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ABSTRACT

The document contains 75 representative addresses from the American Industrial Arts Association's 36th annual conference. The number of addresses by each group are: three general sessions addresses; six by the American Council of Elementary School Industrial Arts; one by the American Council of Industrial Arts Supervisors; fifteen by the American Council of Industrial Arts Teacher Educators; and four by the American Industrial Arts College Student Association. These concerned issues pertaining to teacher education, change, specific subject areas, competency-based learning, and the future. Additional presentations in special interest subject areas are: four in the area of career education; one in communications; six in curriculum; three in electronics; two in foreign programs; five in futurology; three in humanism, one in individualized instruction; three in interdisciplinary studies; two in manufacturing; one in metals; two in plastics; five in teacher education; four in teaching aids; two in transportation; and two in wood. Reports regarding business of the association coucludes the volume. A chronological index for the conference and a comprehensive index are included. (NH)

Industrial Arts and a Humane Technology for the Future

Representative Addresses and Proceedings of the American Industrial Arts Association's 36th Annual Conference at Seattle, Washington, 1974

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AIAA General Session Addresses

Education or Training: Alternative Futures for Teachers

Robert Theobald

I had been invited by the students at the University of Hawaii to examine the changes which were taking place in American society and found myself in the middle of a controversy about whether it was appropriate to have a university course on the subject of "hotel management" or whether such a course was unsuitable for an educational institution.

I found myself challenged to come up with a difference between education and training which would satisfy me. My definitions when I found them were as follows. "Education is the process of learning about a subject from inside so that one understands its articulation and can be fully involved in it, training is the process of learning a subject from outside so that one gains a set of skills which one can employ efficiently without understanding why they work."

As usual, there is something paradoxical about this definition. Training probably produces a higher level of skill, but the skills only remain valid so long as there are no changes in the subject which has been learned. Education produces a greater understanding, but there is less ability to produce tidy rules of thumb applying to each situation, for people know too much to be able to create clear-cut solutions to inherently complex problems.

There is also something surprising about this set of definitions. It proves impossible to decide whether some set of activities should be seen as training or educational except in relation to the priorities and aims of the person taking the subject. An engineer who studies foreign languages will do so in order to be a better engineer in most cases, he therefore needs to learn the languages as efficiently as possible through teaching machines, etc. His engineering knowledge, on the other hand, must be obtained from the inside so that he not only knows how to apply a set of rules but also learns to develop his understanding as the subject changes over time.

The person who intends to be a linguist needs to be educated about languages so that he can understand them from inside, however, he will probably want to be trained in driving and repairing automobiles. His understanding of languages permits him to be creative in this field, but he cannot be creative in the production of automobiles.

I do not believe that I have to stress the differences between this set of ideas and those we currently use. Within our present culture, we confine the use of the word "education" to the process of giving people intellectual and academic skills, while people are "trained" in manual and practical skills. Those who have manual and practical skills are seen as inherently inferior to those with intellectual and academic information.

As you will have guessed, I find present definitions unacceptable. I reject them not only because I do not agree that intellectual skills are more important than practical skills, but also because there is very little education in my sense of the term anywhere within the academic system. We are engaged, almost entirely, in the process of brainwashing people into the acceptance of obsolete information and insisting — by using positive and negative sanctions — that they at least give the appearance of accepting this knowledge. The heroic efforts made by certain people, groups, and institutions do not negate the validity of this general statement.

We should not be surprised at this situation — nor should we be angry. It has long been the function of education to play a highly "conservative" function in the society, to pass on information gained in the past to the young who do not yet possess it. And under almost all circumstances, such a model is neither inappropriate nor destructive. It just happens that we live in an extraordinary period of history, we are passing through one of the massive discontinuities between one style of life and another. Previous discontinuities took place as we moved from hunting and gathering to agriculture and from agriculture to industry.

Our situation is unique, for the past discontinuities have been spread over generations, while the present process of change is taking place in a very short period of time. The process of transformation from the industrial era to the communications era will be essentially complete by the end of this century or man will be in the process of destroying this small planet beyond hope of survival. Thus any education which repeats and replicates the patterns of the industrial era is now counterproductive.

What then are we to do? Our problem is acute, for as I was taught by Frank Tannenbaum, "We can only teach what we know." We must therefore ask what we know that we don't know we know. What experience do we have that we should be applying to our education and are not? What sets of beliefs and values have we ignored because of our drive toward growth during the industrial era? I would suggest that there are two other partial models of reality that we need to rescue from the oblivion into which they have been cast as we have concentrated on power over nature and over other men, the combination of these three models may provide the basic building blocks for an over-all synthesis.

First, we need to remember the Greek fear of hubris, the belief that if man believed too greatly in his own powers he would inevitably destroy himself. We have more modern warnings, too. Malthus in the nineteenth century tried to inform us that the rate of increase in population would sooner or later outstrip the rate of rise in production unless we acted to prevent the development of this situation. In the nineteen-seventies, the Club of Rome has shown that a continuation of present trends in population and production for even a relatively limited time into the future would be destructive of humanity and the planet.

Obviously, these results are not inevitable — we can avoid them by the exercise of intelligence. The point that needs to be made, however, is that up to the present time we have seen little need to think at all about the consequences of economic growth or the technological fix. We have assumed that man did indeed have the power to "dominate" the earth. (This is one of the most unfortunate mistranslations in the bible, man was meant to live with the earth, not to dominate it.)

Those who warn us of these dangers remind us that a long-continued concentration on economic growth would be destructive. we need to remember this. Unfortunately, however, their model gives us few clues as to what we should do next, it tells us what to avoid, but not what to seek. If we are to get an answer to this question — at least a partial answer — we must look at another basic tradition in human thought.

The belief that human happiness can be achieved by adding to human wants has been challenged throughout human history by a style of thinking which argues that happiness is achieved by reducing wants to the availability of resources. Given the new patterns of wants now developing and our apparent inability to satisfy them, there is a growing emphasis in many quarters on the need to rethink our drive toward consumption and material satisfaction.

There are few people today who would deny the need for some movement away from the consumption ethic. Fewer and fewer people believe that a long-continued growth process is feasible in this world. However, it also seems clear that the emphasis on reducing growth can easily be overdone in a world with 3-1/2 billion people and a population which is still rapidly increasing.

There can certainly be no salvation for this world if we resolve to throw away immediately and finally the results of technology. It is easy to argue that we have tried to dominate nature and that in doing so we have destroyed much of the land and other natural resources. But unless we are prepared to tolerate world-wide famines — and unless we believe that people would endure world-wide famines without revolt and massive world-wide destruction — we cannot now return to a simple world which does not rely on technology for its survival.

What then can we draw from these three basic partial models of reality which seem to have persisted through history: a drive to dominate the world, an emphasis on the dangers of domination, and a call for simplicity?

The first view suggests that some form of success is necessary for the survival of any organism, any individual, or any culture. While it may be true that economic growth is no longer a sufficient definition of success for the future, it would be disastrous if we should decide that we are doomed to fail in the future.

The second view reminds us, however, that any model of success will need to be changed precisely because of its success. It is precisely our past successes which require us to rethink what we should be doing at the present time, long-continued growth in a single direction is neither feasible nor desirable.

The third view reminds us that the criteria for success vary greatly between cultures and that there are no slick answers applicable to all circumstances. It reminds us that one of the greatest failures in the industrial era was its intolerance of diversity, whether in its people, its communities, or its patterns of organization.

Where then do we go from here? What routes can we take as we try to do something which has never previously been done — to move from one era to another without massive destruction? What are the patterns which are appropriate for the communications era we are entering, as opposed to the industrial era we are leaving?

I suspect at this point that it will be your tendency to argue that I am talking to the wrong audience, that your job is not to think about massive transitions but rather to teach people about certain ways of doing things. I suspect also, that in your heart of hearts, you agree with those who put down the industrial arts and vocational training as being inferior. I suspect you feel that the people with whom you work have little to offer in the task of promoting such a transition.

But let me suggest an alternative model to you. Is it possible that those who concentrate on symbols and see reality through a mist of statistics are our greatest danger at the present time? Is it possible that the social scientist has placed us in a box out of which we are presently unable to escape? Is it possible that those disciplines whose educational activities have the highest prestige are actually the most obsolete?

Let us take this analysis further. Is it possible that we are still accepting ideas about the change process which have been proved to be ineffective? Is it possible that those whom we still see as knowing most about what we should be doing are actually those who are trying to preserve obsolete structures rather than aiding in the attempt to change them? Above all, is it possible that you as a profession have a more direct responsibility for the change process than you would imagine?

Our present problems do not stem merely from a failure to introduce the right policy. Rather, they result from our inability to break out of a set of obsolete concepts about how the world is structured and ought to be structured. My experience convinces me that those who "ought" to be able to help society make the necessary changes are the people who are least likely to be able to do so, the responsibility therefore falls on those of us who are "less likely."

What can you do? If I answer this question, I have already destroyed the dynamic which might lead you to find out what you can do, for I have pretended that I have answers. I cannot give you answers, because I do not know what potentials your profession has nor the ways in which you can exert leverage on the over-all educational profession. I am sure, however, that so long as you keep your present inferiority complex about the role you play compared to "real" academics, you will achieve nothing of real importance.

I must necessarily suggest, given my model, that those students who enter the industrial arts should be educated in them and not trained in them. I must suggest that it is immoral to simply provide people with skills which we know, as a result of the pace of change, will become obsolete in a few years. It is surely your responsibility to teach people to understand the areas in which they are working so that they can keep up with changing reality if they are willing to make the effort to do so.

In effect, you need to teach people to learn. This task is one about which we still know relatively little, for we have concentrated on passing discrete pieces of information from one brain to another rather than on providing people with learning skills. In addition, you must convince people that they are not inferior because they are working in the industrial arts rather than in true "intellectual pursuits."

