinking and evaluation of non-verbal abilities have brought to light a fuller appreciation for activities dealing with the non-verbal aspects of child development.

Recently, a public school principal approached the Industrial Arts Division at Buffalo State University College with a strong desire to provide a kind of program which could develop non-verbal abilities of students in his elementary school. He pointed out that his request was based on test results which indicated that many of the students had much greater non-verbal ability than verbal, and the present curriculum was not satisfying a vast potential. Of course, his findings only reinforced our philosophy that through the industrial arts experience, children could be provided those activities which are most conducive to developing non-verbal expression. In continuing his quest, the principal explained that some of his teachers were willing to encourage such a program, but felt that they needed some help in designing and conducting suitable activities.

In the past, the teacher education program has resulted in an unfruitful approach in providing an industrial arts course for elementary education majors, the thought being that they would see its values and utilize its activities in the classroom. Theoretically, this is fine, but in practice we find the classroom teacher overburdened with many tasks, leaving her very little time to prepare for creative activities which require materials and tools uncommon to the "normal" school. We also found that a number of teachers did not conduct these activities because of their feeling of inadequacy in required skills.

On the other hand, experience has shown that the industrial arts teachers did not understand the needs of the elementary school children and were not familiar with the curriculum or school organization. Therefore, in many cases when an industrial arts teacher was called upon to work with young children, he reacted in a manner based on his education, which was geared for teaching junior and senior high school. This only served to remove industrial arts further from the elementary school.

Our solution to these problems and to the need for expansion in the western New York area was the introduction of a course which would incorporate a classroom participation program designed for industrial arts majors at Buffalo State University College. Understanding the child through observation and a study of growth and development is an essential element of the course. Also, a basic goal is a total overview of the school curriculum and its possible correlation with industrial arts activities. This is done primarily through research and classroom participation. Each student is assigned to a classroom teacher either in the demonstration school or one of the cooperating public schools. Eleven of our present group of 22 students are assigned to public schools in the area. In each case, the student is placed in a classroom in grades kindergarten through sixth. His major assignment is to observe the curriculum, children, procedures, and to develop the kind of activities which will complement the established curriculum. Students are required to confer with the classroom teacher in planning units for children. They are also responsible for planning and working with children in completing the construction of the particular group projects. The classroom participation consists of at least three hours a week; however, we find many students spending more than the required time.

We have been very pleased with the results to date. Our students have shown an enthusiastic interest in working with young children. Administrators and teachers have also been very pleased with the resulting interest and activities. As an outcome of the program, our long-range goal is to establish full-time positions in the area of industrial arts for the elementary school within our public education system. One or two of the area schools have already recognized the program's worth and are requesting full-time staff allocations.

Mr. Pace teaches at State University College, Buffalo, N.Y.

F-13.4 Ceramics & Plastics
Evaluative Symposium
IS THERE A NEED FOR A PARTNERSHIP BETWEEN ART AND INDUSTRY AS THE NAME INDUSTRIAL ARTS IMPLIES?
Gen. Chm., Hugo Fiora; Chm., Wayne Becker; Rec., Paul A. Smith; Panelists, Earl Marihart, Richard C. Erickson, Armand G. Hofer; Hosts, Larry M. Meier, Stanley Weckstein

PLASTICS—GENERAL TO SPECIFIC

Earl Marihart

The field of plastics constitutes one of the fastest-growing industries in the nation. The evolution of synthetic plastic materials during the middle years of the twentieth century has changed almost every material thing we possess or use. 1869 saw the first patent issued for cellulose nitrate, known to old-timers as "celluloid". As useful and novel as it was, the flammability factor kept it from becoming an important item in our national economy. At that, though, it wasn't until 40 years later (1909) that Bakeland obtained patents covering the first of the commercial synthetic resins, known as Bakelite. This product is still one of the most versatile resins.

By 1935, cellulose acetate, urea-formaldehyde, polyvinylchloride, polyvinyl-acetate, poly-chloride-acetate, ethyl-cellulose and some acrylic resins were being produced commercially in the United States. Production was approximately 91 million pounds in that year. Subsequently, an increasing number of variations of known materials and a great number of new materials pushed the total production to the then-staggering total of 6,143 million pounds in 1960. Thence, the rise in production was fantastic, so that the total by 1965 was approximately ten billion pounds.

By now, most consumers realize that plastics are not "ersatz" materials. Though they often function in place of wood, metal, leather and fabric, complete reliance upon them is not yet accepted. The dry-cleaning that comes with time and the increasing acceptance of plastics will erase the image, so often expressed, that articles made of plastic are "cheap".

The field of research is continually opening up new avenues, not only for the use of plastics, but also for new products. Polyethylene, the flexible, milky white material with the waxy feel, most commonly used in squeeze bottles, is usable from -70°F to 212°F. When this material is subjected to high-voltage X-rays, an entirely new material comes into existence. Polyethylene melts at about 230°F, while this new material will not melt at any practical-use temperature. Strength decreases with high temperature, but it retains considerable strength up to about 390°F. Eventually it will char and burn. It also resists certain of the solvents that would dissolve the original material. Such is the marvel and promise of a material known by the trade name of Irrathene. What I have spoken about was published in 1957. Since then, none but the chemists involved with research in plastics are aware of the possibilities of plastics.

The expanding field of research has opened up new fields of employment. New areas of employment also mean that new health hazards could be introduced. We are all acquainted with Teflon and to a lesser degree with Kel-F. Teflon can be used from -180°F to 550°F, and Kel-F from -320° to 390°F. Each of these fluorocarbons with some of their resins have many already-discovered applications. Those persons who know and are concerned with health hazards warn us that burning Teflon can cause serious illness or death. In normal working operations, the temperature is not likely to be high enough to be a health hazard, but the Teflon dust that settles on a cigarette, cigar or open pipe bowl that is being used, or will be used later, can lead to serious illness.

Even as long as ten years ago, plastic resin and steel powder were mixed and used. Silicone glass laminate was used to insulate the armatures of small motors designed to operate at high temperatures. Glass-bonded mica was the only truly inorganic plastic having many of the desirable qualities of both ceramics and plastics. This is the material known as "mycolex".

In these days, name a situation and the chemists and fabricators can come up with material, which for want of a better designation, we call plastic. Any use from that of a lubricant to the 36-foot boat hull can be furnished.

What I have given are just a few of the high points that anyone interested in learning about plastics could get from textbooks, trade journals and our own magazines. There is, however, a more practical and expanding field for us as educators. While there are some things we can do in our shops and laboratories, much more can be done if our students could meet the artisans and craftsmen who work in the fields of plastics. How you go about doing this will depend largely upon your own ingenuity and upon the agencies with which you work. You are very likely asking yourself what all this has to do with plastics. Please permit me to suggest several avenues of approach.

William D. Wyatt, Jr., industrial process engineer for the Department of Economic Research of the Northern Natural Gas Company, made a study with the title, "Plastics in the Northern Plains States". Time and space do not permit a review of his findings at this time. For those of you who live in that long crescent enclosing Chicago, St. Louis and Kansas City, the study could be valuable. It was brought out that this regional market is growing at a rate two and one-half times as fast as the national market. Have you inquired as to whether some studies have been made for the area in which you live? Reports of this nature could be used to bring plastic industries into your area, and very likely your town.

You have very likely heard the "Dubuque Story". We in the City of Dubuque have an active Industrial Bureau, with a manager, salaried, who has surrounded himself with people of the City of Dubuque and the Dubuqueland Area, who can project the Dubuqueland Image. His analysis of our area, its needs and potential are complete. We also have a group of 50 businessmen organized to carry out specific promotional projects within the framework and goals and policies of the Dubuque Industrial Bureau. These men make up the Dubuque Ambassadors. They help the Dubuque Industrial Bureau secure leads for possible new firms to locate in Dubuque. They project the Dubuque "climate" locally as well as on the trips they take and the letters they write. Fit the name of your city or town where I have used Dubuque and you could share in what we have shared. It is possible that the Dubuque Ambassadors may already have lured an industry from your area or city, especially if you live in a large city. The Dubuque Ambassadors can do just that.

Two new plastics industries have the blessings of the Dubuque Industrial Bureau and the Dubuque Ambassadors, as well as those of us who appear at meetings such as this one. The men heading the Janlin Plastics Company and the Lange Plastics Company are an inspiration to all with whom they come in contact. These men are philosophers. They are truly artist-craftsmen who can design projects to be produced in quantity. These are very practical men with an insight that belies their youth. They do not hold that all things made of plastic can be made more cheaply. These men build for specific purposes, meeting the prime specifications, as should the builders of any quality products. These men are inventive, seeing possibilities where none are apparent. If a product can be improved, they will do it. They turn out "finished" products, perfect in function, pleasing to sight and touch, as any artist-craftsman must. The items I have on the desk before me are just such products. You very likely have wheels and toys made by Janlin, for they are the leading wheel company in the United States. This other product, made of plastic, few of you have used, unless you are one of the masters at skiing and can afford to pay $99.50 to $109.50 for your boots. My wish is that all of you and your students could meet and work with these men.

Mr. Marihart is director of industrial and adult education for the Dubuque, Iowa, school system.

THE RELATIONSHIP BETWEEN ART AND INDUSTRY

Richard C. Erickson

Historically, man's concern with the relationship between art and industry is a somewhat recent development. For very early man, utilitarian considerations alone were the governing forces in the making of his implements. Consequently, the form for these implements necessarily evolved in the direction of functional efficiency with little or no consideration given to the aesthetic.

At some time in the development of man's technology, however, there was a choice between equally efficient implements, each differing perhaps in shape, color, and/or texture. At this point, then, when functional efficiency was no longer the sole determinant of the form his implements would take, aesthetic consideration became an important and integral part of man's industrial output. This condition has survived the ages.

The nature of what was considered aesthetically desirable has varied considerably from culture to culture, from period to period, and, at times, from generation to generation. Any attempt to make value judgments or comparisons between objects from varying cultures and/or periods would certainly have to be based on purely subjective if not biased criteria. However, the important question here would seem to be not which of the pinnacles in the development of man's technology is the highest, but rather what is responsible for the totally different aesthetic considerations that have been incorporated into the products from each era.

Technical knowledge and skills alone as an answer to this question seemingly border on the superficial. The answer must also include such things as the psychological factors that operated in the social order and were, in part, responsible for the forms that the implements of that era would take. Down through the ages, the evolution of man's technology has been punctuated by aesthetic considerations that were indigenous to the design of his implements.

Historically, then, the question of there being some relation between the aesthetic and the functional is only as old as the introduction of machine and mass production methods into the production of man's implements. The situation was no doubt brought about by the machine's reluctance to produce products in their acceptable traditional forms. This, in turn, prompted some "guardians of culture" to become concerned with the apparent decay (with respect to the aesthetic) that our culture was sure to suffer at the hands of machine production.

There have been several reactions to the machine's apparent rejection of ornamentation. Some adopted the notion that if a machine-produced object was optimally functional, it, ipso facto, possessed all the necessary aesthetic qualities. A strong look at this position reveals that of the variety of aesthetic values that exist, only a small portion of them can be met by the conditions of functionality alone.

Others, and notably the manufacturers, looked upon art from previous eras to fulfill the aesthetic considerations for products manufactured in the present era. Art to them was viewed as a commodity, a commodity that was to be purchased and applied to contemporary wares. It was purchased from all the "popular" periods, and the more "progressive" manufacturers even mixed the various styles as they were applied.

From an historical point of view, the most rational conception of machine production as it relates to human aesthetic impulses assumes that the machine has established itself everywhere as industry's primary vehicle of production, and the machine-manufactured product has no real need for traditional ornament or decoration. It is from the peculiarities indigenous to every type of machine that the aesthetic considerations for the present era should be derived. Through the evolution of man's technology, the aesthetic considerations for the production of his implements in any particular era have generally arisen from the dominant cultural aspects of that era.

The aesthetic effect that this attitude can have on the machine-dominated production of the present era has been well demonstrated in the Bauhaus experiment of the 1930's. This is probably the only vein in which a meaningful relationship between art and industry can exist.

Mr. Erickson teaches at Purdue University, Lafayette, Ind.

IS THERE A NEED FOR A PARTNERSHIP BETWEEN ART AND INDUSTRY AS THE NAME IMPLIES?

Armand G. Hofer

Two of the major reasons for including art or the aesthetic element in the study of industry appear to be still valid today. First, an appreciation for good design is considered a worthwhile trait that should be fostered by the schools. The study of industry offers a good opportunity to start developing or to contribute to the development of this trait. Second, workers are needed who will be involved with the design phase of industry. Schools can introduce students to the industrial designer's work, stimulate interest and develop native abilities.

If these are valid reasons for including art in our study of industry, then the question is really not one of whether art should be included, but a question of "what kind" of instruction and "how much" art is needed.

In the study of industry, the concern with art is primarily through the design of manufactured products. If we put enough effort into it, we could probably have nearly all students capable of at least a fair degree of sophistication in designing manufactured products. However, since design is only one of many elements of industry, and since we are not trying to train designers, the element of design should be kept in its proper perspective. Very few students will be commercial designers or even have the talent to do really good design. In regard to the question of how much design should be taught, it seems to me that the answer is to concentrate on an appreciation of good design, with provision for identifying students with unusual ability and providing opportunity to develop this ability.

If our stated objective in teaching design is to inculcate an appreciation for good design, with provision for developing designing ability for those who exhibit unusual talent in this area, the next concern is the best approach for teaching these things. It seems to me that the best approach to developing an appreciation of good design would include teaching the basic elements of good design, and would illustrate these by examples of products that represent good design. To be realistic, the study should include all of the elements of design, including the functional aspects of the object and the properties of the materials, as well as the aesthetic element. If the appreciation for good design is to transfer to the student's activities outside of the class, he will need to develop a habit of analyzing objects according to the principles of good design. Therefore, the culminating activity for most of the students in learning an appreciation of good design should be this activity.