I cannot answer your questions, but I can help to create a framework in which it may be possible for you to ask new questions more effectively. Over the last years, and in particular over the last year, we have been trying to develop ways in which Americans can be given an opportunity to think about the future they want for their third century. Two programs may be of particular interest:

a) Classes of 76. The effort we shall make here is to challenge those in school and college at the present time to decide what sort of questions need to be raised today if we are going to develop relevant educational opportunities in America's third century. I should like to suggest that the type of education you represent needs to be part of the process within which the new questions are raised.

b) National Values Project. It is hoped that communities all over the country will discover the questions which are most critical if their communities are to develop satisfactorily in America's third century. Again, your skills could be important in this effort.

You will notice that I stress the discovery of new questions rather than the stating of new answers. While there are certainly times and places where it is important to know answers, I am convinced that our basic social problem today is that we are developing more and more sophisticated answers to less and less relevant questions. The Russian wheat deal is one prime example, we "knew" that the right question was how to get rid of our surplus wheat. Nobody ever managed to get policy-makers to consider whether there was any surplus of wheat in actual fact.

To conclude, I would ask you three questions. First, are you presently engaged in education or training as I have defined the terms? Second, should you be engaged in education or training? Third, if changes need to be made, how are you going to make them so that they not only help teachers and students but also the whole society as it tries to understand the coming of the communications era?

Once again, we face a paradox. The industrial era claimed to value good work well done, but its rewards went to those who performed bad work and had rip-off skills. The communications era, on the other hand, will have no scope for goofing off or cheating. There is increasing agreement among those studying the future that man's survival demands the development of levels of responsibility far higher than those we have ever achieved.

Our survival seems to demand that man become the missing link between ape and humanity. Such a transformation will require imagination and courage — two qualities which are presently in short supply. The basic challenge of today is not a lack of information but a lack of willingness to act upon what we know and thus create a more human world. How much are each of you willing to do?

Mr. Theobald is a British socio-economist and futurist, as well as editor of Futures Conditional, a new participatory trend letter designed to create a more human future.

Education and the Future State of the Union

Olaf Helmer

There is no major field of human endeavor in greater need of an orientation toward the future than education, for nowhere else is the lead time as great. Our students today will be living out a substantial part of their lives in the twenty-first century, and for their education to make sense, it should be based on some conception of what that world of the future will be like.

Of one thing we can be sure, it will be very different from the present world. It used to be the case not so long ago that societal changes from one generation to the next were not very noticeable, and it made sense to educate students to cope with the conditions of the time. Now we life in a world of "future shock," where not only do major changes come thick and fast, but even the pace of change is accelerating, so that the changes in our societal environment to be expected in the next generation may be as great as those we have experienced in the last two generations. In other words, the world of the year 2000 will be as different from the present as the present is different from the world of over fifty years ago, and the world fifty years hence will differ from the present at least as much as the present differs from a hundred years ago.

When we consider that probably 90% of all technological innovations ever made have occurred during the last hundred years and that at least as many more will occur during the lifetime of today's youngsters, we begin to get a glimpse of what lies ahead for them.

To mention just a few outstanding inventions of the last hundred years, consider the introduction of the telephone, the automobile, the airplane, the space rocket, radio, television, plastics, antibiotics, atomic and nuclear weapons, radiological cancer therapy, electronic computers, and the beginnings of genetic intervention based on an understanding of the genetic code. It is obvious that each of these innovations has had or will have a profound effect on the shape of our society.

Turning now to the future, what would be a comparable compendium of changes that are to be expected over the next fifty years, and how might they affect the future state of the Union?

Here we are entering the field of technological and societal forecasting, and in order to avoid engaging in merely wild speculation, it may be well to begin with some general, somewhat philosophical observations regarding the scientific exploration of the future.

Futures research, as a systematic endeavor, is of very recent origin. While people have always had a persistent curiosity about their destiny, it is only in the last few decades that the need as well as the potentialities of a serious research approach to the future have become fully appreciated. The roots of this futures movement go back to the Europe of the Fifties, where the first two men who may rightly be called 'futurists' were Bertrand de Jouvenel and Dennis Gabor. De Jouvenel is a well-known writer in the fields of economics and political science, and among his many future-oriented publications, his book on "The Art of Conjecture" is the most relevant. Gabor, who received the Nobel prize for his invention of holography, first examined the subject of the future in his book 'Inventing the Future,' which he followed more recently with a very thoughtful work called "The Mature Society."

Formal methods for analyzing the future are of quite recent vintage and have been, and are being, developed largely in this country. They are, on the whole, extensions of techniques that have evolved in the field of operations research, and they are known by such names as "the Delphi method," "the cross-impact technique," and "simulation gaming."

Concomitant with these nascent efforts at exploring the future, and perhaps to some extent stimulated by them, a noticeable change in attitude about the future has come about during the last decade or so. This change is manifesting itself in several ways: philosophically, in that there is a new understanding of what it means to talk about the future, pragmatically, in that there is a growing recognition that it is important to do something about the future, and methodologically, in that there are new and more effective ways of doing something about the future.

Let me expand a little on these three aspects of our thinking about the future.

By the change in philosophical attitude to which I referred, I mean that the exploration of the future is no longer equated with fortune-telling or with the contemplation of crystal balls. Instead there is a growing awareness that a great deal can be said about future trends in terms of probabilities, and moreover that, through proper planning, we can exert considerable influence over these probabilities. Thus fatalism has become a fatality. The future is no longer viewed as unique, unforeseeable, and inevitable, there are instead — it is realized — a multitude of possible futures, with associated probabilities that can be estimated and, to some extent, manipulated.

As for the new pragmatic attitude which is beginning to be noticeable in government and in industry as well as in the field of education, it is due — I think — primarily to the fact that not only are technology and our environment undergoing change, but the pace of change in our time is accelerating. No longer does it take generations for a new pattern of living conditions to evolve. We are going through several major adjustments in our lives, and the members of the next generation will have to adopt continual adaptation as a way of life. For such adaptation to occur without major psychological or economic disruption, it is becoming mandatory for us to strive to anticipate changes in our environment rather than to attempt to deal with them belatedly and inadequately after it has become obvious that they are upon us. The recognition of this need for anticipation has had visible effects, perhaps most notably in the form of legislation creating an Office of Technology Assessment under congressional auspices. By 'technology assessment' is meant the assessment, in advance, of the likely impact on society of technological innovations, for the purpose of averting undesirable (and often unanticipated) side effects of such new technologies or, at least, of alleviating their deleterious implications by suitable regulatory measures. The institutionalization of such precaution may well be viewed as the first concrete evidence that the message of the futures movement has been accepted at the highest governmental levels.

The third point I mentioned, our growing ability to do something about the future, I would like to discuss in a little more detail.

The reason for this new ability, which is beginning to assert itself and which — I am confident — will come to full fruition during this present decade, can be seen in two revolutionary developments that are currently unfolding.

One is what may be called the second computer revolution. It took just twenty years for the first computer revolution to be completed, from the mid-forties to the mid-sixties, during which time the computer grew up from being a bookkeeping device to becoming a highly versatile data processor and research tool. During that period, both the cost and the size of computer components have gone down by a factor of 100, while the calculating speed has gone up by a factor of 10,000.

While these trends are continuing and, together with long-distance time-sharing arrangements, are accounting during the present decade for a continued annual doubling of the amount of computing power in the United States, the second computer revolution is about to add a significantly new flavor to this national resource of ours. It will consist in the amalgamation of several trends which, in combination, will have a powerful impact on planning processes generally. They are (i) the relative automation of the computer, in the sense of doing away with many of the cumbersome aspects of computer programming and thereby facilitating direct communication between the individual researcher and the computing machine, (ii) the invention of numerous highly versatile display devices, coupled directly to the computer, that provide the planner with the flexibility to construct and continually revise images of his ideas as he develops them, and (iii) the construction of networks of computer terminals over which researchers can confer at a distance and cooperate in the solution of problems. These three trends, which are well under way, will constitute the beginning of a true symbiosis between man and machine, where in a very real sense man's intelligence will be enhanced through collaboration with a computing machine.

The other revolution in the making, that will add to our control over the future, is of a very different kind; it is more subtle and potentially even more influential. I am referring to the reorientation that is beginning to take place within the so-called soft sciences.

The traditional methods of the social sciences are proving inadequate to the task of dealing effectively with the ever-growing complexity of forecasting the consequences of alternative policies and thus furnishing useful planning aid to decision makers in the public and private sectors. There are increasing signs that this lack of effective policy orientation is beginning to be overcome. Rather than continue the futile attempt to emulate the physical sciences, researchers in the social-science area are realizing that the time has come to emulate physical technology instead. They are beginning to do this by transferring the methods of operations research from the area of physical technology to that of social technology.

The potential reward from this evolving reorientation of some of the effort in the social-science area toward social technology, employing operations-analytical techniques, is considerable; it may even equal or exceed in importance that of the achievements credited to the technologies arising out of the physical sciences.

Operations research was first brought into being through the exigencies of World War II; it has since continued to develop and become a widely accepted tool, not only in the management of military affairs, but throughout the operations of commerce and industry.

Among the principal operations-research techniques that have proven themselves in these areas and that show great promise of being transferable to social technology are the construction of mathematical models, the use of simulation procedures, and a systematic approach to the utilization of expert opinions. All of these techniques are greatly aided and continually refined through the availability of the computer, and the second computer revolution of which I spoke may well add another order of magnitude to their potency. In particular, automated access to central data banks, in conjunction with appropriate socioeconomic models, will provide the soft sciences with the same kind of massive data processing and interpreting capability that, in the physical sciences, created the breakthrough which led to the development of atomic fission.