The assumption behind having designing activities in the school shop is to make the information about design more real. This appears to be a valid assumption. However, design activity does not need to be an individual activity and it does not need to be directed toward a completely original design. Designing can be carried out as a group experience with as many of the group contributing as are capable. An intermediate stage in learning the designing process might be to have the students, as a solution to a problem, locate an object and re-design it to meet the specific requirements of the problem rather than to attempt an original design. Attempts at completely original designs should be made in an organized manner through an analysis of the problem to be solved.

Dr. Hofer teaches at Stout State University, Menomonie, Wis.

F-13.5 Design & Drafting
Evaluative Symposium
BUILDING CULTURAL AND TECHNICAL HERITAGES INTO DESIGN AND DRAFTING PROGRAMS OF THE FUTURE
Gen. Chm., Jay Helsel; Chm., Victor L. Bowers; Rec., Frank J. Myers; Panelists, James H. Jacobsen, William Grieve, William E. Burns; Hosts, John E. Kopenhaver, Kaoru Hirata. Mr. Grieve's manuscript not provided.

DESIGN AND DRAFTING CONCEPTS BASED UPON HERITAGES OF THE PAST

Dr. James H. Jacobsen

Report on William B. Landon: "Examples of Drafting Concepts Based Upon Our Cultural Heritage and Implemented Into Today's High School Programs."

Drafting is the oldest form of communication. It has evolved from crude attempts to design implements, homes, maps and other necessities to a sophisticated form of graphic communication. The techniques of drafting have been developed through the years and have ultimately become standardized as projections and representations.

Drafting is important to everyone—vocationally or non-vocationally. It is used to convey ideas when the draftsman has a well-founded understanding of drafting. If this understanding is demonstrated properly, his communication will be understood universally.

Student drafting experiences must be gained from orderly progressive insstruction. Assignments must not be copywork, but well-founded on the basic principles of drafting and expressed through problem-solving experiences that provide for student expression and implementation of ideas.

Levels of student attainment vary, and teachers must recognize and identify these levels. It is understood that all students will not ultimately develop into design draftsmen. Tracers and detailers have a place in industry and vocational opportunities are available for those with only these capabilities. Each level of attainment is important and both teacher and student must be cognizant of these levels and their implications.

Report on Clifford Yard: "Where and How Can We Enrich Our Present Day Design Programs Using Our Cultural Heritage for the Background?"

The area of design draws upon our cultural heritage to form foundations that will aid in the solution of current problems. Earlier examples of design provide excellent sources to emulate, and much of the technical knowledge developed in the past has not been equaled.

Design presents problems to the teacher, who must provide a clear definition thereof. The recognition of design as a separate entity in industrial arts has been recent. Although design is usually taught as a separate course, it is felt that this area should be integrated into the whole industrial arts curriculum.

In pursuing the evolutionary design process, the designer may use only paper to solve problems requiring calculation of pure scientific data. The designer may, however, have to resort to mockups in the design of coverings or housings for mechanical parts or use materials to design directly. The design student should use clay for direct design because of its plasticity, which allows it to be used and re-used until a suitable design is formed.

The idea-expression capabilities of the student are usually limited and must be developed. To do this, the student should begin his work on paper. A series of development drawings is an important part of the design process.

A designer may incorporate into his plan only those elements that are known to him, and design is, therefore, primarily a synthesis. Yet those who pursue design as a vocation are at odds as to whether resources should be used when pursuing the initial design.

Rules of design should be non-existent, as they only tend to restrict the creativity of the individual.

Dr. Jacobsen teaches at Western Illinois University, Macomb, Ill.

BUILDING CULTURAL AND TECHNICAL HERITAGES INTO DESIGN AND DRAFTING PROGRAMS OF THE FUTURE

William Edward Burns

The design and drafting program titled Creative Design and Drafting in the Space Age consisted of three enlightening, challenging and thought-provoking discussions.

Frank L. Maraviglia, of the State University of New York College of Forestry at Syracuse, spoke on "Design: Its Impact on Teaching Graphics" as viewed from his specialty of design and landscape architecture; William E. Huss, of the State University of New York College at Oswego, discussed "Technological Breakthroughs for Space Age Drawing" from an industrial education viewpoint; and Mr. V. L. Hoberecht, Graphics Systems Specialist, IBM Corporation, Kingston, N.Y., described "Computer Aided Design and Drafting."

With all due apologies to these gentlemen for attempting to synthesize their thoughts, it seems appropriate that we first review their comments and then examine some suggested implications.

Mr. Maraviglia, a former industrial arts teacher, felt that under the present methods of teaching graphics, we were shortchanging the total educational experience of all the students. He viewed high school graphics courses as an entree not only into the design and scientific fields, but also for those students who seek employment directly from school. He believes that it is not only possible and probable, but also very highly desirable, to teach the fundamentals of engineering graphics in a creative environment. In order to accomplish this environment, we as graphics instructors would have to refocus our thinking in terms of the content and teaching of graphics. As a general observation, the present method of teaching the graphic language has been mostly copy work, which is not creative. To develop this creativity in the individual, we must first realize that both the tools and graphic presentations we use are techniques utilized by both the draftsman and the designer. To some draftsmen, they are the end in themselves; but to the designer they are only a means to execute his thinking in a graphic language for a client.

The use of open-end problems, as utilized by the design-oriented teacher, brings out an interest and potential for creativity in his students. The possibility of a variety of solutions will stimulate a greater sensitivity to the student's own environment. The student learns not only by himself, but also from his classmates. By providing this kind of creative environment, the student can select from many possibilities, choose from a variety of approaches and not be forced into singular solutions to his problems.

Graphics is involved with purpose and teaching technique where the purpose and teaching are things of lasting impact on the student. When graphics is taught as a technique or tool, the atmosphere for creativity is pre-empted and stunted. Design as an abstract understanding or as a purpose is validly and necessarily related to the greater value of the teaching and learning of graphics.

When creativity is part and parcel of a course in graphics, the student is free to accept this challenge and add dimension to his potential; or he can rest on techniques learned through this environment which will aid him as a draftsman. This way, he is better educated, more versatile and more valuable to design professions, such as Mr. Marviglia's.

Mr. Marviglia feels that the student must be exposed to experiences that will enable him to (1) recognize that a basic problem exists, which should then result in his further investigation into materials, sizes, costs and other basics relating to the problem, and (2) to develop and evaluate possible solutions to this problem.

Dr. Huss stated that "tomorrow is here". He indicated that when man projected himself into space, he was forced to change his ideas about the nature of knowledge – that knowledge is moving, changing and dynamic. Explosions of knowledge have resulted in new problems, i.e., health improvements causing a population explosion, automation leading to cybernetics.

Man found that graphic communication and visualization involving space problems were soluble only by conceiving of them in terms of a point moving in space. A point moving in space creates a line; a line moving in space creates a plane; and a plane moving in space creates space itself, which suggests a basic concept for drawing course organization.

Technological breakthroughs have led to a changing emphasis toward design concepts. Attention is being focused on computer drawing which allows a graphic representation to change almost instantaneously in size, shape, view, or to be modified. Drafting tools have resulted in shorter lead-time in industrial production and improved attitudes and understandings toward systems analysis and synthesis, implying an emphasis on analysis over description, and to abstraction over the concrete in our graphics courses.

Graphic methods now employed to solve space problems in design and industrial arts infer that drawing should become a problem-solving course. This would involve planning, design engineering, graphical analysis and space visualization, where students take the initiative in solving problems and teachers become directors of learning. Students should have an understanding of and respect for graphic style which would be reflected in the way they think and in the way they express their thought.

In summation, Dr. Huss pictured the design process as a vehicle for learning about technology. This was represented in a spiral shape involving research – design – production – distribution – elimination – research – ad infinitum.

The many facets to the rapidly emerging field of computer-aided design/drafting systems, the fact that such systems are a reality, and some speculation about how such systems may alter the role of designers and draftsmen, as well as their educational requirements, were the chief thoughts left with us by Mr. Hoberecht.

The computer-aided design/drafting system consists of a stored-program digital computer along with such attachments as XY plotters, numerically-controlled drafting machines, film recorders and graphic display consoles. These allow for graphic output as well as a means for the designer/draftsman to communicate with the system. These systems are available and in use.

The resultant effect of these systems will necessarily alter the role of the draftsman and designer. Some of these people will become programmers and applicators, suggesting again that varying degrees of skill and talent will be useful. Basic applications will call for a minimum of imagination, requiring only that the operator know how to use or follow a "cookbook". At the other end of the continuum will be people primarily making decisions emphasizing judgment and creative abilities. This means that the operator must understand the engineering and design principles built into the programs, the significance of his decisions, and possess the training and qualifications or experiences called for. The engineer will formulate the design guidelines for a product, and the computer will be the tool of the designer/draftsman for the detail work.

Educational requirements for the designer/draftsman will include: (1) algebra, two- or three-dimensional geometry and possibly calculus, (2) an understanding of computers and their applications, (3) basic principles of physics, engineering, circuitry and the ability to read diagrams, and (4) how to accept and use design information, as well as the ability to communicate effectively with other men. He will not need to know the mechanics of "how to draw".

A central theme that seems to be running through these presentations is that a greater variety of forms of communication is developing, and skill in their usage will be in demand in the near future. It seems to call for a re-designing of our drafting programs: (a) from an emphasis on the ability to draw to an emphasis on fundamental understandings, of the underlying theory of the space relationship of lines, points and surfaces such as through the use of descriptive geometry, (b) from an emphasis on lettering to an emphasis on writing, (c) to a greater emphasis on communicating basic processes or relationships incorporating skills in the use of reference books, standards manuals and other technical manuals, (d) to a greater emphasis on knowledge of current developments and their effects, and (e) from individual work to team or group projects with multiple or open-end solutions and the resultant decision-making.

If we accept the premise that industrial arts is a part of general education, then our needs would seem to be preparation of people for general-type skills of the future.

The programs mentioned here would appear to allow for a variety of levels of skills which could very well allow students to develop to their fullest potential.

Mr. Burns teaches at State University College, Buffalo, N.Y.

F-13.6 Electricity & Electronics
Evaluative Symposium
HAS THE ORBITING SATELLITE PASSED BEN FRANKLIN'S KITE?
Gen. Chm., Howard Gerrish; Chm., Joseph Luke; Rec., Lawrence Chaikin; Panelists, B. John Ross, Lawrence F. H. Zane; Hosts, Arthur J. Vetter, Howard O. Wickler.

ELECTRONICS—MILESTONES OR MILLSTONES?

B. John Ross

Defining terms appearing in the title above provides a base for summarizing remarks made by the participants on Wednesday's panel. Each presentation may be viewed as a milestone along the way and each, in the opinion of the observer, may be reviewed as possible millstones to the teaching-learning process.

Fred Culpepper documented many historical milestones and pointed to the rich heritage of electricity/electronics development upon which a curriculum of high motivational potential may be based. Such a curriculum should encourage scientific method and search for fundamental facts preceding many of our technological advancements.

Your observer cautions the reader that enthusiasm for the past should not dominate instructional methodology so as to shun an activity-based program. Rather, "great scientific discovery" should be instrumental in generating currents for highly-charged bodies in the learning process.

Harry Krane added a second instructional link to the circuitry relating to the past. Supervisory personnel are important to the successful promotional aspects of introducing amateur radio communications as one of the areas of the electronics program. Sequential steps leading to Federal licensing provide highly-structured motivation to the beginner and advanced student alike. This program is enhanced as its forces contribute to the strengthening of verbal skills and those in other related subject areas.

Perhaps the millstone to be introduced here is that emphasis on only one phase of the program may restrict the broad experiences of a total program.

Ken Barton completed the circuit by outlining some program differences in representative urban and rural districts. The possible solutions for narrowing differences readily suggest the range of these differences. Use of Federal funds, consolidation of districts, and salesmanship are necessary for expansion of electronics programs. Teacher competence, so necessary a component to implementation, can be increased by blending the ingredients of a broader preparation and experience, professional activity in the specialty area and good evaluative criteria.

Two final millstones are added to provide a future guidance system for the launching of ideas and programs. Emphasis cannot be placed on the past, present or future alone, nor can a total industrial arts program be dominated by one instructional area.

Mr. Ross is with the Bureau of Industrial Arts Education, Albany, N.Y.

SPACE AGE AND COMPUTER ELECTRONICS TECHNOLOGY

Lawrence F. H. Zane

The purpose of this presentation is to outline briefly electricity and electronics in industrial arts as presented by this morning's panel on the subject "Space Age and Computer Electronics Technology—Are You Prepared for the Countdown?" The emphasis of the panel was on the future of this important area of industrial arts. Panelists were: George Francis from Millersville State College, David Jelden from Colorado State College, and Art Francis from Eastern Michigan University.

Dr. George Francis divided the communicative process into two categories—the visual and the audio, and he also presented two of the techniques that he had developed to improve the communication between the teacher and the student.

Carefully selected criteria led to the construction of what he called magnetic plaques. These operative pieces were illustrated by a series of colored slides. Such teaching media, according to his evaluation, provided significant differences in the effectiveness of teaching a variety of concepts. Electricity/electronics teachers should be familiar with this device. Possibly one could experiment with the hook and loop board utilizing this very same concept.

The second technique presented by Dr. Francis was the video projector. He describes this device as essentially an electronic version of the overhead projector. A video head amplifier shoots at a transparency which is illuminated by a modified cathode ray tube. The image is amplified and transmitted to conventional television monitors, enabling the instructor to close the communicative distance between himself and his students.

Our final panelist pointed out that the future role of electricity/electronics will be dependent on man's ability to teach himself and his ability to make use of resources that surround him. Dr. Jelden illustrated the importance of this theory in his presentation on learner-controlled education.

He believes that in the teaching of electronics the pupil should achieve at his own rate of speed. He lists some of the advantages of individualized self-instruction and some of the criteria of a successful system. Emphasis on the resourcefulness of the teacher was evident throughout his learner-centered, learner-controlled system of instruction. The strength of his program appears in the use of a multi-media method of teaching.

Methods and techniques used to re-emphasize the general education aspects of industrial arts, particularly in mathematics and science, were discussed by Dr. Art Francis from Eastern Michigan University. The bases for integrating and correlating mathematics and science with industrial arts were very neatly outlined. He cited excellent examples found in team teaching to illustrate the future concerns in this area.

Are our electricity/electronics teachers prepared for countdown? The panelists have demonstrated their concerns about this program. What does the future have in store for our youths in electricity/electronics?

On March 3, 1967, Dr. William J. Thaler, a Georgetown University physicist, reported he had developed a way of transmitting FM music and voice simultaneously over a laser beam.

Francis I. du Pont and Co., in their February, 1967, "Investor News", suggested that the most glamorous area of research is electro-optics. This field is described as "a system whose input (from radar, for example) is an electronic signal which is transformed into an optical signal."

Time magazine of February, 1967, described "telefactoring" (doing something at a distance) as a new and promising technology that will extend man's grasp and vision a great distance.

These recent developments are but a few examples of the future role of electricity/electronics in industrial arts.

Throughout the nation industrial arts educators have taken positive action. Let me cite a few of them:

1. a summer institute for advanced study in space technology under Title XI, NDEA, is scheduled this summer in Florida.

2. the National Aeronautics and Space Administration has an Education and Community Service Division in each of its field centers and operation offices. Several articles indicating their services have appeared in our Journal.

3. a committee headed by Dr. John L. Feirer of Western Michigan has recently published, "Industrial Arts in Space Technology," a curriculum supplement designed to show where space technology can be incorporated into industrial arts education.

Teachers of industrial arts electricity/electronics program have planned and developed many projects to incorporate new and future developments in the field. The orbiting satellite has passed Ben Franklin's kite. I am confident our teachers are aware of this, and I am more confident that their future involvement in space age and computer electronics will enrich our curricula.

Mr. Zane is with the State Department of Education, Honolulu, Hawaii

F-13.7 Graphic Arts & Photography
Evaluative Symposium
TECHNOLOGY AND THE GRAPHIC ARTS
Gen. Chm., Philip D. Wynn; Chm., William R. Hoots, Jr.; Rec., William Dinino; Part., W. Carlisle Anderson, James F. Snyder; Hosts, Conrad Angelbrandt, Jack C. Brueckman. Mr. Anderson's manuscript not provided.

STATEMENTS ON THE PRESENT—GRAPHIC ARTS

James F. Snyder

Because this is to be an evaluation period I wish to state that the following comments will be along the lines of the program that was presented. However, I must add that the presentation was not the topic that was assigned – "Photography—The Basic Tool of the Graphic Arts".

The present day is showing a lot of changes in all areas of education. The area of graphic arts is no exception, as you well know. We deal with an industry that changes overnight. How do we enable ourselves to stay abreast of this industry? It truly will be an effort of the creative teacher. He must pursue the coordination of his program with journalism, art, basic photography and other subject areas. The areas of art and photography are definitely a must as the visual communication that says more than the written word.

Many of today's problems may be the results of non-creative teaching. However, it seems that many of our problems could be resolved with some help from the industry that is looking for possible employable persons from our schools. A lend-lease program seems possible, as many companies already are involved in such a program with their products.

The biggest problem at hand is, are we able to instruct without the equipment about which we are to teach? In answer to those critics who think that a program can be maintained without the equipment, may I suggest that they re-assess their definition of industrial arts. When you take the hand and/or the skill away from the subject, is there any longer a process? Is there any longer industrial arts?

It would seem to me by definition that industrial arts includes learning by doing. Thus without the machines for some practical experience, do you still have industrial arts?

Mr. Snyder teaches at Fairmont State College, Fairmont, W. Va.

F-13.8 Mechanics & Power
Special Panel Session
APPLICATIONS OF MECHANICS AND POWER FOR INDUSTRIAL ARTS PROGRAMS
Gen. Chm., Paul Wighaman; Chm., Walter Griggs; Rec., Howard Shull; Panelists, Dmitri Slobodian, Paul E. Waldrop; Hosts, Clark M. Younger, James S. Holtz.

APPLICATIONS OF MECHANICS AND POWER FOR INDUSTRIAL ARTS PROGRAMS

Dmitri Slobodian

When informed of my assignment to observe a presentation in power mechanics on one day, then react as a panelist later in the week, it occurred to me that the job had many implications. First, we have been listening to many experienced educators expounding their philosophies as to what constitutes "power mechanics", and how to implement it in the industrial arts curriculum. Second, I am reminded that each of us has a very unique background of experiences, interests, desires and values which form the basis of our philosophies. Lastly, each of us, when confronted with the job of implementing a course of study, must take into consideration outside forces which will influence our efforts, in this case, the pupil with his interests and needs, the community and the administrative personnel.

Once the power mechanics program is established as part of the total industrial arts curriculum, it now falls on the teacher or teachers to implement the program. How this is done will determine success or failure. As Dr. Duffy indicated, it is the teacher's job to develop a program which will be dynamic and flexible, ever mindful of the pupil's interests, abilities and needs.

One of the challenging aspects of teaching is the selection and preparation of what to teach. The second important aspect is the teaching job itself. Of course much of the success with the program will depend on the qualifications and capabilities of the teacher. So often we attempt to teach in an area with inadequate preparation, be it academic or manipulative. For example, I was once listening to a beginning teacher explaining to a class the function of carburetion and how its successful operation is based on other engine factors. He went on to say that the carburetor functions by use of the engine vacuum in the intake manifold. He indicated that this vacuum is measured in pounds and that the correct vacuum should be about eighteen pounds.

Of all programs which can be offered in the industrial arts curriculum, power mechanics, if properly handled, can and does capture the interests, needs, curiosity and imagination of most all youngsters. It is sufficiently broad so that one can begin teaching it at almost any point in its historical setting, its present setting, and/or by projecting it into the future with pupil research and experimentation. The number and variety of activities in which youngsters can engage are unlimited, challenging the most gifted, the average and the slower learners.

The program can and should be designed in a way which will compel the youngsters to use all of their faculties of learning, applying mathematics, principles of science and a considerable amount of reading. Coupled with the above, the youngsters should be able to put together all of their ideas on paper, be they research findings, historical findings, or just reporting on a project. I would also recommend that the youngsters make oral presentations to the class. Again, keep in mind that industrial arts is part of general education, preparing youngsters for our industrial, social, political and technological society. Also, the students are developing and experiencing all of the mental, manipulative and social skills which should assist them in entering the labor market or going into higher education as better-prepared individuals.

In the past the major emphasis for industrial arts programs was to accommodate youngsters whose primary interests were in the development of the manipulative skills, along with a limited amount of mental skills. Today we must shift gear, because our technological and social advancements demand skills on a much more sophisticated level. I do hasten to say that manipulative skills, although sophisticated, coupled with technological know-how, will remain with us forever.

In summary, implementing a power mechanics program into the industrial arts curriculum is basically two-fold. First, the local school system must find a need for it and have it included in the curriculum. Secondly, the toughest job is a sound preparation with a dynamic and well-qualified teacher who is willing to meet the challenge of present-day technology, a teacher who is also willing to work hard to have the pupils challenged and have the pupils challenge him. It is a rare occasion to find a program in industrial arts where a challenge is being promoted from three different directions, namely, technology, youngsters in school and the challenge of the teaching job itself, keeping a dynamic program in operation.

Mr. Slobodian teaches at Garden City High School, Garden City, Mich.

APPLICATIONS OF MECHANICS AND POWER FOR INDUSTRIAL ARTS PROGRAMS

Paul E. Waldrop, Jr.

Webster defines mechanics as: "1. the branch of physics that deals with motion and the action of forces on bodies; 2. knowledge of machinery; 3. mechanical aspect; technical part." Power is "5.a. physical force or energy; as electric power; b. the capacity to exert such force in terms of the rate of results of its use: as 60 watt power," and industrial arts is "the technical arts used in industry, especially as a subject for study in school."

The job of combining the above three concepts into a working utilitarian program in a power mechanics class can be done quite easily. Like other subject matter areas, it depends upon the level of understanding which the teacher wishes his students to achieve. In general we can say that there are three levels of understanding—knowing-about, knowing and knowledge-impartation. One can read, observe, discuss and listen, and achieve some degree of knowing-about. As one becomes involved to the point where he can perform in an area of endeavor, he arrives at the knowing level. As his knowledge and ability grow, he arrives at a point of confidence which permits him to impart his knowledge, thus reaching the third level. To view these three at a distance permits a ready perception; where viewed at close range, they blend into a continuum. A teacher in power mechanics can provide the first level of understanding without too much difficulty, and few instructors need to go beyond the second level. It is the degree to which the second level is reached that is of greatest concern.

Teaching is the provision of a controlled environment wherein learning can take place. The environment established by the teacher of power mechanics will determine the level of understanding achieved by the student. The environment established by the school will determine the ability of the children to function in society.

Let us see what it is we want for our children, then provide the means of attainment. Since industrial arts is general education, as such it should adhere to the seven cardinal principles of education. For these seven we must find ways and means of achievement. The nature of our work provides a wonderful opportunity to do this; but in addition to meeting the seven, we must also meet some rather unique objectives—those more immediate objectives which are served best by our curriculum content. Programming and scheduling should all be slanted toward achievement of the objectives of industrial arts and education. The ultimate goal of all of this activity is to make our unique contribution to the growth and improvement of the individual and thereby to the growth and improvement of all mankind.

The needs of our people today are still those which are embodied in the seven educational objectives. Our unique objectives are merely detailed modifications of these seven. Let us then examine the area called power mechanics and see how it might be used to reach the objectives of education. Of the seven principles, all have some degree of attainment, but numbers 3, 4 and 5 seem to be the ones which power mechanics can reach the best. Number 3 provides for an ability to read and write and to think, study, and act. Number 4 calls for an ability to earn a living, and number 5 stresses worthy home membership. Objectives of industrial arts provide for understanding industry, development of talents, technical problem-solving ability and development of skills. It is the job of the skillful teacher to blend these two sets of objectives into a whole, apply content and method, develop lessons, order materials, create evaluative criteria, and then at every marking period rate his students. This blend of different media when brought together skillfully with thought for the objectives will result in well-educated youngsters.

Power mechanics can be logically divided into three main areas of activity: 1) power generation, 2) power transmission and 3) power utilization. It is the discovery and blending of these three that has resulted in present-day achievements of modern industry. The operational needs of everyday living today are the same as those of 2,000 years ago. It is the adaptation of power to the tasks of 2,000 years ago that has made the difference. Consider food consumption. Two thousand years ago, man, by the application of muscle to the task, could feed himself and his family. About 20 acres was all he could handle and surpluses were few. Today one man can handle 600 acres by the application of power. To make concepts such as these realistic is the task of the teacher.

The beginning of such a task with a group of youngsters can best be accomplished by capitalizing on the area of their main interests—usually it is the automobile. This area will serve as a temporary focus of attention while the "training" is underway.

Training—a dirty word to some—is still a necessary part of any operation. This is where the "rules" are learned—how to handle tools—axles, wheels, levers, screws, inclined planes—concepts such as pressures, vacuum, torque, alignment, fits, ratios. The car is a physics laboratory made real. A good teacher can capture his students with such a device and provide an excellent background for a transition into a complete program of power mechanics. The youngsters have to begin somewhere, and an old vehicle can become the vehicle at negligible cost. The prime concern here is that the training of all youngsters be thorough to the point of the second level of understanding.

The teacher, during the course of these operations, must see to it that the various systems are explored and exploited to the fullest. The mechanical-electrical, the chemical-electrical, the internal combustion, the pneumatic, the hydraulic, communications and sensing devices and, in short, all of the peripheral aspects of power systems must be explored, and explored by use of all the senses.

The good teacher will relate the work of the student to the objectives of education in general and industrial arts in particular. Additionally, an astute teacher will relate the activities of his classes to areas of math, history, social studies, physics, economics, general science, English and yes, even music and art.

When a student has acquired a sufficient set of mental tools, he then has the capability of applying his knowledge in new and varied ways. This does not mean that he will automatically begin using his knowledge. Other conditions are necessary, such as motivation, desire, need, curiosity. Whenever drives appear and a student has the background, then new and creative applications of learning can occur. One additional ingredient is necessary here—environment. This is education. The teacher, as provider of the environment, must encourage his youngsters to develop techniques for combining power sources with power utilization. All of the work and effort which youngsters can put into such endeavor can serve to create within them that soul-satisfying feeling of a job well done. It is the duty and responsibility of the teacher to see to it that each student is as successful as possible.

Evaluation of students should be based upon structuring of objectives prior to the beginning and a review of objectives at the end. Each student must be evaluated in terms of the objectives. An evaluation should consist of some determination of student talents, problem-solving ability, understanding of industry, shop skills and knowledge. When the ultimate need for some form of a letter or number grade occurs, give the student a chance to rate himself and give his rating some weight. The grade should be a reflection of his ability as well as his standing with others. If he does poorly, then the environment for him was not well prepared. If the environment was well provided, then the whole of society will benefit.

The educational end of this power mechanics program implies creativity. This is one of the highest forms of intellect and one to which we offer seemingly little in the way of environment. Let us challenge the entire school system with a program embodying training and education in power mechanics. Let us seek out students who dare to be different and encourage them in ways which society accepts. Let us have conformity where necessary, but let us question that conformity and, where reason dictates, let us diverge. If we are to have a forward-looking program of education instead of good old "manual training", then we can do no less.

From such programs as this, our schools can develop engineers and service station attendants, scientists and mechanics, artists and technicians, successes and failures. The successes, however, should be greater than at present, and the failures should show a marked decrease. When youngsters are given a chance to show what they can do, they become one big smile. They feel as if they are "in". They feel successful and they like the feeling. They like it so well that they wish to repeat their successes. If the proper environment can be provided, the program can become educationally meaningful, and industrial arts power mechanics will become the most desirable program in the school.

Mr. Waldrop teaches at East Carolina College, Greenville, N. C.

F-13.9 Metals
Evaluative Symposium
IMPLICATIONS OF METALS TECHNOLOGY—PAST, PRESENT, AND FUTURE—FOR INDUSTRIAL ARTS METALS CONTENT
Chm., Kenneth R. Clay; Rec., Ronald Pimental; Panelists, Olin Singer, Dennis Darling, Douglas T. E. Foster; Hosts, Donald G. Dietz, Dale Hinds.