Among the new pragmatic approaches taken by operations analysis is the systematic utilization of the intuitive judgment of experts. A method developed, and still being refined, for the purpose of obtaining a consensus of informed opinions has become known as the Delphi technique, which has by now been employed in thousands of instances all over the world. This technique generates a kind of anonymous debate among the participating experts, using a series of successive questionnaires, where, in each questionnaire after the first, the respondents receive feedback information about the outcome of the preceding round.

The Delphi approach derives its importance from the realization that projections into the future, on which both public and private policy decisions must rely, are largely based on the personal expectations of individuals rather than on predictions derived from well-established theory. Even when the subject lends itself to a formal mathematical description — as is the case for various aspects of the national economy, for example — the input assumptions and the range of applicability of such descriptions are subject to the intuitive intervention by an appropriate expert. In view of the absence of a proper theoretical foundation and the consequent inevitability of having, to some extent, to rely on intuitive judgment, we are faced with two options. We can either wait indefinitely in the hope of eventually having an adequate theory available that would enable us to deal with socioeconomic and political problems as confidently as we do with problems in physics and chemistry, or we can make the most of an admittedly unsatisfactory situation and try to obtain the relevant intuitive insights of experts and then use their judgments as systematically as possible.

Operations analysis, and with it futures analysis, is committed to the second of these approaches. That is, we go as far as we can by building a theoretical foundation on which to base projections into the future, but we do not reject the intuitive insight of experts, even if that insight has not yet been articulated in the form of a fully-reasoned theory of the phenomena in question. In thus relying, at least in part on the intuition of specialists, it becomes important to give these experts every support that may improve the accuracy of their judgment. Creating a conceptual framework in the form of even a partial model of the area under consideration often is of substantial help, particularly if several experts are involved, because it provides a common operating base and thus an effective aid to communication. The Delphi procedure, to which I referred briefly, serves to stimulate the thinking process since it requires the participating experts to respond to opposing positions taken by others in the group.

The Delphi procedure has, in particular, been used extensively to obtain from appropriately chosen experts systematic forecasts in the areas of technology and of societal changes. Before giving you some examples of the results of such surveys, let me point out a structural difference which frequently exists between technological and societal forecasts.

For most potential technological breakthroughs, if they are at all plausible, it is merely a question of when, not whether, they will occur. The influence we can exert on their attainment is usually merely in terms of the time at which they will come about, which can be hastened by increased expenditures on research and development or delayed by withholding such expenditures. The opening up of new sources of energy is a clear case in point. until recently, the paucity of funding, especially in nonnuclear energy research, had reduced the probability of an early breakthrough. now, with the present spurt in R&D funding, the expected breakthrough dates have advanced appreciably.

In the area of societal trends, by contrast, we rarely have this kind of inevitability, where the only form of intervention consists in varying the financial support of certain endeavors. Instead, we tend to find ourselves confronted with certain issues which can be resolved in a variety of ways, and societal forecasts depend on how we, as a society, will choose to deal with such issues. Examples of such issues are the questions of what to do about the deterioration of public morality, or about inflation, or about race relations. To make forecasts in any of these areas is much harder than in the area of technology, because a forecast here typically requires much more than the fixing of a date for the occurrence of a specific event. What is called for, rather, is the specification of a particular approach to resolving a given societal issue, to attach a date to its becoming effective, and to predict the consequences — both good and bad — of whatever measures are taken.

Thus there are two kinds of potential future developments: those which are either totally beyond our control or at best can be advanced or retarded through the control of expenditures, and those, on the other hand, which depend directly on how certain public issues will be resolved. The first kind, besides including most scientific and technological developments, also comprises such events as natural catastrophes, certain political events (such as the recent curtailment of Arabian oil exports), and changes in public attitudes (such as an increasing participation in novel life styles). The second kind of developments, over which we do have a considerable measure of control, includes, in particular, legislative actions and executive regulations, reflecting the government's deliberate interventions toward the resolution of existing issues.

I emphasize the distinction between these two categories of potential future occurrences because of their different significance to the educational planner. In the case of a development of the first category, that is, one essentially beyond our control, the planner's attitude will have to be on the whole a passive one, since all he can do is to get the best possible expert advice in order to estimate the probability of the occurrence of the event in question. In the case of an event of the second category, since it is known that the outcome will depend on deliberate intervention, it is more appropriate to assume a more active, participatory attitude. The question here breaks down into subquestions:

what is motivating the decision makers — what decision should they make? how can their decision be influenced — and what will be the implications of their decision?

The distinction which I have tried to make between two categories of future events, of course, is not clear-cut, and there are many shadings between the extremes of no control and full control. Moreover, the question of controllability is relative to the viewpoint of the person posing the question. What is beyond the control of the private sector may well be under the public sector's control, and what is not under the control of the public sector of the United States may be subject to the manipulation of foreign powers.

Yet, in turning now to some specific forecasts on the future state of the Union, I shall observe this categorization, with the understanding that it is meant to be neither binary nor absolute.

I begin with a listing of important events which are not directly controllable but at best are subject to indirect intervention and which, in the opinions of experts, have a high probability of occurring before the end of the century:

In bio-medicine, the control of most bacterial and viral diseases will be achieved, and the death rate from cancer will be substantially reduced. A baby's sex will be easily preselectable, and human cloning will become possible (i.e., the replacement of the nucleus of an ovum by a somatic cell, with subsequent development in a host mother of an identical twin of the supplier of the somatic cell).

In the environmental area, great strides will have been taken toward the depollution and eutrophication of inland lakes (such as Lake Erie), and expenditures generally toward protecting and restoring the environment will rise by an order of magnitude.

The computer and communications revolution will exert an even greater influence on our society than the industrial revolution has. There may well be computing machines having an IQ of 150 or more. Computerized television terminals will be in most of our homes, and many people will be carrying portable telephones. Automated highways will be in existence, and many activities which now require travelling to an office or workshop will be capable of being carried out via electronic communication at home. Three-dimensional television is likely to have been perfected by the year 2000.

The world food situation, which may have worsened considerably during the 1980s, may be eased before the turn of the century by the production of artificial protein.

A permanent manned Moon base is likely to be in existence.

In the social area, a guaranteed minimum income as well as cradle-to-grave medical care are likely to be provided by law. The work week may be reduced to about 32 hours. The percentage of the labor force consisting of women will rise from the present 38% to about 46%. The population growth rate will continue to drop, resulting in an almost stable population by 2000.

Attitudinal trends will continue to change, in particular, racial tension will diminish, unconventional family forms and life styles will be experimented with by an increasing number of Americans, consumerism and citizens' lobbies will flourish, and greater responsibility of corporations with regard to their products and their societal obligations will be insisted upon.

These, then, are some of the changes that are likely to occur during the next twenty-five years. Looking beyond that period, to the first quarter of the next century, we may anticipate that many of these developments will continue or come to full fruition:

Automation will profoundly affect every aspect of our lives. Most diseases will be eradicated, genetic intervention will become common practice, and mass manufacture of artificial food is likely to be possible.

The temporary energy shortage during the latter part of the 20th century will probably be replaced by an abundance of cheap electric energy derived from thermonuclear or solar energy sources. This availability of abundant energy will lead to the exploitability of low-grade ores that was not previously economically feasible.

There also is a possibility that the alchemists' dream of the transmutation of elements into one another will become a reality, in which case the threat of material shortages may be forever banished.

Great strides will be taken in space exploration, and a whole new orbital industry is likely to emerge.

This much for a brief selection of likely developments, none of which are highly controllable. Next I would like to turn to what I called developments of the second kind. Here we are concerned with major public issues, whose societal implications will depend very much on the manner in which we, collectively or through governmental action, decide to resolve them. I shall identify ten such issues, and in each case briefly indicate two diametrically opposed policies for resolving them. The choice in each case, I believe, will make a decisive difference to the future of our society, and an educator concerned about the future of his students should be conscious of the fact that the implications of most of these issues will impinge on the societal environment in which the graduates from his educational endeavor will have to function.

The issues I have selected are the following:

Issue #1 Full-employment economy vs. leisure economy. Productivity in this country may eventually reach such a point that considerably less than a 40-hour work week will suffice, at least in theory, to support a reasonably high living standard for all Americans, especially if we manage to stay out of any further wars and resolve the energy problem. Thus, increasing amounts of time could be freed for so-called leisure activities. On the other hand, there are many alternative pursuits that could keep us well occupied at present levels of working hours per week if we choose to engage in them. Foremost among them are: the eradication of poverty in America, to the point where all families are brought up to at least the present-day level of middle-class comfort; the exploration of the solar system, and the development of the so-called "third world" to the point where hunger, poverty, and large-scale disease are eventually eliminated. The choice between these alternatives — leisure vs. full employment — is ours; they may be the most important options affecting the future state of our society.

Even in a relatively full-employment economy (at present standards), not to mention a more leisure-oriented economy, our options may not include the simultaneous full-scale pursuit of the three major areas I just enumerated (domestic-poverty eradication, space exploration, development of the underdeveloped nations), so that choices between these alternatives may still have to be made. Hence we have:

Issue #2: Space exploration vs. social needs. This is an issue both of the past and of the future. A few years ago, there was a rising clamor, particularly among the younger and the disadvantaged segments of our population, to shift public spending from space exploration to our urgent social needs. While large-scale support of the space effort has indeed ceased, this is not because social programs have been allowed to draw sizable resources away from it, but largely because many economists advocated a slowing-down of our economy (with results, incidentally, which were a far cry from the ostensible objective of halting the inflation). One of the reasons, admittedly, for not funneling more sizable funds into social programs is that there still is an inadequate grasp of just how the social ills of this nation can be effectively cured. Once our understanding of the required social technology has sufficiently improved, and once we are off the present drive toward economizing at all cost, the same issue will arise again, and our choice as a nation will be whether we wish to resume large-scale ventures in space exploration or whether we want to make an all-out, constructive effort toward social reform — or whether we can afford to pursue these two efforts forcefully in parallel.