IMPLICATIONS OF METALS TECHNOLOGY: PAST, PRESENT AND FUTURE

Olin D. Singer

Starting with a very humble origin, industrial arts has evolved through a series of changes which were and still are justified by the prevailing principles and thinking of the day. Initially, manual training and its development of manual skills (or in the pedagogic jargon of the day, the training of "hand and eye") provided little conviction to many educators that it had very much significant value. The next step was manual arts, a slight expansion of the basic philosophy; manual arts, with the expanded philosophy, did little to change the thinking or stimulate the acceptance of the program by educators in general. But even so, the original ideas of the first attempts endured. (We must have been doing something right.) During the experimental period of industrial arts, our nation was changing from a largely agrarian society to a rapidly-expanding industrial one. Almost simultaneously, a major revision of philosophy and an expansion of offerings were taking place, giving industrial arts a semblance of educational respectability.

Since the end of World War II, industrial arts has made great strides. We have moved out of the basement and up to the ground floor, both physically and academically. By expanding and improving our physical plants, we have become contributing members of the educational team in our respective schools. With improved shops and laboratories, we are able to introduce more diversified course offerings. It seems that industrial arts has reached a point now where we have improved and perfected the basic concepts to the fullest extent. We have now reached a point in history demanding new thinking and new ideas.

The time has come for a re-evaluation of the objectives of industrial arts, keeping in mind the ever-present question of what the next twenty years will bring in the way of industrial and technological changes.

We are well into an all-pervasive phenomenal era, enhanced by a violent eruption in science and technology. It is now common knowledge that it is only in the past century—2% of recorded history—that 90% of all advances in science and technology have been made. More practically speaking, 90% of all scientists and technicians that have ever lived have worked or are working in this century.

Recently, a great deal has been written in our professional literature concerning the need for changes and up-dating our industrial arts offerings. As so often stated, revisions are needed to bring our programs in line with contemporary industrial methods. It should be stated here that industry is the key word, for it is from industry that we derive our content and purpose. If industrial arts provides the experience, insight and understanding of our complex industrial society, then our programs should be abreast of present industrial techniques. On paper, our objectives seem to answer the needs of the student, but in actual practice we must admit that our achievements do not fulfill the paper promises.

Today, as never before, the advances in the methods of working metals have been fantastic. The adaptation of basic physical science principles and laws has resulted in the manufacture of some five hundred different types of metal working machines. New methods, new concepts and new principles of metal working are being developed every day. The research and developments of the past five to ten years have resulted in a number of new metal working techniques. Too few of us as industrial arts teachers are focusing the students' attention on recent metal working developments. Electrical discharge machining is used in tool and die manufacturing, and, in the near future, it will be used in ordinary production operations. The ultrasonic cutting, forming and welding machines have passed the experimental stages in usefulness. Electrochemical machining methods as well as abrasive machining, capacitor discharge cutting, explosive forming, hydroforming, cold extrusion—all are being used effectively in one industry after another today, now.

These processes are an immediate or impending part of production methods, and production will employ today's student. Without a doubt, he is well-grounded in the outdated, traditional method of riveting sheet metal, drilling and hand-filing odd shapes, or laboriously making a wooden pattern for a once-and-done casting. But he is not being made aware of and taught the new and more improved methods of doing the same basic operations more efficiently and more precisely.

A professor at MIT estimates that as many as 70% of the present-day jobs in manufacturing will disappear within the next ten years. Statistics are debatable, but there is no doubt that changes are taking place in the metal working industries. These changes demand a change in the methods and contents of the schools' metal technology classes now.

Federal government research states that present high school graduates change occupations at least twice during their working lives. If this is so, then it is imperative that the high school student be given as broad a background as possible.

There are rapid changes in production methods taking place, and since the changes are compelling the retraining of our job force, then we, as teachers, must seek new directions in the classroom.

Rather than teaching material and methods restricted to a narrow vertical column and being primarily concerned about shaky, so-called "established" occupations in a fading arrangement of industry, we must recognize the changes that are taking place. We must take a new tack. We must broaden our scope by teaching on a horizontal plane. Only then can we introduce and discuss each innovation in technological progress. Only then can we make an attempt to prepare the student for the different job opportunities that are opening up tomorrow. Only then can we feel we are teaching with the added dimension of depth.

It is necessary to comprehend the magnitude of the problem before we can hope to deal with the questions facing us. Only by keeping abreast of technological changes can we hope to serve the well-being of our students. We must continually study and evaluate the new industrial progress so that it may be brought into our programs. Because of time and schedules, some of the old methods and processes will have to give way to the new ones. But justified change is good.

How do we equip such a program? Certainly the cost of some of the new metal processing machines places them well out of the reach of an industrial arts program. On the other hand, a comparison of a given supplier's catalog of just ten years ago with one for the present school year will show any number of new (new to school use) machines that are within reach of most school budgets.

Although we must be realistic and accept the fact that many of today's new machines will not be immediately available for our classroom use, it is our universal obligation to introduce the student to the newer processes. We all have access to introduce the student to the newer processes. We all have access to industrial films and film strips. We can provide demonstrations using models and mock-ups. There is a limitless supply of visual aids which will serve to demonstrate the basic operating principles of new machinery.

For the future, then, industrial arts must find a pragmatic compromise between the traditional, almost obsolete, processes and the newer competitive practices. We must attempt to bridge the gap that now exists between the static traditional methods and the dynamic newer methods, because this gap will only widen as long as we have progress.

Mr. Singer teaches at Pennridge Senior High School, Perkasie, Pa.

PRESENT TECHNOLOGY AND INDUSTRIAL ARTS

Dennis E. Darling

I would like to start by posing a question which, if not answered in the affirmative, may necessitate a change in the title just stated. Is there a technology of the present? We often recall many of our past experiences which remain important to us today as specific attitudes, ideas, interests, information or understandings. These past experiences, which we recall in many ways, suggest the need we have for their use in the present. We also, and perhaps more frequently, spend time planning for those experiences we hope to have in the near future—some time beyond the present. Within our spectrum of time—past, present, future—the present time segment might simply be indicated by the term "today".

What I have to say concerning our present technology and our industrial arts curriculum depends entirely upon the extent of the concept "today". Since today will become yesterday and tomorrow will become today, it seems that we can very easily involve ourselves in a series of activities which become established to the point where they are difficult to change. If we extend the concept of present time to include more than what we think or do on any given day or, for that matter, in any given activity, individually or as a group, we run the risk of holding on too long to attitudes, ideas, interests, information and understandings which should have moved into the past. Likewise, we run the risk of avoiding valuable future experiences.

By performing these time tactics, I am simply attempting to focus upon present-day technology as something we can only appropriately understand and use if we encompass our every attitude, idea, interest or bit of information with the ability to change them.

In terms of the sessions which we have held at this convention for the purpose of discussing past, present, and future technology in specified curriculum areas, we seem to approach today's technology within yesterday's structure. I point out the titles heading these sessions—metals, woods, etc. It seems that if we are going to develop an individual adaptable to technology in our future culture, we had better start today to let some of these inappropriately-used terms pass on.

In the Thursday session on present technology (metals), we covered a variety of materials, specifying techniques, skills and knowledge related to these materials.

In summary, I would simply imply that where there is a job to do involving technical problems, we will need individuals much better equipped than those with segmented concepts of materials, processes and tools, in order to provide solutions which can adapt to technological change—individuals who can operate in the present while making the most of their past and applying both to the future.

Mr. Darling teaches at Michigan State University, East Lansing, Mich.

FUTURE METALS TECHNOLOGY CONTENT FOR INDUSTRIAL ARTS

Douglas T. E. Foster

The metals content of the future must be the result of very careful evaluation of many important factors based upon a changing philosophy, in some areas, relative to the aims of industrial arts and its place in the general education of all students. If our program is to reach every young person and give him a true picture of the place of industry and technology in his society, we should consider the question asked by Dr. Brand Blanshard at Yale University in 1963, "Do we want our end product to be a learned man, a trained man, or an educated man?" The learned student may have much information about many things, but be completely unable to apply this knowledge to a practical problem or to use it in the critical analysis of news articles or propaganda—an important duty of every citizen. A trained student may be practiced and adept at some particular skill or process, but be completely without knowledge or interest in the world about him or man in general; whereas, the educated man will have mastered the most important of his tools, his own intelligence, and learned how to use his abilities to analyze, improve his appreciation of the ideas and ideals of others, develop new ideas and help put them to practical use for the advantage of all mankind, and expand his own special talents for professional, vocational or avocational applications.

Dr. Warner and Dr. Sladicka illustrated that some of the more modern developments of the metal trade industry may be easily adapted to the average school program, while some are of a nature where this is prohibitive, due to the high initial cost of equipment and the constant change and development of components thereof. Therefore, it seems that more and more of our effort will have to be channeled toward the lecture type of instruction, using special teaching aids, visiting speakers, industrial tours and student participation in special research projects. The shop or laboratory will always be a very important asset to any program for demonstrations, to allow for practical applications and to meet the special needs of many students.

If we are to become a part of the general education of all students, we must first of all reach all students. This can never be done in a comprehensive high school with a student body of between two and three thousand students and only five or six industrial arts facilities capable of handling a total of four to six hundred individual students. Some thought should be given to large group instruction, special afternoon classes, full-time use of all facilities, special related programs with other areas of the curriculum and, above all, to some way of re-educating the people in the community, parents in general, so they will all know and understand the true purpose and objectives of a modern industrial arts program. Most of our citizens have completed their formal education with little or no concept of the contributions of the metal working industry to our civilization, our present standard of living, and the development of practically every other industry and profession.

Do they have the important background to be able truly to analyze the problem referred to in the newspapers of this past week, which stated the "technological gap" was imposing a strain on US-European relations, or do they understand why, as Lord Borden of the Manchester University's Institute of Technology stated, "American industry gained about $560 million last year through the 'brain drain' from England?" Is it the advance of American technology or the old-fashioned social ideals of some European countries which is actually to blame?

In the field of the metal working program, we should consider that we must meet the needs of many diverse students: (1) every young boy and girl, who will be the voting citizens of tomorrow, so that they will realize that the constant advance and development of our field has given them the things they are so used to in their everyday life, at a price they can afford to pay, and also been important in manufacturing equipment and supplies for every other profession, vocation or avocation in which they may be interested; (2) the college-bound student, who needs and desires some fundamental knowledge of the history and development of American industry; (3) the young person, planning to enter a technical school or junior college, who needs theoretical and practical preparation; (4) the terminal student, who will enter the field of work upon graduation from high school and who definitely needs a sound background in problems and practices of modern industry and some development of his own abilities and talents so he will have definite salable skills to offer an employer; (5) the ever-present potential "drop-out", who may suddenly see a reason for remaining in school by having his interests enlivened by a well-planned industrial arts curriculum.

There will always be a place for "technology of the past" in studying the history and development of our technology and for illustrating such important factors as time and cost. The "technology of the present" and its possible impact upon the social structures of other nations should be understood, as well as its importance to our present standard of living. Above all, however, every student must understand the importance of the ever-changing technology, and be conditioned to the absolute necessity of changing old ideas and initiating new methods and standards for the ultimate good of fellow men.

Mr. Foster teaches at Rhode Island College, Providence, R.I.

F-13.10 Woods
Evaluative Symposium
FROM TREES TO SPACE CAPSULES—WOOD IS ON THE MOVE
Gen. Chm., David A. Rigsby; Chm., George Keane; Rec., Ozzie Hackett, Jr.; Panelists, Joseph L. English, Jerome W. Black, Wiley G. Hartzog, Jr.; Hosts, Alan DeOld, Clarence H. Preitz.

WOOD—FROM SHOP TO LABORATORY

Joseph L. English

Perhaps no other subject area of industrial arts is more neglected than the theoretical structure of wood. The wood industry in the United States is the fourth largest industry in the country and provides jobs and products for millions of people. Research indicates that the number of programs and the number of students enrolled in these programs are significantly higher than other subject areas of industrial arts. Why then is there a problem?

The following facts should illustrate the situation as it exists today:

1. No available synthetic material can satisfactorily duplicate the physical and mechanical properties of wood.
2. Hard woods are in short supply.
3. Technology has increased the utilization of woods and wood products.
4. The new products are better and less expensive.
5. Adhesives have revolutionized the wood industry.
6. The survival of the wood industry depends upon research.

With these facts in mind, ask yourself the following questions:

1. How does my program reflect the technical changes in the wood industry?
2. Do my aims and objectives reflect student needs—both general and vocational?
3. In terms of changing technology, is it more advantageous for the student to know how to "drive a nail," or is it more important for him to understand why fasteners and adhesives hold material together?
4. Am I doing my job as an industrial arts teacher if my students can produce a "project," but know nothing of the material used to produce it?
5. In my junior high school program, does the bright creative student produce the same project as does the average or slow student?
6. In my high school program, what do I offer the college-bound industrial arts student—more nail-pounding and sanding?

An analysis of the above questions will reveal the true nature of the problem. It is not the curriculum or subject area that is obsolete, but rather the course of study and the techniques used to implement them.

As woodworking developed, much skill was needed to perform the various required operations. Today, tape- and computer-controlled equipment can duplicate the most delicate and complicated designs required for mass production.

It has been said that the two areas of greatest demand in the wood industry are for skilled craftsmen and wood technologists. Apprenticeship training and vocational education programs can produce skilled craftsmen, while the industrial arts program must lay the conceptual foundations for the wood technologist.

Operation and growth of the wood industry are no longer dependent upon the artistic talent of craftsmen, but rather upon scientific research and development in the area of wood technology.

The theoretical and related content of the wood industry has emerged from an art to a science, and it is about time industrial arts assumes its responsibility for providing a true understanding of the wood industry.

When one observes massive new buildings with modern but traditional equipment, staffed with administrators dedicated to the status quo and apathetic teachers, it is obvious why curriculum content in the industrial arts woodworking course has had little change in the past twenty years.

The following quotation by George Bernard Shaw seems appropriate: "After losing sight of our direction, we redouble our effort."

Mr. English teaches at Pennsylvania State University, University Park, Pa.