Issue #3: International cooperation vs. isolationism. As in the previous case, resource constraints as well as a desire for more leisure time may force a stipulation of priorities between domestic and foreign pursuits. Some strengthening of international institutions may be mandatory for reasons of self-protection, in particular, cooperative measures to halt further pollution of the oceans and of the atmosphere will be indispensable for survival. A decision, if any, in favor of more extensive foreign aid directed toward the development of the so-called third world might be implemented in many ways, ranging from a unilateral increase in financial and technological support for developing nations to a joint approach to these problems. Such a joint approach might be taken either in collaboration with other advanced nations, such as the Soviet Union, or through the equivalent of an international income tax levied and distributed by the United Nations.

Another choice in the domain of international relations that may for the first time in history be within our reach is the following:

Issue #4. War as an instrument of foreign policy vs. the obsolescence of war. We live in an era of transition, in which fewer and fewer nations still consider going to war as a deliberate instrument of foreign policy, while others — including the United States — have not yet learned to avoid being inadvertently drawn into military conflict, either through unintended escalation of military support designed to be preventive of war or by the occurrence of an accidental or preemptive outbreak of war. For some pairs of nations, such as Canada and the United States, it is currently unthinkable that disputes between them might be settled by war, others, even including former arch-enemies such as France and Germany, are well on their way toward the same state of mutual abelligerence. The choice for the United States is either to continue on its traditional course of spending a sizeable fraction of its resources each year on war preparedness (on the assumption that inadvertent outbreaks of war must still be contemplated in our national planning) or to make an all-out effort, possibly even through partial or total unilateral disarmament, to create an atmosphere of trust generally that is comparable to our relations with Canada, so as to relegate the idea of war to the aberrations of the past.

Within the area of domestic improvements, there are many options open to us. Some of the more important ones are these:

Issue #5. Bigger cities vs. new cities vs. more uniform population density. Estimates of the United States population at the end of this century, which have been in the neighborhood of 300 million, tend of late to be closer to 250 million. Even to accommodate this smaller increment, either our present cities have to be allowed, as they have in the last few decades, to sprawl in laissez-faire fashion, or provisions have to be made for large numbers of sizeable new cities, or some positive inducements have to be offered that will cause people to settle more uniformly over the inhabitable portions of this country. While, presumably, some mixture of these possibilities will occur, the quality of life in our future society will depend a good deal on which alternative will receive the greatest emphasis. If there is no definite policy, the urban-sprawl alternative will win by default. If there are to be new cities in quantity, a public/private partnership may be required in order to create the institutional mechanism for encouraging the enormous investments that will be necessary. If, finally, the goal is a more evenly distributed population, this will require better access by high-speed ground transportation to what are still largely urban areas — and thus, again, large investments possibly necessitating cooperation between the public and private sectors.

Issue #6: The old vs. the new vision of the "good life". Increasing numbers of people, particularly among the younger generation, are replacing in their vision of what constitutes a good life the traditional goal of a substantial income, material wealth, and social status by that of an inner sense of spiritual self-fulfillment and a measure of social and cultural participation. This trend can be strengthened or discouraged, with results that will affect preferences among other options, including those discussed as Issue #1 (full-employment vs. leisure economy) and Issue #5 (bigger cities vs. new cities vs. more uniform population density).

Issue #7: Centralized vs. decentralized government. There are conflicting sentiments regarding the issue of centralized vs. decentralized government. On the one hand, the growing complexity of public affairs and the narrowing decision deadlines entailed by the general acceleration in the pace of change make for greater centralization of governmental decision-making functions and, in particular, for the abolition of overlapping governmental jurisdictions that have proliferated at the local and regional levels. On the other hand, even today's degree of concentration of power in federal agencies has generated a feeling of alienation and frustration among the general public — alienation because of the remoteness and incomprehensibility of governmental processes, frustration because of the apparent unresponsiveness of governmental decision-making agencies to the preferences of the people. A compromise between these tendencies toward centralization and decentralization will have to be found, possibly through the invention of new political institutions, that will satisfy the needs both for greater governmental efficiency and for greater participation of the public in its government.

Issue #8. Integrated vs. polarized society. There are currently trends toward a racially more integrated society as well as certain trends toward polarization, both racially (black separatist and white supremacist movements) and by age groups (youth culture, retirement communities). Forecasts differ as to whether integration or polarization will dominate in the long run, and the societal structure that will emerge by the end of the century will depend greatly on which of these trends we elect to promote or suppress.

Issue #9. Continuing technological and economic expansion vs. leveling off. Closely related to, but not identical with, the options described as Issue #1 (full-employment vs. leisure economy) is the choice between planning to continue on the path to technoeconomical expansion and planning to level off gradually before the depletion of natural resources and the pollution of the environment reach catastrophic dimensions. The choice is a difficult one, because the feeling prevails that the next two decades might bring many technological hopes to fruition. We seem to be on the verge of being able to exploit the progress in transportation, housing, and communications/computer technologies to improve the quality of life for large masses of the American people by an order of magnitude. The amount of freedom in this choice may depend largely on how soon a new, economical source of energy (such as might be derived from thermonuclear fusion) will become available, for the scarcity of raw materials can be expected to be overcome by recycling and by extracting metals and food from low-grade ores and soils as well as from the oceans — all of which activities require large amounts of energy.

Issue #10 Competitive-market ethics vs. public-interest ethics. The moral climate in the world of government, business, labor, and the professions is felt by many to have deteriorated to the point where the public interest is in serious jeopardy. Except for the governmental sector, this decline in deference to the common good seems to derive more from the normal operation of competition in a free economy than from the nefariousness of individuals. The choice here is one of permitting the gradual deterioration to continue until the public clamor for reform can no longer be ignored, or of anticipating the inevitable before a crisis is reached, and cooperatively recreating a climate in which business, labor, and the professions can thrive while not disregarding the demands of the public interest. To pursue a reform in the direction of an increased attention to the public interest rather than to abide primarily by the pressures of the competitive market would require submission to social audits and adherence to ethical standards of conduct and performance laid down by either governmental or self-regulation.

This list of ten issues is, of course, not complete and could be extended indefinitely. Among many other examples of areas in which additional choices among alternative options could be formulated, the following may deserve special mention because they are currently much under discussion and may be resolved during the next ten years: the ongoing revolution in sexual mores, the nascent psychopharmacological revolution, the problem of adolescent socialization, the redirection of formal education toward greater relevance; the overdue reform of internment facilities (prisons, hospitals, institutions for the mentally or physically handicapped and the aged); and political reforms involving possible abandonment of the present congressional seniority system, controls over lobbying activities, and the conduct of political campaigns.

These, then, are some of the issues with which our society is faced. What we do about them, and how soon some of the technological advances I listed will become reality, will largely determine the kind of societal environment in which today's youngsters will have to spend their lives. As educators, this should be of concern to us, and, although I have done little to offer solutions to the problems implied by this concern, I hope I have succeeded in providing some food for thought that may eventually be translated into didactic precepts.

Dr. Helmer is a Professor of Futures Research, Graduate Faculty of the School of Business Administration, University of Southern California.

Technology and Institutional Change

Michael Michaelis

I once read that when Gertrude Stein was dying, she opened an eye and looked at her friend, Alice Toklas, and whispered. "What is the Answer?" Miss Toklas sat mute. A few minutes later, Gertrude Stein opened both eyes, and with her last breath she asked, "Then what is the Question?"

Precisely. What is the question? One way to put it is this: Does society see technological vitality as necessary to its future well-being, and — if so — what is the evidence that we are taking deliberate steps to ensure full and beneficient use of our technological resources — that is "humane technology for the future?" The answer to these questions — today — seems to be:

1. Ambiguity on the value of technological vitality for the future, depending on whether you question the intellectual community now often exhibiting a strong anti-technology view or the technocrat — in business or in government — for whom advanced technology seems to offer panacea.
2. No, there is little evidence that we are taking deliberate steps to ensure full and beneficial use of technological resources.

In this paper I will address myself to a variety of issues related to these questions, and I will suggest that the present-day answers I have given are susceptible to change. But only if we aim for institutional change and deliberately do so, instead of putting our bets on the surrogate, i.e., technological change alone, as the driving force to shape the future.

TIME

There seems to be a most critical time-mismatch between those who make policies and operational decisions — whose horizon spans no more than three to four years at most and one year more generally — and what I might call the "natural time span of change," which is 15 to 30 years. Harlan Cleveland (formerly Assistant Secretary, State Department, and Ambassador to NATO, then President of the University of Hawaii) illuminated this general characteristic of U.S. politics and policies when speaking in the context of foreign aid. He observed that, "We know in our hearts that we are in the world for keeps, yet we are still tackling 20-year problems with five-year plans, a staff of two-year personnel working with one-year appropriations. It's simply not good enough."

That's right, we cannot go on like this. Because of the complexity and interrelatedness of our society, many of the most desirable and needed changes can only come about over a relatively long period. In many cases, that "natural period of time" is 15 to 30 years. Yet many of those most concerned with problems of our society are looking for alternatives and options to yield relatively rapid transformation, if not instant solution. The time horizon of self-interest on the part of policy and decision makers, motivated in the best sense, if you will, by desire for personal advancement, re-election, or financial gain through near-term visible profits, is at odds with the natural time cycle of change.

Failure to understand that many solutions when instigated cannot instantly solve the problem reinforces a tendency to abandon the issue, to withdraw, to become alienated, or, on the other hand, to move to an extreme position advocating drastic overhauls or revolutionary changes, ignoring the fact that intrinsically such changes cannot promise a more rapid response.

But these time scales need not remain mismatched. For instance, current tax laws on investment property encourage short-term rationality, a developer makes most money when he "develops" and sells the land quickly. Vermont, however, has introduced a new tax law which taxes quick land turnovers heavily and long-term holdings not at all, and which thereby encourages the individual to think of the long term.

THE TRAGEDY OF THE COMMONS

What I am talking about has become a popular concept ever since Garrett Hardin, in his famous 1968 article, revived the logic of William Foster Lloyd's 1833 pamphlet on population. The problem of the "tragedy of the commons" is quite straightforward. In the parable, the "commons" is a common grazing land on which each villager has the right to graze as many cattle as he wishes. Each commons has, of course, a limited capacity. At the beginning, the number of cattle grazed stays "well below the carrying capacity of the land."

But each herdsman, "as a rational being," seeks to maximize his gain. Calculating more or less consciously and explicitly, each asks, "What is the benefit and cost to me of adding one more animal to my herd on the commons?" Since the profit from the additional animal is received by the herdsman, the positive utility to him is almost plus one. Since, however, the effects of overgrazing are shared by all herdsmen, "the negative utility for any particular decision-making herdsman is only a fraction of minus one." Thus, each individual has an interest in increasing the size of his herd, and it is to no individual's advantage to reduce the size of his own herd in order to reduce the ill effects of overgrazing.

Therein is the tragedy. Each man is locked into a system that compels him, through rational self-interest, to increase his herd without limit in a world that is limited. Freedom in a commons brings ruin to all.

Against this tragic fate, what can be done? Hardin sees it as a problem for which there is no technical solution, i.e., no solution that "requires a change only in the techniques of the natural sciences, demanding little or nothing in the way of change of human values or ideas of morality." Lacking a technical solution, Hardin looks to politics and suggests the answer to the tragedy in coercion. "a mutual coercion, mutually agreed upon by the majority of the people affected."

PROBLEM versus OPPORTUNITY

But the real "tragedy of the commons" is that it cannot be solved, in the sense that no solution can be found that is logically consistent with the parameters and assumptions stated. For instance, one solution advanced is a strong central government or ruler. This assumes wisdom and ecologically-aware altruism, which no authoritative ruler—like everyone else—exhibits as "a rational, self-interested individual." If he imposed ecologically-sound policies (like limiting the cows on the common), he would perceive himself acting contrary to his own rational self-interest by increasing popular discontent, undermining consent, and reducing popular support. The rational, self-interested ruler considers himself always better off by allowing people to satisfy their self-interest and thus consent to his rule until just before environmental costs become infinite and the system is on the verge of collapse. Because of the apparent costs of meeting ecological problems, a rational, self-interested ruler would avoid action as long as possible.

Neither the "solution" of an autocratic government nor the "solution" of coercion based on consent is logically consistent with the premises of the parable, since each "solution" relies on humans with characteristics different from the short-term, rational self-interest that characterizes the herdsmen who precipitate the tragedy in the first place.

Herein lies the deeper tragedy of the commons. Each herdsman, acting on self-interest, sees the opportunity for gain but not the problem of the community. Those called upon to solve the long-range, apparent problem of limited communal resources do not have the long-time vision of opportunities either, but see equally short-time-bound imperatives of a problem to be solved.

OPPORTUNITY

The tragedy of the commons can only be resolved by breaking one or more of the premises on which the remorseless workings of the tragedy rest. John Locke's proposal in the seventeenth century, i.e., that the commons can be made unlimited, no longer holds for "spaceship earth." We must therefore look to technological changes in the "cow" (e.g., make them smaller and consume less) and to changes in human attitudes and the institutions and laws that encourage and support those attitudes.

These observations on factors structured into our society, which inhibit the effective use of our resources and thereby our response to contemporary and continuing problems, are only to suggest the wide range of factors and forces which must be dealt with in a radical way, that is, by getting to the root, if we are to preserve and manage a socially and physically inhabitable world.

A systemic approach to the future, acknowledging technology as a vital force—for good or evil—but ours to control, suggests the following:

1. Recognition that everything is related to everything else.
2. A focus on opportunities rather than the traditional preoccupation with problems, i.e., long-term goals versus short-term brush fires.
3. Anticipatory action instead of reaction to crisis.
4. Recognition of social invention and institutional change as a major self-conscious approach to societal problems.

In my view, institutional change will soon supersede physical-technological change in importance in managing society.

BARRIERS TO INNOVATION

Technology for the future has a new role. Our predominant need is no longer to make things possible, but to satisfy human wants and preferences. To this end, technological innovation must be matched by significant institutional changes. In particular, public policies at the Federal, state, and local levels must be formulated and changed where necessary from the status quo, so as to stimulate and enable the private sector to take larger risks in pursuit of innovation. The dynamics of the market and feedback control through profit can make private business an effective innovation and resource allocator, provided that government establishes imaginative and flexible incentives and constraints in such a way that profit is made doing what society most needs done, in a manner that society finds acceptable.

In this context, I can mention a study* that I led for Arthur D. Little, Inc., with National Science Foundation support last year. It followed quite logically on the President's Message of March 1972 to Congress in which he spoke of the need to create an environment for marrying the nation's technical capability with its entrepreneurship and strengths in production, marketing, and finance, in order to move the rate of innovation into higher gear. Our study was targeted on finding out what industry itself perceives as significant barriers to innovation, i.e., on the real-life experiences of industry in pursuing innovation. We also looked for suggestions from industry of possible changes in public policy that would help remove barriers to innovation. We looked for similar perceptions and suggestions in the financial community, the labor unions, and in Federal Government.

Our definition of innovation needs to be clearly understood. We define it as a process that extends all the way from an idea or invention and related research and development through production, marketing, and distribution — all the way to the marketplace and full diffusion in the marketplace. Until that process is complete, innovation has not taken place. It is a long drawn-out process in time, and it is a very complex and risky one.

Some basic principles emerged from this study. These are more in the form of general comments on public policies and public posture, rather than the specific recommendations that also emerged:

- There is a very real need to designate and to support strongly — from the top in government — a focal point in the Executive Branch to coordinate public policies specifically related to innovation. We have such a focal point today, at least in name. Though I take my hat off to the National Science Foundation and its Director in providing science and technology advice to the President, I don't believe that the Foundation has yet become, though it can, such a focal point for innovation because it has not had full support from the top and from other agencies to carry out that role. Such support is essential if the various parts of the Executive Branch are to be brought into unison where policies for innovation are concerned, not only in their thinking but also in their actions.
- A clarification of public policy objectives is needed. The nation may wish to innovate for a whole variety of reasons, quite aside from corporate objectives. There are national objectives related to international trade, to productivity, to consumer satisfaction, to job creation, etc. Though there are many public policies that relate to each of these objectives, I have yet to find one that explicitly takes into account the opportunities for and the complexities of the process of innovation. It is seldom that these existing policies interact with each other in such a way as to stimulate innovation, or at least to minimize barriers to innovation.
- We also have to consider that public policies for innovation need to be industry-sector specific. It is admittedly difficult for government to hone its policies to be sector-specific. It is a politically sensitive issue, but one that we cannot evade. If we think of the steel industry on the one hand and the drug industry on the other, we soon realize that it is unlikely for identical incentives to operate equally effectively in both cases.
- There is no question that market demand is the most persuasive incentive for innovation. I have seen, of course, the results of the Marquis-Myers study, and I tend to feel that we sometimes downplay market demand as an incentive more than we should. We more often put ourselves in the posture of "pushing" technology because we have demonstrated "feasibility." This is like pushing a string. I'd like to see a lot more "pull" on the other end of the string, and that is the pull exercised by the market.

In many areas of public need, that is in areas where public money — tax money — is a dominant force (e.g., housing, transportation, education), we do not make sufficiently productive attempts to articulate markets. It isn't enough for industry to know that there is a need. You need to know the dynamics of these needs in market terms. You need to know what kind of performance specification the market requires for the goods and services that it wishes to buy. You also need to know trends of competition, including foreign, and trends in government regulation that may impinge on the behavior of the market. Ideally, you also want a big enough market with common performance requirements and market dynamics, because fragmented purchases often do not provide enough incentive for the risks you have to take in innovating.

In short, market articulation and market aggregation are two powerful tools that government can use in purchasing goods and services for its own missions. The aggre-

*"Barriers to Innovation in Industry. Opportunities for Public Policy Changes," 1973 (National Science Foundation/RANN, Washington, D.C.) Arthur D. Little, Inc., Industrial Research Institute.

gated purchasing power of Federal and state government is indeed very large, reaching into the hundreds of billions of dollars. Even if only a portion of that market could be rationalized, I believe we would mobilize a powerful pump-priming effort for innovation.

- Finally, there is a lack of open, mutually trustful, and productive interaction between industry and government. For instance, those who have been involved with antitrust matters will recognize the issue. Both sides have varying interpretations of these provisions and though both sometimes speak to each other, I have the impression that they do not speak with each other. There is much ritual and speech-making and policy pronouncements, but there is also a great deal of shying away from the realities of the issue and from present, as distinct from past, needs for jointly re-examining public policies. We simply must learn to understand each other's problems and find ways of not only communicating but also collaborating through imaginative new institutional linkages and through innovative policies and practices. Industry and government are in the same boat. We act as adversaries much of the time, and often there is indeed a good deal to commend these adversary roles. But we also need a much more purposeful and collaborative stance as well, so that we can anticipate serious problems that inhibit risk-taking in both the national and corporate interests before crises and shortages are upon us. When these occur and call for immediate action, we inevitably find too little lead-time for taking the most useful actions. We must learn to act in anticipation of rather than in reaction to perceived needs.