FROM TREES TO SPACE CAPSULES—WOOD IS ON THE MOVE

Jerome W. Black

We have learned that living today in a city or rural areas, an important part of the educational program in our school and wood industries is concerned with these resources as they relate to new discoveries, new inventions and development of new materials brought through science and technology.

The discovery of other materials that are associated with wood products and are creating new applications would include the hardboard, particle or chip board, veneers, polyethylene film, synthetic foam, plastics, pulp and paper products and many more. One of the newest breakthroughs in peacetime is use of nuclear energy in the development of irradiated wood-plastic composites.

As we see wood is on the move, how does it affect other aspects of industry and our society today?

We find that here in the United States, we have only nine percent of the world's timberland, but we produce 40% of the world's lumber, 58% of its plywood. With this complex of lumber, plywood, mill work and fabrication of wood products and paper products rank fourth among American industries and its contribution to the national income, and fifth in creation of jobs.

The question was asked us, "is there a need today for skilled woodworkers?" The trade of a skilled craftsman in woodworking is going down, and the manufacturers are willing and are paying a higher price to get them. Several companies in the south have gone to Sweden to import skilled craftsmen, even to the extent of financially moving their complete families and supplying new homes.

Are woodworkers becoming extinct? No! - But! We were given figures to show our trends in the industries. In the 60's, the plywood consumption of woods will be increased by 52%; in 1980, it will be 80% above 1962. But the per capita consumption of lumber will be five percent lower in 1970 and ten percent lower in 1980. The per capita consumption of veneers and plywood will increase 34% by 1970 and 42% by 1980.

The trends are about the same in the furniture and fixture manufacturing industries. Eight our of ten wood furniture production workers are engaged in sanding operations and 85% of the shaping requirements are being met by new automatic control-profiles. Programmed operations are moving in.

With an over-all increase in employment at an average rate of 1.2%, the number of white collar employees will increase by two percent to 19.4% of those employed in furniture and fixture manufacturing. Repairmen in the field will increase by 43%, upholsterers a one percent increase, cabinet makers decline by 13%, laborers decline by 12.4%, plant operatives increase by 15% to comprise about 50% of total employees in the industry. The trends in the pulp, paper and board industries follow a similar pattern.

With the above facts, is woodworking becoming extinct? We can conclude that the industry is not vigorously expanding, but it is healthy.

Have we, as educators, kept pace with the changing condition of today's woodworking industries?

Most all industrial facilities across this nation have in one form or another a woodworking program. This point may even be stretched enough to say that there are more woodworking shops or labs in industrial arts than any other single area of industrial arts instruction. We could then safely say that more high school students are exposed to woodworking than other forms of shop work. If, then, the woodworking industry is only the fourth largest industry in this country, and woodworking is our most common medium of instruction, why can we only provide enough skilled craftsmen to begin to fill the needs of the woodworking industry?

Many changes are taking place in education today, especially in the fields of science and technology. Likewise, changes can and must be made in the methods and curricula of our industrial arts programs. Our programs must be organized to give the student an insight and understanding of industry and its place in our society; to help each student discover and develop his talent in the technical fields and applied sciences. As industrial arts teachers, we must accept the challenge of educating our youth by teaching and emphasizing new techniques, new processes and skills, not as ends in themselves, but as the means for achieving our goals in industrial arts.

Mr. Black teaches at Falmouth Senior High School, Falmouth, Maine.

FROM TREES TO SPACE CAPSULES—WOOD IS ON THE MOVE

Wiley G. Hartzog, Jr.

From trees to space capsules—wood is on the move, particularly in the sense that the wood industry is becoming more and more an industry of skilled specialists and technicians. Computers, techniques of automation, conveyorized assembly lines, metallurgical developments, particularly in the development of carbides, techniques of automatic offset printing, new products and techniques of plastic laminates, polyesters, polyurethane resins, electronic heat sources and electro-statics have all been applied to the design, manufacture, assembly and finish of modern wooden articles.

Having been located for eight and one-half years in one of the major wood-furniture-producing areas of the United States, I have been amazed at the speed with which these developments have been accepted and utilized by the industry. A tour of my community would reveal furniture factory rough ends (first manufacturing stage for rough lumber), formerly an area requiring large numbers of semi-skilled and unskilled manual laborers, that are almost completely automatic today. Machines have been developed that can grade, measure and cut lumber to dimension automaticaly, simultaneously maintaining a complete inventory of what it has done through the use of computers. We find this done before lumber is kiln-dried for increased efficiency, so that waste and scrap need not occupy valuable kiln space. On this same tour, you would also see core stock and veneer panels being manufactured from sawdust, chips and low grade woods, specially ground for the process, using modern adhesives and electronic machines to make panels, often limited in size only by the buildings housing the machines. You would also see assembly line techniques formerly associated with, for example, the automotive industry by utilizing conveyor-driven assembly lines with each worker doing one operation toward the total. In fact, woods have moved so fast in my area of the country that a survey of manufacturers, conducted a few years ago for the purpose of expanding the vocational offerings of my school, indicated 100 percent interest in our training electronics technicians and no interest in our training cabinetmakers. If, in industrial arts, in teaching woods we are to continue the aim of illustrating industry, we must change many of our methods and procedures. Woodworking might be considered one of the original areas of industrial arts. Unfortunately, in many instances, we are making use of the original techniques of teaching it. I, personally, find that I use many of the techniques of teaching woods in industrial arts general shop that my father used fifty years ago in teaching woods in manual training. This does not mean to say that these methods lack validity, but to indicate that they no longer represent a total representation of woods as applied to industry.

Mr. Hartzog teaches at Lenoir High School, Lenoir, N.C.

OUR CULTURAL HERITAGE IN TRANSITION THROUGH FEDERAL, STATE, AND LOCAL ASSISTANCE
Chm., Glenn I. Newhouse; Rec., Howard M. Sasson; Panelists, David H. Soule, Raymond Carrell, Robert E. Buxton; Hosts, Edward Richards, William R. Roach.

OUR CULTURAL HERITAGE IN TRANSITION THROUGH FEDERAL, STATE AND LOCAL ASSISTANCE

David H. Soule

The history of American education contains a fascinating chronicle of the values surrounding governmental assistance to education. The issues we explore today are not new. I think one of our basic purposes should be to examine, in reflection of the values of the community and the needs of the nation, what has happened. This subject should be of prime concern for the education profession and of equal importance to the public.

I am impressed with the similarity of governmental behavior in 1967 to the apparent behavior of Congress 30 years ago. Many of us have forgotten the multitude of Federal laws containing implications and provisions for public schools which were enacted in response to Depression-induced conditions of the early and mid-1930's. During this period, there were nine Federal agencies for relief and recovery programs which were of importance to the public schools. These programs featured putting unemployed people to work in specially-designed activities. At the same time, other legislation provided assistance on school building projects, as well as helping with maintenance problems.

It seems to me that presently we are in a paradoxical situation. We are all familiar with Dickens' A Tale of Two Cities – "It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness. . . ." How incredible it would have seemed to Dickens that a society which spends as much as does our nation on education should have one-fifth of its population in poverty. We have a surplus of capital, labor and productive ability of farms and factories – yet we have unmet needs in our educational facilities, depressed areas, medical care, transportation and slums. Today we are able to control our environment as no other age before us – yet we can't control the hydrogen, oxygen and sulfur compounds from our cars or the effluent we pump into our streams.

In terms of public support, particularly at the national level, there is no question that some curricular areas have stolen the show. This lack of balance has unduly limited our flexibility in dealing with the problems ejected from the cornucopia of technology. Since the founding of the republic we have always asked more than we had any right to expect legitimately from our system of public education. And today this is more characteristic in our propulsive society than ever before. The situations that we ourselves have created out of our past successes demand that we increase our efforts beyond anything now deemed possible. No culture with our values can build the splendid structure now possible upon a foundation of deprivation and hopelessness for a part of its population. By combining on a vital and present basis with the other forces responsible for the development and progress of the community, the schools can reassert that bond which at its most cohesive has been responsible not only for the success of our schools but of our culture.

Another issue at heart is the question of how close geographically should governmental agencies bring cultural opportunities to needy persons. An essential part of the problem is the recent determination to provide equal opportunity to groups who have been out of the "mainstream" of these cultural opportunities. There have been projects to get at the nub of the problem earlier, by instituting new and innovative programs at the secondary, elementary and pre-elementary levels.

Yet an institution honestly wanting to bring these groups into the "mainstream" often realizes that it must do something more than just open its doors. The cycle of cultural and academic deprivation must be broken. Inferior schools and programs produce inferior students who return to reinforce the cycle at the lower levels once again.

In this transitional period of experimentation and innovation, public agencies may have to discard old traditions and standards. Special remedial and enrichment programs financed by outside agencies have become a normal part of the scope and sequence offered to students from these deprived groups. Old standards of financial support, pegged to ability and effort to finance schools, may have to be modified to a basis of the development of human capital through education. In short, the institution has to take one step beyond merely opening its doors to qualified students. It must help make these culturally-disadvantaged students qualified, and then temporarily support them. There is a transitional stage where students can be prepared to the point where they can take their rightful place in the mainstream of society. The question is whether schools, accustomed to dealing with middle-class clientele, can or will have the interest and ability to bridge the gap to other segments of society.

As this nation advanced economically, the fissure between the privileged and less fortunate became less tolerable to the latter. The most slaves could hope for was that an employer would be kind and charitable. Kindness and charity are no longer enough. Today the people of this country are in the revolution of rising expectations. They are demanding all sorts of benefits from governmental agencies. People are asking for and expecting to receive freedom from poverty and toil. They are asking these same agencies for medical care, schools and roads. With this Federal, state and local assistance has come the dissolving of distance and an increase in the speed of communications.

In spite of the aforementioned benefits, we as a nation are still plagued with problems of poverty, unemployment, prejudice, crime and juvenile delinquency. Many individuals who went out to help people of another culture understood very little about the values of that culture. Untold dollars have been allocated to aid people in these cultural situations —an allocation which often results in the alienation of the very people it sought to aid.

James Harvey Robinson went so far as to say that except for our animal equipment, practically all we have was handed to us gratis, and that civilization itself is little else than getting something for nothing. In the fields of science, education, ad infinitum, our debt to Federal, state and local assistance is great. Our present-day research laboratories, hospitals and universities as well as our schools will attest to the contribution made by these agencies. We, as a profession, have not known a strong chief executive committed to education before, and now that we have him, some of us are finding it hard to cope with. Like it or not, we are now being pulled or tugged along to more financial assistance to education.

The significant item in assistance to local programs indicates that opportunities have been provided for people to improve and understand their culture and heritage. Whether we have an alluvial or a stalactite-stalagmite relationship remains to be determined by historians. Personally, I think it's more of the latter than the former.

In conclusion, I would like to point out that ours is not the only culture in the throes of change.

A health director reported this week that a small mouse, which presumably had been watching television, attacked a little girl and her full-grown cat; both mouse and cat survived, and the incident is recorded here as a reminder that things seem to be changing.

The mice of the world are no longer doing what the cats say.[1]

FOOTNOTE

1. James Reston, The New York Times, July 7, 1957.

Mr. Soule teaches in the Oakland County Schools, Pontiac, Mich.

OBSERVATIONS OF OUR CULTURAL HERITAGE IN TRANSITION

Raymond Carrell

Dr. Streichler pointed to the responsive abilities of the industrial arts teachers to adapt themselves to coordinator roles in cooperative industrial experiences programs.

This is an indication that industrial arts teachers can accept a changing role as it might apply to the technician and technology. The composition of a technician involves such complex factors as skill, knowledge and functional level, indicating the need to incorporate this occupational segment into our changing curriculum.

Finally, the hoped-for result of all our talk and deliberation will be a student informed about industry and its occupations.

Rev. Sullivan states that all educational breakthroughs were preceded by need, that a backward glance at our population capability has shown a population of which 75% are drop-outs, and that this group was mainly from the 21-59 age group and was either a member of a minority group and/or poor. This need became the birthplace of the Opportunities Industrialization Center (OIC)

The OIC concept, created by the needs of the poor, is an adult form of education for the poor. Its purpose is training for a job or a better job with respect and dignity.

In two short years, more than 2000 men and women have been placed in productive jobs. Most of them were unemployed or under-employed. More than 1600 in Philadelphia are presently being trained for 30 different jobs by OIC. Through dedicated leadership and poverty funds, OIC has spread to over 100 American cities and Central and South America.

Some of the same problems inherent in the US industrial arts programs are present in the English schools. The term "handicraft" is not acceptable, low-ability students are identified with lack of progress, and the goals are not identifiable with the program.

Due to the persistence of S. John Eggleston and others, plus the raising of the minimum school-leaving age (due in 1971), governmental funds were made available for a feasibility study to:

1. clearly define objectives;
2. show that real possibilities do exist in the curriculum for handicraft; and
3. make an objective assessment of handicraft in the wider context of the school and society.

The hoped-for result of this study will be a document that will serve as a guideline for future planning. It is likely that the research document will include the following areas:

1. the reappraisal of skilled performance and satisfaction in society;
2. practical studies in three-dimensional design;
3. practical studies in applied technology; and
4. handicraft as a service subject to other secondary school subjects.

Mr. Carrell teaches at Niles Township High School, North Division, Skokie, Ill.

OUR CULTURAL HERITAGE IN TRANSITION THROUGH FEDERAL, STATE AND LOCAL ASSISTANCE

Robert E. Buxton

According to an announcement made at a TIAA meeting in Murfreesboro, Tenn., last Friday evening by Dr. Howard Decker, the new Title III Guidelines differentiate pointedly between industrial arts and vocational programs and specify the use of Title III funds for industrial arts only. The statements are directed to the attention of principals and superintendents, as well as of teachers. This clarification of purpose should assist many industrial arts teachers in the accomplishment of a difficult task: helping administrators and lay persons recognize the purposes of industrial arts, and the value of the educational experiences provided in a good industrial arts program.

Members of the United States Congress have recognized the significance of industrial arts and have provided funds for extension and improvement of programs. However, the efforts of Congress and the US Office of Education will amount to nothing unless teachers at the local level tackle with diligence the preparation of plans and proposals in cooperation with their administrators. Another way teachers can help is to participate in institutes funded to assist them in making progress.