To get more specific, let me suggest a possible scenario for the future. I said at the beginning that we can't go on like this. Neither this country nor the world can keep reeling from crisis to crisis (energy now? food tomorrow?) without courting human, social, and economic upheavals that carry within them the seeds of ultimate disaster: war.

I spoke to a central issue, as I see it; namely, the severe mismatch between the short time horizons of policy makers and the inherently much longer "natural" time period needed for major innovative policies to mature into significant changes that could forestall, or lessen, impending crises.

On the other hand, experience shows us that it takes at least 15 to 30 years for major innovations to be consummated that could forestall, or lessen, crises. Such major changes involve the fullest application of all our resources — human, institutional, economic, and technical — and considerable institutional obstacles need to be overcome in order to effect such changes.

For such changes to occur, the innovative policy or invention must be made and nurtured not by the individuals and organizations who later stand to gain directly from the results, but by their predecessors who should have taken the visionary and imaginative risks in sufficient time. Our system of rewards, incentives, and constraints — governed by "terms of office" that seldom exceed a handful of years — focuses attention more on "results today" than on "risks taken for a better tomorrow."

To be sure, the needs of tomorrow, the crises that may impend, barring early corrective policies and actions, are foreseen by thoughtful analysts. But few are heeded, because even fewer consider it "their business" to risk near-term personal or institutional rewards and security by championing risky actions that can turn potential into reality. They refrain from challenging the status quo of antecedents and vested interests.

Long-range planning is frequently advanced as the obvious solution, both in government and in industry. Some such efforts have paid off, but less frequently than we would wish. Or why else are we beset by crises when resources of all kinds are sufficient unto our needs, if only they be used imaginatively and equitably?

These mismatchings of time horizons on the one hand and of resources and needs on the other can be aligned if we reconsider our system of rewards and constraints. This is a task in which government and industry must join together so as to find new and mutually reinforcing patterns of policy-making and action. These new institutional arrangements must be so designed that the needed incentives for long-range policy-making and risk-taking are a built-in, integral feature.

PERFORMANCE versus PRODUCTS

One such arrangement, for instance, would be to consider the possibilities for business, appropriately regulated by government, to sell "performance" instead of "products." Consider transportation, 25% of our scarce energy resources are now used to move vehicles that carry people and goods. Over 90% of all passenger-miles are traveled in privately-owned automobiles. The total "performance" of society's functional need for mobility is less than optimal, to say the least. The policies and rewards of those who make automobiles are well-tuned to their mission of selling us a product. Incentives to make the "total performance of transportation" rise to the much higher level attainable by our potential technical and economic capabilities are not an integral part of their business.

New institutional arrangements are needed that are geared to provide the customer with an alternative to purchasing and owning a product (a vehicle), namely, to provide and sell the functional performance of transportation. Such performance would involve, of course, a mix of many technical modes of mobility, depending upon what or who needs to be moved from whence to where. Such performances can be specified and measured (as to value received) in technical, economic, and social terms. The technical capabilities of creating such performance-based transportation systems exist. The institutional mechanisms are still lacking.

This does not mean any basic change in the profit-motivated capitalist market system. What it does mean is a new way of perceiving links between consumer markets and business, and between government and business, which remove institutional and perceptual barriers to productivity gains and technological innovation.

Carl Madden, chief economist of the Chamber of Commerce of the United States, has characterized the mode of business strategy I suggest as

> ...evidence of how the United States could achieve large-scale social improvements...evidence of how environmentally balanced economic growth could be accelerated to provide necessary resources...offering socially-oriented employment of currently unused advanced technologic resources...offering a new institutional organizing mode consistent with basic philosophical insights of this century...providing a way to achieve more responsible performance from society's dominant power institutions.*

Successful examples of major innovations have a common feature that seems to me of overriding importance: the enterprise is structured and motivated to provide performance of complex systems that meet functional needs of society. The key words are performance, systems, and functional needs. For instance, the operation of the complete systems of defense and of space exploration (in the public sector) and of voice communication (the telephone system in the private sector) — each a functional need of society — is specified, executed, and measured in performance terms related to perceived or anticipated needs.

What I am suggesting is that such functional performance orientation of an enterprise can substantially enhance its innovative behavior and increase its productivity. One promising avenue for exploration and experimentation would therefore be the creation of business systems which can provide total performance capability in satisfying the various functional needs of society. This would involve adapting our free market institutions in such a manner that consumers have the option of buying as much performance in a total transportation system as they need and can afford, as an alternative to buying the separate component products and partial services now offered to meet this particular functional need.

The distinction I am making is between functional-performance orientation and product orientation.

The prevailing product orientation of much of industry is exemplified by companies, for instance, whose business it is to make and sell building materials, others who construct a house out of such materials, others who supply it with utilities, others who engage in land speculation for siting the house, and so forth. This is not to discredit the housing industry, it is laboring under severe restraints of all kinds which inhibit technological advance and which themselves cannot be overcome by technology alone. Though we have technical knowledge to improve housing, the policies and practices of business, finance, government, and labor impede the use of this knowledge. All these enterprises are involved in what I would call the "shelter" system. Their individual aims and motivations may well strive toward the whole system, but their respective business strategies and decisions are circumscribed by the specific product or service they offer. The interrelationship between them lacks orchestration to get the most out of the technological performance of the system as a whole and thus limits productivity.

*Carl H. Madden, Clash of Culture. Management in an Age of Changing Values (Washington, D.C., National Planning Association, October 1972).

To serve a function-oriented market profitably, enterprises will have to focus heavily on continuous technological and institutional innovation. The institutional behavior of those who sell performance of an integrated transportation system will be quite different from those who make and sell automobiles. A company offering functional performance capability will help create, and will function in, an environment characterized by.

- Aggregation of functional markets with related performance requirements.
- Development of new business practices, more capable of higher risk-taking, stemming from the ability to control all the elements that make for systems efficiency and innovation.
- Stimulus for continuous technological and institutional innovation aimed toward performance objectives.
- Greater potential to act in anticipation of need rather than by reaction to crisis. disruptive impact of innovation — future shock — is eased.
- Increased demand for higher skills in management, engineering, and labor. employment opportunities are upgraded.
- Improved quality of life — through humane technology — inasmuch as the advent of new technology will be significantly influenced by consideration of societal good through a functional-performance business' pursuit of profits.

Such an environment does not, by and large, now exist in product-oriented corporations. It is resisted by these institutions primarily intent on preserving or enlarging the market share of a product and by the individuals who work in them, who have a very human fear of uncertainty lest their product line and its related work skills should falter. But under functional-performance orientation, each component product or service of the enterprise and its continuous change can be treated as a more manageable risk, because each component is seen as an integral part of the total performance-based system.

BROAD BENEFITS

Functional-performance orientation is advantageous to the consumer, too. It creates an environment where consumers buy and evaluate system performance, in terms of improved performance and lower costs rather than isolated product performance. Both improved performance and lower costs can be achieved in great part by technologic innovation. Such innovation has to be managed for the functional system as a whole rather than be allowed to occur haphazardly by unexpected interactions of component parts, technological innovation therefore must go hand-in-hand with institutional change.

Functional performance corporations will more readily assume the responsibilities for research and development, particularly those leading to major innovations on which their competitiveness or market share depend. Fewer vexing debates and political battles should therefore ensue on whether industry or government should pay for R&D. Functional performance enterprises, who perforce must perceive it as an integral need of their operations, will be motivated to do so.

Where both enterprise and customer recognize the operations of the enterprise as performance of a functional need, they will be able to judge its total performance. It should be easier to make trade-off decisions to minimize adverse impacts, because interaction of component parts is controllable. Accountability for both benefits and adverse impacts is more clear-cut and visible, and a discerning citizenry and regulatory agencies can act with greater purpose and success to resolve issues.

The steadily growing interest in the social responsibilities of business corporations will, for a functional performance firm, be a matter of everyday concern. It is implicit in the goals of such a firm, and it should be a recognized measure of its success. The business of such corporations are the problems of our society. What is today considered as enlightened self interest — the corporation's stake in a good society — can become the primary goal to be achieved with profit.

Many economists have warned that the nation's productive performance (gross national product) will be insufficient to attain simultaneously the many social and economic goals implicit in the problems we face. Painful choices of priorities — health versus education, transportation versus shelter, for instance — will need to be made. Traditionally, growth depends on relatively haphazard and often narrowly-motivated business interactions. Though production and distribution of particular products and services may, in itself, have reached a high degree of efficiency (benefit, costs), the total system efficiency is often quite low. Functional-performance orientation focuses on total system efficiency, and should thus serve to optimize allocation of resources. This means that resources now used inefficiently, be they material, financial, or human, can be freed and reallocated to other purposes, responsive to market demands. It stands to reason that the simultaneous attainment of more national goals is a possibility.

I am not advancing this concept of performance vs. product as a panacea. I am suggesting it as illustrative of the kinds of imaginative daring that we must consider in so restructuring the arrangements of our free enterprise society that rewards and actions can be made to mesh with the time scale necessary and the great resources available to avoid the quick-fix solution of one crisis that so often sows the seeds of the next one.

Institutional transitions necessary to gain maximal human benefits by further technological advances are sweeping and have interlocking effects. This calls for orchestrated sets of choices on rewards and constraints, with initiatives for such choices emanating from many sovereign sectors of our society — consumers, producers, governments. This problem of coupling many-to-many in a concerted function of making choices is the challenge before us. In responding to this challenge, we must explicitly recognize the wide spectrum of value-laden attitudes and aspirations of our pluralist society. We must attempt to orchestrate them so that rewards and constraints serve to stimulate and govern both our near- and long-term actions.

The business community should now consider it a prime responsibility to reconsider its missions, in concert with enlightened public policy, so that its system of rewards leads to policies and actions that are judged not only by the balance sheet this year but also by the vast potential we possess for meeting human demands equitably and in greater measure in the decades ahead.