One effort to ramrod change and equalize educational opportunity is the development of about 20 regional educational laboratories across the United States, including Alaska and Hawaii. My discussion will pertain to an activity sponsored by Appalachia Educational Laboratory, Inc. located in Charleston, W.Va. This seems to be most opportune, since Lady Bird Johnson is at this very moment inspecting the educational environment in the Appalachian area.

This description is from Quality Education for Appalachia, published by the Laboratory:

"Rugged hills sweep suddenly skyward . . . tight, ribbon-like valleys lace in winding patterns along the rivers . . . small, isolated cities are visited by twisting stretches of narrow asphalt – this is Appalachia.

"Appalachia. A fairyland of contrasts and surprises. A land of modern cities and long-ago villages . . . of sleek new airports and one-room schools . . . of burgeoning promise and barren despair. A land isolated and imprisoned by the very geography which gives it character and makes it one of the most charming, captivating and capricious of America's last frontiers.

"The clocks of time have ticked slowly in Appalachia for many years. Change has been tardy in its arrival, and the sweeping pace of the rest of the nation has been slowed to a walk by the rugged and relentless walls of hills which lace its terrain."

Too many miles of unpaved roads, tarpaper shacks and one-room schools. Unemployment averages 50% above the national rate. Annual income: One out of three families with $3000 annually, or less, compared to one out of five nationally. Only 8.7% have annual incomes of $10,000 or more, compared to 15.6% in balance of the U.S.

Population increase, 1950 to 1960, less than one percent, compared to over 20% for balance of U.S. A dearth of human resources; many youth have left "seeking their fortunes". Only 5 per 100 adults over 25 are college graduates, compared to 8 per 100 nationally.

Now there is hope; there are educational innovations; several specific programs have been developed, aimed at:

(1) reducing the negative effects of cultural deprivation;
(2) assisting in the modernization of the school curriculum;
(3) combatting regional isolation;
(4) improving the transition from school to work;
(5) raising the general level of educational aspirations and expectations; and
(6) speeding the adoption of sound educational change.

Thirty teachers will be selected for expense-paid participation in each institute, one at West Virginia Institute of Technology, the other at East Tennessee State University. To be eligible, each teacher must come from a school where 70% of the students come from communities of 2500 or less.

The four major objectives of the institute are:

(1) to define essential occupational information;

(2) demonstrate techniques for incorporating occupational information into the course content of industrial arts;

(3) test the effectiveness of a summer workshop as a medium of increasing IA teachers' knowledge of occupational information; and

(4) test the effectiveness on students of a curriculum modified with essential occupational information.

Participants will be involved in a variety of learning activities: Specialists or consultants will speak about, and the teachers will be involved in:

- the purposes, trends and needed changes in industrial arts;
- procedures in locating, reviewing and evaluating various occupational materials;
- procedures in working guidance personnel, assessing pupil records, aptitudes and abilities;
- guidance techniques, individual and group, with specialist;
- micro-teaching demonstrations (participants involved in two or more of these);
- US Department of Labor activities (by a representative);
- job analysis, by a job analyst from industry;
- numerous industrial field trips, coordinated with the objective, discussion and activity in each instance;
- curriculum revision, course outline development, audio-visual preparation;
- industrial psychology (specialist);
- vocational-technical school (field trip);

- AV communication workshop, materials production; and
- teaching team approach.

Teacher educators may have dreamed about providing such experiences, and teachers may have desired them. Now with Federal funds and the drive of the AEL, Inc., such innovation can become a reality. This is promotion of our cultural heritage. Thus, our cultural heritage is in transition.

The logic of approach is the apparent soundness of occupational knowledge as a motivational factor. As the 17-year-old youngster said in effect about the Richmond Plan: "This is the best yet, because I can see where I'm going. This makes learning more meaningful. It's much better than the industrial arts woods and metal shop classes that I took before."

It is the hope of the laboratory, and our hope, that this effort to help youngsters identify with people and jobs will make industrial arts course work more meaningful. We hope also that participating teachers will be stimulated to upgrade and update their programs. This is imperative if the cultural heritage of the sixties is to replace the cultural heritage of the thirties in Appalachia.

Dr. Buxton is chairman of the Department of Industrial Education at East Tennessee State University, Johnson City, Tenn.

F-13.12 Special Interest - B. Evaluative Symposium

CONTENT FOR TEACHING INDUSTRIAL ARTS IN TRANSITION

Chm., James D. Dixon; Rec., Claudius W. Wilken; Panelists, John J. Mikush, William M. Bateson, Robert D. Ryan; Hosts, Bo Reed, W. Earl Watson. Mr. Bateson's and Dr. Ryan's manuscripts not provided.

WHAT SHOULD INDUSTRIAL ARTS OFFER IN THE YEARS AHEAD?

John J. Mikush

Education can be an eye-closer as well as an eye-opener. It can make a person over-emphasize the known, over-value his knowledge and scorn the ideas of less-well-trained men. It can build a sense of security where there is no security. In order to prevent this, we should make sure we are giving our students a good general education.

A great many men become obsolete within their working lives because they have graduated into a special field. They forget the basic things because they no longer use them every day, and they fail to learn new things because they haven't the time or compulsion to do so. Those who possess only a theoretical knowledge of their field face many difficulties not present for men with similar education, who have had manipulative and creative mechanical experiences.

With the increasing demands for students of technical professions to have a more liberal education, courses in the industrial arts on both the high school and collegiate levels have become fewer.

This deficiency presents a serious problem for the individual, the profession and our society in general.

Too often school counselors, parents, students and administrators are not aware of the importance that industrial arts programs offer in providing an opportunity to apply the mathematics, science, etc., which students have learned.

They do not realize the importance of the relationship that should exist between science, mathematics and industrial arts.

As a result, most academic students have had little opportunity to learn the skills necessary for planning and constructing the experimental devices they conceive. The use of industrial arts facilities and teachers for science projects can contribute a greater understanding of the actual part science plays in industry.

While some colleges still recommend that engineers, scientists and doctors select drafting and metal working while in high school, the great majc.ity do not. Often this is because of the many requirements needed to gain admission into college, which leave little or no time for electives—even on the high school level.

We should then strive for courses in industrial arts which will give and encourage both skills and a basic understanding of what is involved in our various subjects.

For example—what type of program should be offered for industrial arts metal shops?

A program should be developed whereby the students will be able to utilize fully all of the available shop facilities in order to attain the following objectives:

1. Knowledge of all types of machining operations in the metal working field;
2. Knowledge of related industrial processes;
3. Knowledge of mechanisms;
4. Knowledge of motion force and energy;
5. Knowledge of basic metallurgy;
6. Knowledge of applied mathematics;
7. Knowledge of good design; and
8. Knowledge of how to write research reports.

The type of project should provide opportunities for problem-solving and should involve both scientific principles and industrial arts fabrication.

Typical problem:

1. Prepare a drawing.
2. Prepare a bill of materials.
3. List a procedure.
4. List a few scientific implications.
5. Present a short paper on related technical information.
6. Give a list of references.
7. Evaluate problem and project.

All attempts to improve and modify industrial arts will demand study, time and money. Any program offered must carry weight with both the college admissions and the employers of our nation, and it should meet their needs. Along this idea, we must then design and gear our programs to develop into paying jobs for students and also be meaningful to the students who select the courses.

As for cost, we must count on Federal aid to stand the greatest burden.

In closing, I would like to list 23 problems, issues and needs which I believe trouble industrial arts today.

1. More opportunity to observe industrial practices.
2. Closer and more active liaison with teacher training institutions.
3. Establishment of understanding collegiate endeavors and new developments in industrial arts.
4. Standardization of course requirements for degrees in industrial arts in our state colleges.
5. Broader development of skills and knowledge of the basic industrial arts areas for undergraduates.
6. Opportunity for teachers to attend national conventions.
7. A critical look at class size.
8. More money for our shops to keep up with new equipment and tools.
9. Promotion of publicity - within the school.
10. Promotion of publicity - within the community.
11. Need for higher standards in most of our industrial arts programs.
12. Development of course material which will challenge the better student.
13. Development of courses geared to technology.
14. Allowing the industrial arts teachers to take a more active part in selection of students.
15. A need for student exhibits with better awards offered as incentive.
16. Better use, through co-operation with industry, of community resources.
17. Expansion of our courses to meet the needs of the college-bound students.
18. Ending the use of shops as "dumping grounds."
19. Work with engineering colleges in phases of drafting and metalworking.
20. Setting up courses with colleges so that engineering students and industrial arts students and others who would find it beneficial would receive college credits for these courses.
21. Setting up different levels of shopwork: some having homework - some meeting two periods a day, and others only by the semester.
22. Provision of services and facilities by the state department to assure better

quality programs.

23. Development of a state-wide program, whereby teachers may receive college credit by working in the trades during the summer.

Mr. Mikush teaches at Bridgewater-Raritan High School, West Raritan, N.J.

F-13.13 College Students
Evaluative Symposium
THE COLLEGE STUDENT PROGRAM—THE RETROSPECT TO FUTURE
Gen. Chm., Rex Miller; Chm., L. H. Bengtson; Rec., Gordon Taylor; Panelists, Lee LaBute, Herbert Siegel, Barry E. McNew. No manuscripts provided.

F-13.14 Student Clubs
Evaluative Symposium
WHAT HAVE WE ACCOMPLISHED—WHAT IS OUR FUTURE?
Gen. Chm., W. A. Mayfield; Chm., John D. Jenkins; Rec., Elmer S. Ciancone; Panelists, J. B. Morgan, James L. Boone, Jr.; Heath Galster; Obsr., Nancy Bergau. Miss Galster's manuscript not provided.

WHAT WE HAVE ACCOMPLISHED—WHAT IS OUR FUTURE?

J. B. Morgan

Before we attempt to answer these questions, let us review the need for student clubs. Today many students are encouraging their teachers to organize industrial arts clubs. In response to these demands, teachers are developing a genuine interest in setting up student clubs on a local basis. Some states have had great success in organizing student clubs, but the majority have been unsuccessful. The AIAA has made excellent advances in providing leadership and in developing the materials and instructions necessary for organizing student clubs on the local and national level.

I. Why do we need students' clubs?

1. So students can establish their own identity.
2. To help up-grade departments.
3. To perform services for the school and community.
4. To assist in creating a positive image for industrial arts in the school, community and nation.
5. To assist in bringing students together across the nation.
6. For better communications.
7. To promote professionalism.
8. To assist students in selecting a vocation.
9. To help in meeting the objectives of our program.
10. To develop worthy, useful citizens for our community, state and nation.

II. What we have accomplished.

1. The Executive Committee of the AIAA has set aside funds for the development and promotion of student clubs.
2. The national office has prepared a packet of materials to assist teachers in establishing student clubs.
3. The packet contains a handbook which explains in detail how you can set up student clubs.
4. Currently we have 85 student clubs affiliated with the AIAA, with a student enrollment of 1,715, and many more who are not registered with the national office at this time.

III. How can we implement these needs?

1. Teachers can request from AIAA National Office the handbook for student clubs.

2. Teacher educators must do a better job in preparing young teachers to accept the role of leadership.

3. The colleges must prepare professionally-minded teachers for the future.

4. Teachers of the future must possess personality traits necessary to stimulate young people.

5. Cooperation on the local, state and national levels is essential.

6. Teachers must provide school and community activities which are worthwhile experiences for club members.

7. Teachers should provide field trips and outside professional speakers for club meetings.

8. Selective membership may be desirable.

9. Teachers should give praise and recognition to the student when he deserves them.

Mr. Morgan is at South Colorado State College, Pueblo, Colo.

THE IMPACT OF INDUSTRIAL ARTS FAIRS ON STUDENT CLUBS

James L. Boone, Jr.

This panel is concerned with two aspects of the student industrial arts club movement: past accomplishments and future achievements. Looking back, we can be proud of the fact that local, state and national organizations are established and functioning. It is a great task to initiate organizations of this nature, because many demands are being made on the time of our students, and we are competing with other worthwhile activities. Nevertheless, industrial arts clubs have been organized and are operating, thanks to the untiring efforts of a rather small group of teachers. As we all know, some teachers do not support or sponsor student clubs. They ask, "What is the purpose of such organizations?" This question should be answered before we try to think about the future of industrial arts clubs. For the sake of brevity, this question will be answered by presenting—in statement form—the rationale for student clubs:

1. Student clubs teach democracy through parliamentary procedure.
2. Student clubs teach leadership by placing students in situations in which they must make decisions and act upon them.
3. Student clubs teach professionalism through association with other student and teacher organizations. Student participation in this convention is an excellent example.
4. Student clubs help students satisfy the human psychological need for belonging and acceptance by one's peers.
5. Student clubs satisfy the human need for recognition and praise.

There are many other benefits to be gained through student clubs, but the five aforementioned advantages are of sufficient importance to justify club activities, for they are benefits that cannot be realized solely through classroom or laboratory activities. Too, these are benefits that are desirable in the eyes of the school administration and of the parents. The teacher who can convince his school district that he is teaching his students democracy, professionalism and leadership need not worry about his own future. One of the large industrial cities of this nation still has a large number of vocational agriculture teachers on its high school faculties, although the soil around the students' schools and homes has long been displaced by concrete and asphalt. The agriculture teachers stress the teaching of leadership through FFA clubs, and they have state-level contests to prove it. School principals are reluctant to abandon a program that fills their display cases with trophies. If you do not believe in student clubs or contests, you should give this some thought.

Now let us look at industrial arts fairs and their impact on industrial arts students and clubs. To be successful, an organization must have goals and a steady procession of activities to motivate its members. In addition, these activities must be accented periodically by special occasions, and they should be highlighted by one or two outstanding events annually. The industrial arts fair is an excellent device to provide this type of motivation. A combination of local, regional and state fairs offers a series of events that challenge the students in their classroom and club activities. The state fair, which usually takes place in May, serves as a year-long goal toward which students can plan and work.

Industrial arts fairs provide students with an opportunity to be recognized for outstanding work that they have done in their classrooms and laboratories. The fairs provide recognition to teachers who are successful in imparting knowledge and skill to their students. Fairs stimulate a competitive spirit within students, which is perhaps the most essential element to success in later life.

All of us have witnessed the feeling of pride, accomplishment and unity that comes to a school and community when it has an award-winning athletic team, band or choir. The students who participated in such activities are proud of their part in bringing honor to their community, and they develop a strong sense of loyalty and responsibility. Industrial arts students should not be denied the opportunity for experiences such as these. Let us strengthen our programs through vigorous support of industrial arts student clubs and fairs. Our future depends upon it.

Mr. Boone teaches at Texas A & M College, College Station, Texas.

F-14.0 AIAA
Annual Business Meeting
AIAA Business Meeting and Awards Program
Presiding, Robert L. Woodward; Chm., Howard S. Decker; Reports, Pres. Report to Mmbrs, Robert L. Woodward; Minutes of 1966 Bus. Mtg., Howard S. Decker; Treas. Rep., Howard S. Decker; Outstanding Tchr. Awards, Sherwin D. Powell; D. L. Biemesderfer; Rec., Ralph Bohn; Hosts, Neill C. Slack, Benjamin Kneisley; Resolutions, Earl M. Weber.

1967 PRESIDENT'S REPORT

Robert L. Woodward

The prestige of the American Industrial Arts Association is at an all-time high. In fact, our Association is held in high esteem by all professional educational organizations affiliated with the National Education Association, and is highly respected by those branches of government and by those industries that are familiar with our Association's objectives, program and conduct. Our Association has attained its present position through the cooperative and diligent efforts of its members and their officers.

Over a six-year period, three years as president of the American Council of Industrial Arts Supervisors and one year each as vice president, president-elect, and president of the American Industrial Arts Association, I have had the privilege of serving with outstanding leaders—five presidents, members of six executive boards, three executive secretaries and one assistant executive secretary.

As you are aware, the first executive secretary was appointed by the executive board in 1953; prior to that year, the executive secretary was elected by the membership. At this time, our immediate past president, Earl M. Weber, is asked to honor our executive-board appointed, former executive secretaries and assistant executive secretary. (Citations for distinguished service were presented to Kenneth W. Brown, Executive Secretary, 1953-1961; Kenneth E. Dawson, Executive Secretary, 1961-1966; and Jack Simich, Assistant Executive Secretary, 1961-1966.)

The excellent relationship of our Association with other professional education organizations can best be shown by citing a few examples: (1) During the 1966 assembly of the World Confederation of Organizations of the Teaching Profession in Seoul, Korea, the American Industrial Arts Association was made an associate member. Our Association will be represented at this organization's international meeting in Vancouver, British Columbia, Canada, August 2-9, 1967. (2) In October of 1966, Ralph C. Bohn and Howard S. Decker, upon invitation, represented our Association at the annual meeting of the Association of Organizations for Teacher Education in Washington, DC. (3) Between the months of March and May, 1967, the American Association of Colleges for Teacher

Education has scheduled five regional meetings concerning the evaluative criteria study for the National Council for Accreditation of Teacher Education. Our Association has been invited to have ten members participate in the regional conferences, two persons for each of the five conferences. Invitations have been extended to ten members of our Association who are also members of ACIATE. And (4) later this year, our Association has been invited to have representation at the Consortium on Title XI of the National Defense Education Act.

Within the context of "professional relations", recognition also is given to a number of our Associations' committees: (1) Late in 1966, certain members of the AIAA Educational Testing Committee and Chairman Leonard W. Glismann represented our Association at a work session conducted by the Educational Testing Service in Princeton, N.J., to develop achievement tests for industrial arts. (2) During October, 1966, Denis J. Kigin, chairman of the AIAA Safety Committee, was delegate for our Association at the National Safety Congress held in Chicago. And members of this committee are involving educators and industrialists in the preparation of the manuscript on "Educating for Safety Via the Industrial Arts". (3) Our Association's student club program under the guidance of the AIAA Industrial Arts Club Committee and Chairman Rex Miller and assisted by Wilma Schlup of our national office is continually growing and strengthening the Association-teacher-student joint goals. (4) Each year, the orientation meetings and receptions planned and hosted by the AIAA International Relations Committee under the chairmanship of Donald E. Perry provide a friendly link between our Association and the visitors from foreign countries who attend our conventions. And (5) through the efforts of the AIAA Teacher Recognition Committee and Chairman Sherwin D. Powell, the outstanding industrial arts classroom teacher award program now ranks among the most significant state-national professional contributions of our Association.

Last year at our San Francisco convention, Earl M. Weber, in his President's Report, discussed the amendment, passed by Congress, which included industrial arts in Title XI of the National Defense Education Act. This "legislative breakthrough" provides for institutions of higher learning to obtain Federal funds to conduct institutes for advanced study in industrial arts.

Since our last national meeting, industrial arts has also been included in Title III of the National Defense Education Act, effective July 1, 1967. The inclusion of industrial arts in NDEA, Title III, makes it possible for school systems throughout the United States to obtain Federal funds for industrial arts, on a 50-50 matching basis, for the purchase of equipment and instructional materials and for minor remodeling of facilities.

Members of our Association and profession should take full advantage of this long-awaited opportunity and needed encouragement to improve our instructional programs and teaching skills in industrial arts education under the provisions of these NDEA titles.

Appreciation is extended to Senator Winston Prouty of Vermont, who introduced the Senate amendment (to the Higher Education Act of 1966) to include industrial arts in NDEA, Title III; to members of Congress, who passed the act; to President Lyndon B. Johnson, who signed the act; and to the many dedicated members of our Association who worked as a team to inform the members of Congress of the need for including industrial arts in NDEA. Appreciation also is extended to the AIAA Legislative Information Committee members and their chairman, John O. Conaway, and to Howard S. Decker and Ralph C. Bohn, who personally provided needed information to the members of Congress during the amendment's progress through Congress.

The membership of our Association has been kept fully informed about Federal legislation concerning industrial arts through letters from our national office, the Journal of Industrial Arts Education, and the publication Federal Aid for Industrial Arts. Shortly after Congress passed the act which contained the amendment to include industrial arts in NDEA, Title III, letters were sent to all members announcing this fact. The November-December, 1966, issue of the Journal covered the inclusion of industrial arts in NDEA, Title III, reported on the success of the five experimental industrial arts institutes held during the summer of 1966, and provided detailed information about the twenty-nine industrial arts institutes that will be held during the summer of 1967. Early in 1967, the AIAA packet service supplied the membership with most of the brochures giving details concerning the 1967 summer industrial arts institutes.

Our Association is the recipient of much favorable attention in the publications of educational and commercial organizations and agencies. A few examples are: (1) the significant increase in the number of promotional and news articles concerning our Association appearing in the publications of state associations and agencies; (2) the two-page article titled "What is the American Industrial Arts Association?" presented in the January, 1967, issue of the Rockwell Power Tool Instructor and distributed to 40,000 educators in the United States; (3) the article by Howard S. Decker featured in the January-February, 1967, edition of Safety published by the National Commission on Safety Education, NEA; (4) the picture on the cover of the February, 1967, issue of the million-circulation NEA Journal depicting an industrial arts activity; (5) the excellent coverage of our Association's activities and conventions by the Bruce Publishing Company in its IAVE magazine and by Prakken Publications, Inc., in its School Shop magazine; and (6) the outstanding work being done by A. P. Bornstein and the national office staff in producing our Association's magazine, the Journal of Industrial Arts Education.

Within the framework of "good public relations", acknowledgment also is given to certain of our Association's committees: (1) The manuscript "A Guide for Equipping Industrial Arts Facilities" has been completed by the AIAA Equipment Committee under the leadership of Sam R. Porter and now is being readied for publication by our national office staff. Committee members are commended for the excellent results of this three-year project. The information provided in this publication will be of invaluable assistance to all persons concerned with equipping industrial arts facilities as well as to those preparing industrial arts proposals under the National Defense Education Act, Title III. (2) The AIAA Publications Committee members and Chairman Neal W. Prichard provide an important, continuing service to our Association. They review and recommend material, such as the AIAA Equipment Committee manuscript, for publication. (3) Members of the AIAA Public and Professional Committee, with Alfred F. Newton as chairman, are furthering our public relations program through the dissemination of information about our Association. And (4) the AIAA Research Committee members under the relatively new leadership of William T. Sargent are reviewing research findings in industrial arts and selecting problem areas requiring research which will result in a better understanding of certain aspects of our discipline.

The prestige and continued growth of the American Industrial Arts Association depends upon the enthusiastic support of the membership, the accomplishments of our standing and special committees, the diligence of our Association's Executive Board, and the dedicated and efficient work of our executive secretary and the staff of our national office.

Appreciation is expressed to the members of the special nominating, elections, and resolutions committees. The work on the 1967 elections now is complete and the resolutions are ready for presentation to our Delegate Assembly.

Only one committee is yet to be covered, that is, the AIAA Membership Committee under the leadership of Harry Gunderson. Membership is the life-giving blood of any organization. During the past six months, through the concerted efforts of the AIAA Membership Committee, the regional and state representatives of this committee, and the work of our executive secretary and our national office staff, our Association's membership is the largest it has ever been.

Acknowledgment is made concerning the contributions to our Association by the American Council for Elementary School Industrial Arts, the American Council of Industrial Arts Supervisors, and the American Council on Industrial Arts Teacher Education and their respective presidents, Robert G. Thrower, T. Gardner Boyd, and Howard F. Nelson. Walter Wilson, our Canadian representative, is increasing the membership and furthering the work of our Association in Canada.

As the membership is aware, the Executive Board, at its meeting July 29-31, 1966, in Millersville, Pennsylvania, was faced with the task of selecting and appointing a new executive secretary-treasurer. Background information concerning all candidates nominated by the members of our Association was thoroughly reviewed, and selected candidates were interviewed by the Executive Board. After considerable discussion befitting this important decision, the members of the Executive Board unanimously agreed on one candidate. Letters were sent in August, 1966 to the total membership, informing them of the appointment of Howard S. Decker as our executive secretary-treasurer.

Our new executive secretary-treasurer and our completely new national office staff are meeting the responsibilities of our national office in a highly professional manner and with a remarkable degree of skill and efficiency. Praise is also given to George H. Ditlow, who, as convention director, has assumed many of the 1967 convention responsibilities, with the assistance of William T. Kelley and his Pennsylvania committee, and has worked with our executive secretary-treasurer in making arrangements for the Association's future conventions.

This report is a "success story". Our Association is held in high esteem. Our members, the largest number we have ever had, are working as a team. Industrial arts now is included in Titles III and XI of the National Defense Education Act. Our future is bright.

Dr. Woodward, president of AIAA, is consultant in industrial arts education, California State Department of Education, Sacramento, Calif.

TEACHER RECOGNITION AWARDS REPORT

Sherwin D. Powell

To: Executive Committee
From: Sherwin D. Powell, Chairman, Teacher Recognition Committee
Date: March 12, 1967

REPORT OF TEACHER RECOGNITION COMMITTEE

Members of Committee:
Sherwin D. Powell - Department Chairman of Industrial Arts
William J. Palmer High School
Colorado Springs, Colorado
Elmer J. Hemberger - Head of Industrial Arts Department
Downingtown Schools
Downingtown, Pennsylvania
William B. Landon - Department Chairman of Industrial Arts
Englewood High School
Englewood, Colorado
William J. Wilkinson - Director of Industrial Arts
Nether Providence High School
Wallingford, Pennsylvania

AIAA state representatives and State Teacher Recognition Committees were very active in making this committee a success.

Report:
The number of awards presented this year and during the past four years are:
1963 --- 21 awards
1964 --- 30 awards
1965 --- 30 awards
1966 --- 39 awards
1967 --- 44 awards.

Sixty states were contacted through both their State Representatives and Teacher Recognition Committee Chairmen.

Sixty states are: Puerto Rico, Guam, eight provinces of Canada and 50 states.

Forty-four states (3/17/67) are participating with AIAA this year in the Teacher Recognition Awards program.

Some of the states that are not participating have indicated a desire to participate next year. Those not participating are:

Unites States		Canada
Alabama	Louisiana	Alberta
Alaska	Nevada	British Columbia
Arkansas	New Mexico	Manitoba
Idaho	Washington	Northwest Territory
Kentucky	Wyoming	Nova Scotia
		Quebec
		Saskatchewan

Plaques were sent to three states for presentation before the Philadelphia convention. They were: Mississippi, South Carolina and Texas.

The Teacher Recognition Committee wishes to express its thanks to all state representatives who have worked to make this teacher recognition program a success. Many states appoint a Teacher Recognition Committee; these committees also deserve a vote of thanks. Without the support and necessary work being done at state levels, this program could not succeed.

The chairman and committee feel that this Teacher Recognition program is a continuing success. The program is a must for a public relations program. It is valuable to our public, but equally valuable for our own members.

The chairman of this committee wishes to thank the members who have performed the committee duties for this year (listed on first page of report).

RECOMMENDATIONS

This committee recommends that all State Representatives cooperate with state teacher recognition committees if they are in operation. If the state does not have such a committee, the State Representatives should appoint one with the cooperation of the state industrial arts association.

Forms for reporting the Teacher Recognition Committee chairman's name will be passed out to the State Representatives during this convention.