Dr. Michaelis is Director of the World Future Society and Interdisciplinary Communication Associates, Inc. He is a member of the senior staff of Arthur D. Little, Inc., Washington, D.C.

ACESIA

American Council of Elementary School Industrial Arts

Career Awareness: Four Selected Activities for Elementary School Children

Wayne A. Wonacott

The elementary school industrial arts program is interrelated with the instructional program of the Los Angeles City Unified Schools, as designated in the general course of study. The instructional program is developed in terms of the need for effective living, and the industrial arts program serves many of these needs in a manner which gives it a place of importance in relation to the total educational program.

Industrial arts activities promote learning and give children appreciations and understandings not easily obtained in any other way. Critical thinking and problem solving experiences are also of prime importance in a constructive program.

As an integral part of the elementary school program, industrial arts makes four distinct contributions:

1. The clarification and application of concepts in other subject fields, such as history, geography, science, art, music, mathematics, language arts, literature, etc.
2. The interpretation of our industrial-technological society.
3. The satisfaction of personal interests utilizing the materials of industry.
4. The discovery of personal abilities through a program of career awareness.

The Los Angeles Board of Education has unanimously adopted career education as an area of high priority in the educational program. Staff members have been commissioned to initiate programs that will serve immediate needs as well as long-term goals.

In the elementary schools, there are four units or activities based on the theme of career awareness which have been tried out on an experimental basis by a number of teachers with their children.

CAREERS IN PRODUCT DESIGN

Product design is an important function in business, industry, and technology. New products are constantly appearing at the market place and old products are being modified for various economic factors. There are hundreds of exciting careers in product design, and young children should be more aware of their existence.

Lesson 1 — Product Design

Children play the roles of designers in a large toy factory. Using tools and materials, each person designs a toy, game, or puzzle that will be of interest to young children.

Each designer constructs his own product, but the group stops frequently for problem solving and evaluation. As the products are being constructed, the children learn about some of the careers in product design.

Lesson 2 — Market Surveys

After the products have been completed, an impartial survey is taken to determine the consumer interest toward the various toys. This is accomplished by having a number of other children observe the toys and judge them in terms of first, second, and third choices. The results are tabulated to find the most popular toys in the group. Careers in market research are discussed.

Lesson 3 — Mass Production

Using the product survey as a basis, four or five toys are selected to produce. The designers of the chosen products select workers for their work crews, and they act as leaders. Each leader and his crew are responsible for producing a quantity of their particular toy.

Each team is responsible for ordering materials, analyzing the product, dividing the labor, and organizing a production schedule. Enough toys are produced to give the workers the experience of cooperative effort. Careers in factory work are discussed.

Lesson 4 — Product Promotion and Sales

After all of the factory work has been completed, a toy store is set up and a sale is planned. A sales campaign is organized to boost profits, salesmen are selected, and they are trained to sell the merchandise.

All of the careers centering around product promotion and sales are recorded and discussed.

LEATHER PRODUCTS AND SALES

Leatherwork is an ideal addition to the elementary industrial arts program. Children can design and produce leather goods that are of good quality and are salable. During the school year there are a number of events which offer the opportunity to sell student-made products. These include the annual carnival, spring festival, open house, P.T.A. events, Christmas sales, student stores, etc.

In all metropolitan areas, leather experts are available for classroom demonstrations to assist teachers in introducing tool skills and organizing a classroom business enterprise. A call to the Tandy Leather Company in the community will arrange help for a leather expert.

Leather products include key rings, wrist bands, medallions, book markers, key cases, etc. Other products include letter holders, note birds, trivets, pencil holders, note pads, calendars, collages, and pictures.

Opportunities for career awareness are found in designing and making the products, organizing the store, planning the sales campaign, actual sales, and the evaluation of the results. Every school participating in this activity so far has made a profit, and some have declared a dividend to the stockholders.

CAREERS IN PRODUCT IMPROVEMENT AND SAFETY

Ralph Nader has done a great deal to point up the need for product improvement and safety. His efforts have inspired this particular experience for elementary school children. The unit centers around a classroom truck factory.

In order to develop an awareness of the career opportunities in the area of product improvement and safety, the students are given the opportunity to participate in activities that develop basic concepts in factory production methods, product servicing and maintenance, safety, and product improvement.

In the first lesson, the learners produce 30 to 40 toy trucks. Line production procedures are used for the construction of the vehicles.

The second lesson includes "selling" the fleet of trucks to the kindergarten for play purposes. The kindergarten class usually uses the trucks for a series of safety lessons on pedestrian and driver education. All broken trucks are returned and repaired by the producing class in an organized service and maintenance station.

In the third lesson, all of the trucks are returned to the producing class for a lesson on factory recall. The students are divided into factory teams to consider all of the improvements that are necessary to make the truck fleet better and safer. All improvements are made, and the toy trucks are returned to the kindergarten class for permanent use.

THE PERFORMING ARTS AND RELATED CAREERS

The career opportunities in the performing arts are open to persons in many more places than in the traditional centers of Hollywood and New York. It is safe to say that the opportunities are now world-wide.

In this unit, students are made aware that there are many and varied careers in the performing arts for people who have abilities in the arts and skills in certain technical fields. Some of the industries which make up this category are the radio and television industry, the theater (drama, dance, music), industrial shows and exhibitions, fairs and festivals, sports promotions, zoos, and amusement parks.

The students in the classroom are given the opportunity of exploring careers in the performing arts by constructing animated wooden puppets and staging a production that highlights some of the artists and craftsmen who are necessary to assure a complete and successful production.

Over a two-year period, one school produced two operas — "The Magic Flute" and "The Bartered Bride" — using the animated wooden puppets as the medium of expression. The primary purpose was to acquaint the children of the school with the story and the music of the operas before attending a professional performance.

At the same time, the children learned how to use some of the hand tools that were necessary to construct the animated wooden puppets and the miniature scenery. Children were selected to plan costumes, devise hair styles, construct special props, paint scenery, set up lights, tape music and narration, etc. Thus the students began to learn first-hand what abilities and skills it takes to put on a performance. (Plans for the puppets may be obtained by writing The Elementary Industrial Arts Section, Los Angeles City Unified Schools.)

Mr. Wonacott is Supervisor of the Division of Career and Continuing Education, Los Angeles City Unified Schools, CA.

Careers in Product Improvement and Safety

Wayne A. Wonacott

The consumer is the prime tester of all manufactured products. Even though a product is well-designed and engineered, economically produced, and is salable in a competitive market, it is the consumer who determines the continued success of the product.

Consider the great variety of products that the consumer buys, uses, and evaluates. The manufacturer wants to know the evaluation of his product, but seldom comes out and directly asks the consumer about it. He generally judges the merits of his product through sales figures and the incidence of product failure. On more expensive items, the manufacturer offers a written guarantee with a card that is returned to the factory at the time of the sale. Products are improved following a pattern of failures in returned merchandise.

Errors and faulty parts in manufactured goods are usually costly to the maker, because he may distribute thousands of products before the mistake is discovered. The consumer may lose his investment, or he must spend time having the error corrected.

The government takes an interest in manufactured goods when public health and safety are involved. Some of the industries that have been concerned in this area are food and drugs, toys, electrical appliances, automobiles, etc.

For example, when it has been determined through practical experience that certain parts of an automobile are unsafe, the manufacturer recalls all affected vehicles to the nearest service center to be corrected. This is termed factory recall. There are many career opportunities in various industries for designers, technicians, tool designers, engineers, and sales specialists who are able to work as a part of a product improvement team.

DESCRIPTION OF THE ACTIVITY

In order to develop an awareness of the career opportunities in the area of product improvement and safety, the students are given the opportunity to participate in activities that should develop basic concepts in factory production methods, product servicing and maintenance, safety, and product improvement.

In the first lesson, the learners produce 30 to 40 toy trucks. Line production procedures may be used or each child may put together one whole truck.

The second lesson includes "selling" the fleet of trucks to the kindergarten for play purposes. The kindergarten class may use the trucks for a series of safety lessons on pedestrian and driver education. All broken trucks are returned and repaired by the producing class in an organized service and maintenance station.

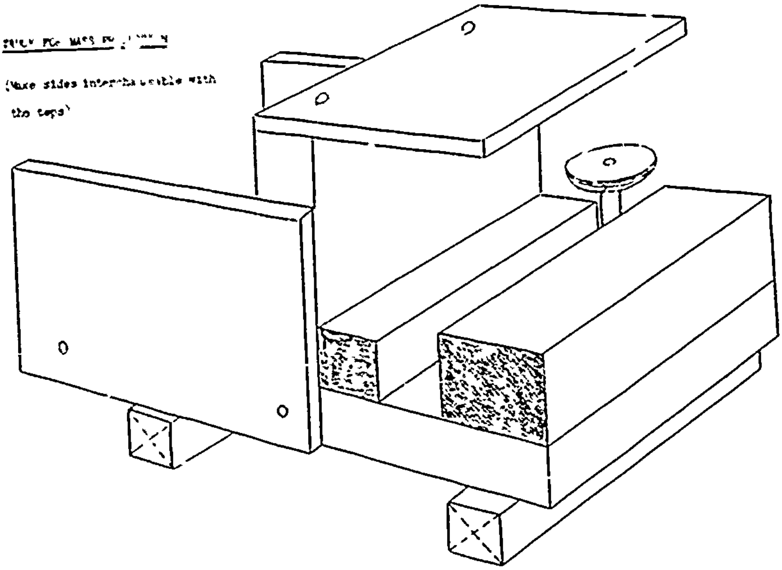
In the third phase, all of the trucks are returned to the producing class for a lesson on factory recall. The students are divided into factory teams to consider all of the improvements necessary to make the truck fleet better and safer. All improvements are made, and the toy trucks are given back to the kindergarten class for permanent use.