Outstanding Industrial Arts Teacher Awards were presented to: John Vetnar, Arizona Industrial Education Association; Carlington H. Kuglin, California Industrial Education Association; James J. Devlin, Ontario Industrial Arts Association; Jess F. Schmitt, Colorado Industrial Arts Association; Russell H. Anderson, Connecticut Industrial Arts Association; Robert V. Benson, Delaware Industrial Arts Association; William Coleman, District of Columbia Industrial Arts Teachers Association; Leslie A. Moore, Florida Industrial Arts Association; Thomas Gower Latimer, Georgia Industrial Arts Association; Bert D. Thompson, Guam Industrial Education Association; Charles N. Iseri, Hawaii Industrial Arts Association; George Edward Stephenson, Illinois Industrial Arts Round Tables; Joseph M. Mrak, Indiana Industrial Education Association; Robert M. George, Iowa Industrial Education Association; John C. Powell, Kansas Industrial Education Association; Gordon A. Parritt, Maine Industrial Arts Association; James Goodwin, Maryland Industrial Arts Association; Herbert B. Downs, Massachusetts Industrial Arts Association; John Dyksterhouse, Michigan Industrial Education Society; Theodore Welander, Minnesota Industrial Arts Association; James C. Drown, Jr., Mississippi Industrial Arts Association; Donald L. Lax, Missouri Industrial Arts Association; Philip A. Matross, Montana Industrial Arts Association; Raymond A. Headberg, Nebraska Industrial Arts Association; Elton E. Beard, New Hampshire Industrial Education Association; Earnest B. Mayo, New Jersey Industrial Arts Association; Richard S. Enders, New York State Industrial Arts Association; William S. Scarborough, North Carolina Industrial Arts Association; Thomas J. Klinkhammer, North Dakota Industrial Arts Association; Otto P. Furpahs, Ohio Industrial Arts Association; Myrl S. Kirk, Oklahoma Industrial Arts Association; James L. Grossnicklaus, Oregon Industrial Arts Association; Joseph L. Kennedy, Pennsylvania Industrial Arts Association; Victor J. Monge, Puerto Rico Industrial Arts Association; Edmond Medieros, Rhode Island Vocational and Industrial Arts Association; Douglas D. Blackman, South Carolina Industrial Arts Association; Eugene A. Otto, South Dakota Industrial Arts Association; John R. Ralston, Jr., Tennessee Industrial Arts Association; Thomas M. Oliver, Texas Industrial Arts Association; Andrew C. Baggs, Utah Industrial Arts Association; Richard J. Collins, Vermont Industrial Arts Association; Roland J. Walton, Virginia Industrial Arts Association; Clifford F. Garner, West Virginia Industrial Arts Association; Harry B. Olstad, Wisconsin Industrial Arts Association.

Mr. Powell is chairman of the Department of Industrial Arts, William J. Palmer High School, Colorado Springs, Colo.

AIAA OUTSTANDING TEACHER AWARDS

D. L. Biemesderfer

This item in the 1967 convention program of the American Industrial Arts Association is designed to recognize and to honor superior performance in the industrial arts shop and classroom. What makes this piece of business unique and significant is the fact that these men who appear before us have been chosen by their own peers as distinguished teachers. No higher commendation can be accorded a man and his work than the voluntarily-bestowed acclaim of his associates in the ranks. We join in warm congratulations to you on the distinction which is yours today.

Moreover, the Association merits high approval for officially recognizing quality professional achievement. It is refreshing to find a professional association, particularly one involving teachers, giving high priority to the competence and dedication of those of its members who choose to excel in meeting the responsibilities of practitioners to youth and to society. For this convention to end on the high note of public appreciation for truly great teaching is infinitely more to be desired than to invoke a benediction of carping criticism of salary schedules and bitter wrangling over fringe benefits.

"Distinguished Teacher" – I would know of no more soul-satisfying title than this. To be numbered in this select company is to be included among those to whom the world is eternally indebted, as the agents by whom the ancient landmarks of our culture are preserved, and by whom new trails are blazed for the inquiring minds of young. In a very special sense, teachers are the custodians of America's heritage and, at the same time, are the engineers of a new and spine-tingling future. In the face of the critical responsibilities which have always attached to the teacher's office, it should be not only a matter of great personal satisfaction to you to be lifted above the run-of-the-mill of teacher performance, but also a somewhat awesome challenge to fulfill the role of professional leadership which has been accorded you.

It would be appropriate on this occasion, when we are paying merited honor to excellence in the teaching function, to express the hope that teaching will always remain your primary concern—the consuming interest of your professional endeavor. In the realm of the teaching of the industrial arts, this generation and our hopes for the future can ill afford to lose from the shop and the classroom the creative spirit and the stimulating zeal you have already demonstrated. The allure of administrative position and salary, status in the managerial hierarchy, the flesh pots of industry are all too frequently successful in enticing from the classroom our most able teachers. Within the school system itself, there is the disposition to transfer from classroom to administrative post the outstanding and therefore the irreplacable teacher. It is this fact of academic life which prompted Dr. Logan Wilson, president of the American Council on Education, to state, "The faculty itself regards relief from teaching as the chief reward for accomplishment." The classroom teacher's assignment must be made as attractive, in every respect, as any other post in the school system if we are to avoid de-vitalization of the matrix of learning—the classroom.

To you, the outstanding teachers of industrial arts for the year 1967, our sincere congratulations and our best wishes for continued personal satisfaction in the thrilling adventure of teaching and learning.

Dr. Biemesderfer is president emeritus of Millersville State College, Millersville, Pa.

ANNUAL BUSINESS MEETING REPORT

The meeting was called to order at 2:45 p.m. Dr. Robert Woodward, president, presented the annual report to the membership. During the report, Dr. Earl M. Weber, past president, presented three awards for outstanding leadership to: (1) Dr. Kenneth Brown, (2) Dr. Kenneth Dawson and (3) Dr. Jack Simich. Dr. Roland Williams accepted the presentation for Dr. Kenneth Dawson, who could not be present.

Dr. Woodward introduced the officers who will hold office starting July 1, 1967: Dr. Ralph C. Bohn, president; Dr. Delmar W. Olson, president-elect; Sherwin D. Powell, vice-president for teachers.

Dr. Howard S. Decker, executive secretary, introduced Dr. G. Wesley Ketchum as parliamentarian. Dr. Decker read the minutes of last year's meeting; minutes were approved as read.

Dr. Decker presented the treasurer's report, which was approved as read, motion made by Edgar Hare and seconded by Robert Fricker.

Dr. Decker reported on membership: 10,312 in all classes, the highest membership on record. He also reported that 1400 libraries subscribe to the Journal, for a total circulation of 11,712.

Dr. Decker reported on attendance at the convention: 3136 registered, the highest number on record. The number of exhibitors was also the highest on record.

Dr. Weber read the report of the resolutions committee. Each resolution was read and Dr. Weber moved for adoption; each motion was seconded by an official delegate and was voted upon. Each resolution was passed.

Dr. Decker reported that the banquet had been sold out, and attendance would be between 790 and 800.

Additional new business was considered. Motion was made by Miss Laura Lewis, and seconded by Kenneth Shank, that "the General Assembly adopt the action of the Membership Committee and State Representatives to double the regular and life membership of the association by 1970." Motion was passed.

The business meeting was adjourned at 3:45 p.m.

The award phase of the program was conducted by Sherwin D. Powell. The Outstanding Teacher Awards were presented to teachers selected by individual state associations, following a presentation by Dr. D. L. Biemesderfer on "Outstanding Teacher Awards". Awards were presented by Dr. Woodward, who was assisted by Dr. Bohn, Dr. Biemesderfer, Mr. Powell, Mr. Wilkinson and Miss Jacqueline Killam.

The awards meeting was adjourned at 4:25 p.m.

Respectfully submitted,
Ralph C. Bohn
President-elect
AIAA

RESOLUTIONS

1. Appreciation to the President

WHEREAS Dr. Robert L. Woodward has given unstintingly of his time and has provided capable and intelligent leadership as president of the American Industrial Arts Association, and

WHEREAS the American Industrial Arts Association has made notable progress under his direction,

THEREFORE BE IT RESOLVED, that the officers, the Executive Board, and the members of the American Industrial Arts Association express sincere appreciation for his outstanding service as president of the association during the year 1966-1967.

2. Appreciation to the Program Participants

WHEREAS many members of the American Industrial Arts Association have given many hours of faithful service in making the effective plans and excellent preparations for the twenty-ninth annual convention in Philadelphia, Pennsylvania, and

WHEREAS innumerable responsibilities were willingly accepted and capably completed by many persons working in the vicinity of Philadelphia, and

WHEREAS a cordial environment, cooperative spirit, and friendly atmosphere characterized the convention,

THEREFORE BE IT RESOLVED that sincere appreciation be expressed to Dr. George Ditlow, program chairman; Dr. William Kelly, general chairman, and to all of the industrial arts students, teachers, supervisors, and teacher educators whose generous contribution of time and effort insured the success of this convention.

3. Appreciation to the SHIP

WHEREAS the continued support and assistance of the SHIP is a significant factor in the conduct of the annual convention of the American Industrial Arts Association, and

WHEREAS the commercial exhibits do contribute in large measure to the spirit and substance of the convention,

THEREFORE BE IT RESOLVED that the members of the American Industrial Arts Association express their sincere appreciation to Gene Bellezzo, president of the National Educational Exhibitors Association, and to Deck Officer William E. MacLachlan and his crew, and to all the commercial exhibitors for their participation in the 1967 convention.

4. Commendations for Teacher Recognition Program

WHEREAS the American Industrial Arts Association is pledged to encourage and recognize excellence in teaching, and

WHEREAS the program for the recognition of outstanding teachers has come to be one of the highlights of the convention program,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express their appreciation and commendation to Vice President Sherwin D. Powell and his committee for the excellent conduct and continued promotion of this program.

BE IT FURTHER RESOLVED that expressions of appreciation and commendation be forwarded to the officers and members of the state associations who have participated in this program.

BE IT FURTHER RESOLVED that the officers and members of the American Industrial Arts Association express sincere gratitude to the SHIP organization for its continued financial support of this program to recognize outstanding classroom teachers.

5. WHEREAS the American Industrial Arts Association has experienced significant growth both in the size of its membership and the scope of its program, and

WHEREAS the services to the membership and to the profession have vastly increased in quantity and quality, and

WHEREAS this professional growth and maturity is in large measure due to the dedicated efforts of those who have so faithfully served as representatives of the Association in the national office,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express their sincere appreciation and gratitude to Dr. Kenneth W. Brown who served as executive secretary-treasurer from 1953 to 1961, Dr. Kenneth F. Dawson who served as executive secretary-treasurer from 1961 to 1966, and Jack Simich who served as assistant executive secretary from 1961 to 1966 for their generous contribution of time and effective efforts on behalf of the Association.

6. Appreciation to Executive Secretary

WHEREAS the effective functioning of the national office is a vital factor in the promotion and improvement of industrial arts education, and

WHEREAS the coordination and administration of all phases of the program and services of the American Industrial Arts Association are the responsibility of the executive secretary and his staff,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express their sincere appreciation to Dr. Howard S. Decker for the very capable and efficient manner in which he has assumed the duties of executive secretary-treasurer of the American Industrial Arts Association.

7. Industrial Arts in NDEA

WHEREAS industrial arts was included in federal education legislation by provision of an amendment to Title III of the National Defense Education Act, and

WHEREAS funds provided for securing needed equipment and materials for industrial arts classrooms and laboratories and for in-service training of teachers and specialized supervisors will assist in the improvement of instruction in industrial arts and better the education of the youth of America,

THEREFORE BE IT RESOLVED that the American Industrial Arts Association officially express its appreciation to President Lyndon B. Johnson, Senator Winston Prouty, and to the Congress of the United States for their support of industrial arts as a vital part of education.

8. NDEA - Title III

WHEREAS Title III of the National Defense Education Act has provided broad federal assistance to the majority of elementary and secondary school students, and

WHEREAS the ability to purchase needed equipment permits creative curriculum planning and the improvement of instruction, and

WHEREAS effective supervision and administration leads to improved instruction and implementation of imaginative curriculum planning,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association request that the Congress of the United States appropriate the full authorization of $110,000,000 for NDEA Title III (a) and $10,000,000 for NDEA Title III (b) for school year 1967 1968 (Fy 1968).

9. NDEA - Appropriation

WHEREAS the National Defense Education Act has been highly successful in providing improved instruction in the elementary and secondary schools of our nation, and

WHEREAS this improved instruction has been achieved through the in-service education of teachers, specialized supervision, curriculum development and the provision for equipment and instructional materials,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association encourage the Congress to extend this act for five years and to increase the appropriation to $175,000,000 in fiscal 1969.

BE IT FURTHER RESOLVED that the Congress be urged to retain the existing administrative procedures including an appropriation of $15,000,000 in NDEA Title III (b) for specialized supervision and administration.

10. Education Professions Act of 1967

WHEREAS the Education Professions Act of 1967 will bring order to the present diversity of educational legislation through flexible authority allowing the coordination, broadening, and strengthening of programs for the education of teachers and other personnel for all levels of education,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association support and encourage the passage of the Education Professions Act of 1967.

11. New Affiliates of the American Industrial Arts Association

WHEREAS, Association affiliates aid significantly in furthering the program of the American Industrial Arts Association and in carrying its program to the membership, and

WHEREAS, Association's petition for membership on a voluntary basis is an affirmation of interest and support for the program of the American Industrial Arts Association,

THEREFORE BE IT RESOLVED that affiliation membership be approved for the following associations, and their officers and members be commended for their actions in making this request:

Hawaii Industrial Arts Association
Maryland Industrial Arts Association
South Carolina Industrial Arts Education Association
South Dakota Industrial Education Association.

12. WHEREAS the success of the convention was insured through the wholehearted cooperation of the school district of Philadelphia, and

WHEREAS the school district provided valuable support in manpower, equipment and facilities,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express sincere gratitude to the Board of Public Education and and the Administrative Staff of the School District of Philadelphia.

13. WHEREAS the Governor of the Commonwealth of Pennsylvania has exhibited interest in and concern for Industrial Arts Education by proclaiming the week of March 13th to 17th as Industrial Arts Week in Pennsylvania,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express sincere gratitude to Governor Raymond P. Shafer for this proclamation.

14. WHEREAS the total program of the American Industrial Arts Association convention is enriched and strengthened by the activities designed for the ladies in attendance, and

WHEREAS this year's program for the ladies provided many interesting features,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express appreciation to Mrs. William T. Kelly and her committee for their program of Ladies' Hospitality.

15. WHEREAS the Mayor of the City of Philadelphia expressed his support of industrial arts education and demonstrated this support by a proclamation read at the third General Session of the 29th Annual Convention of the AIAA,

THEREFORE BE IT RESOLVED that the officers and members of the association express appreciation to Mayor James H. J. Tate for his proclamation.

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