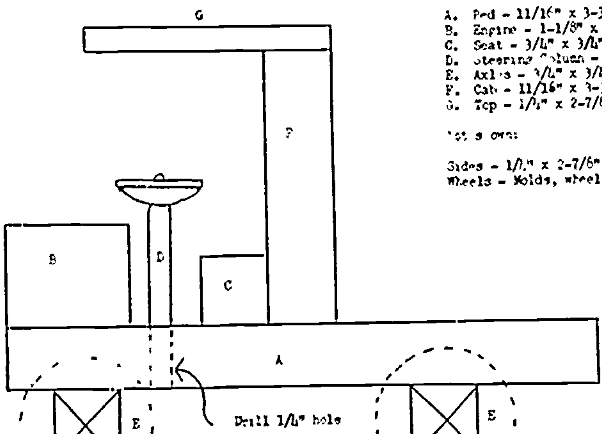
LESSON 1. FACTORY PROCEDURES IN PRODUCT FABRICATION AND DISTRIBUTION

Inform the students that they are to have the opportunity of constructing a fleet of 30 to 40 wooden trucks, using simplified factory methods. When completed, the trucks are to be used by children in another class.

TRUCK FOR MASS PRODUCTION

(Make sides interchangeable with the tops)





TRUCK FOR MASS PRODUCTION

Basic Chassis - Actual Size

A. Bed - 11/16" x 3-3/4" x 6-3/4"
B. Engine - 1-1/8" x 1-3/8" x 3-3/4"
C. Seat - 3/4" x 3/4" x 3-3/4"
D. Steering Column - 1/4" diam. x 2-1/2"
E. Axles - 3/4" x 3/4" x 4-1/2"
F. Cab - 11/16" x 3-3/4" x 3"
G. Top - 1/4" x 2-7/8" x 3-3/4"

Not shown:

Sides - 1/4" x 2-7/8" x 3-3/4"
Wheels - Molds, wheel, 1-1/2" diam.

The trucks will be built from a specific plan in order to develop concepts of production-assembly line methods, interchangeable parts, and the team approach to factory work.

At this time, have the class decide which method is going to be used to produce the trucks. There are three basic choices:

Method 1 — The entire class is set up into one continuous production-assembly line.

Method 2 — The class is divided up into four to six production teams. Each team produces trucks.

Method 3 — Each pupil builds one entire truck, but works in partnership with another person.

As the activity progresses, have the class keep a cumulative record of all of the career opportunities that relate to manufacturing.

Teacher/Student Tasks

Show a plan or a model of the truck that is to be produced.

Make the following plans cooperatively with the students:

1. Measure and record the size and name of each part.
2. Make a list of the jobs that it takes to build a truck.
3. List the jobs in the proper sequence.

Method 1 — A continuous production-assembly line

Have the class select a shop foreman, an inspector, a warehouseman, and a tool keeper.

Divide up all of the production-assembly line jobs as follows. ask for volunteers, then hold a period of tryouts.

Make up the patterns, templates, jigs, fixtures, and other devices that help to speed up production.

Set up the production and assembly lines in the room so the flow of parts from station to station is logical and efficient.

Have each worker prepare his station with the necessary tools and supplies.

Make two or three trial products to smooth out the production flow and to train the workers.

Set up check points where the inspector measures the accuracy of the parts and judges the workmanship according to planned standards.

Method 2 — Several production teams

Have each team select a foreman or a lead man. The lead man takes charge of his team and divides up the jobs according to ability and interest.

Determine the quota of trucks for each production team.

The team will not have enough workers for a continuous production-assembly line, so the jobs can be broken down as follows:

1. Cut and finish all of the parts.
2. Assemble the parts.
3. Paint and finish the trucks.

Have each team obtain supplies, tools, and other equipment. Have each worker set up his station according to a team plan.

Before work begins, be sure each worker knows his job.

Have each worker cut two or three parts for a trial run. Inspect the parts for accuracy.

Set up a warehouse for completed parts. Be sure each worker knows his quota.

When enough parts have been produced, reorganize the team and assemble the parts into completed trucks. Check for accuracy and workmanship. When all of the trucks have been completed, organize the team for painting and finishing.

Method 3 — Each worker constructs one entire truck

Have each worker choose a partner. Partners are to assist each other in any situation that is too difficult to do alone. Each worker is to make one complete truck.

Plan the classroom for work. Move tables, bring in the tool cart, set up the saw-horses, and organize the supplies.

Demonstrate the tool skills necessary to build the truck.

Stop the class during work periods to help as follows. solve problems, reinforce tool skills, demonstrate new tool skills, and relate the work to occupations and careers.

Continue the work periods until the truck fleet is completed.

Summary

Hold an evaluation of the work that has been accomplished and discuss the following points:

1. Do the finished trucks measure up to the original plans?
2. Did you do your best work? Did you enjoy the work that was assigned to you?
3. What tool skills did you learn?
4. Would you like to work in a truck factory? Why?
5. What is it like to work on a production or assembly line?
6. Why are mass-produced items less expensive than custom-made products?
7. Why is teamwork necessary in a manufacturing plant?
8. How many careers have we listed as a result of producing trucks? Are there others?
9. Do you think the trucks will last when they are used by five- or six-year-old children?
10. Would you like to have kindergarten children play with the trucks? Do you want to watch?
11. How can we "sell" the truck fleet to a kindergarten class?
12. How do auto dealers sell trucks to customers? What is a factory warranty?

LESSON 2. PRODUCT SERVICING AND MAINTENANCE

Inform the students that the truck fleet has been delivered to a kindergarten class. They are to use the trucks for a driver and pedestrian safety project. They will play with the trucks in the room or in the kindergarten yard, carrying "freight" from place to place.

The kindergarten teacher will plan the safety program with the children, laying out streets, crosswalks, signals, loading zones, etc.

Let the pupils know they will be able to watch the kindergarten children play with the trucks during one period.

When the trucks break down for any reason during the play project, the broken trucks will be taken out of service. Broken trucks are to be repaired by the maintenance teams.

Teacher/Student Tasks

Have the students deliver the trucks to the kindergarten teacher. Let a student representative explain the warranty covering all vehicles in the fleet.

Arrange a date for the students to observe the kindergarten children using the trucks in the safety project. While observing the trucks being used, have the students look for the following things:

1. Are the kindergarten children enjoying the trucks?
2. Are the trucks operating OK?
3. Are the trucks breaking down? How many? What parts are failing?
4. Are the trucks being used properly?

Upon return to the classroom, evaluate what was observed.

Bring back all of the broken trucks and assign them to individuals or maintenance teams to repair. Keep a record sheet of every repair job. After eight or ten trucks have been repaired, do not take back any more.

Summary

1. What part is causing the most problems?
2. What other parts seem to cause trouble?
3. Are careless drivers causing any breakage?
4. Are any of the parts faulty or weak?
5. Do you like to do repair work?
6. Could any of the parts have been made stronger? How?
7. Could the truck construction be improved?
8. Were the correct nails used at first?
9. Would glue help to strengthen the truck?
10. What careers are there in the repair and maintenance of trucks?
11. What does a truck or auto manufacturer do when his vehicles have faulty or unsafe parts?
12. What is a factory recall?
13. Do we need to have a factory recall of the trucks that were "sold" to the kindergarten class?

LESSON 3. SAFETY AND FACTORY RECALL

Let the students know that there is to be a factory recall of trucks being used in the kindergarten class. Certain parts of the vehicle have been declared faulty and unsafe.

Have the pupils discuss factory recall with their parents and ask if any family cars have been repaired in such a situation.

Inform the learners that the weaknesses of the trucks will be evaluated and the necessary steps will be taken to fix them. When the trucks have been brought up to safe specifications, they are to be returned to the kindergarten for permanent use.

Teacher/Student Tasks

Have the students pick up the truck fleet from the kindergarten class. Let them know you are going to make the trucks stronger and safer.

Divide up the workers into five or six teams. Each team should list the parts of the truck that need to be improved. The list from each team should be read, and a final decision on repairs should be made. The final list might include the following improvements:

1. A change in nail size.
2. The use of glue in addition to nails.
3. Changing the direction of the grain of the lumber for the top and sides.
4. Reinforcements for any part.

Give each team a quota of trucks to repair. Each team should elect a lead man who will divide up the various jobs and responsibilities. Keep a record of each truck, listing all repairs done.

Return the truck fleet to the kindergarten. Have a factory representative show the children the improvements that have been made to the trucks. He can make suggestions on how to "drive" the trucks for better "mileage."

Ask the kindergarten teacher to check for real improvements in the fleet as play is continued. The factory representative can follow up on this information.

Summary

Evaluate all three lessons to determine what was accomplished and what was learned. Center the discussion around the following questions:

1. Were the trucks really improved by the repairs made during the factory recall?
2. Is the factory recall system successful, or is there a better way to assure safety in car and truck manufacturing?
3. Is a factory recall of cars and trucks expensive? Who really pays the bill?
4. Did you enjoy working in the factory?
5. What careers are available in truck servicing, maintenance, testing, engineering, design, and sales?
6. How would a person train himself for one of these careers?
7. What is it like to do the same job day after day?
8. Would you like to work on a factory team to improve cars and trucks?
9. What safety features would you like to see put on the cars of the future? Are these features possible?
10. Who is Ralph Nader? What has he done for automobile safety?

Mr. Wonacott is Supervisor of the Division of Career and Continuing Education, Los Angeles City Unified Schools, CA.

Leather Products and Sales

Wayne A. Wonacott

The purpose of this lesson is to show that leather can be combined with other materials such as wood to construct products that are functional and decorative. The learners should be given the opportunity to design wood and leather projects that fulfill practical purposes, and upon completion the products should be salable.

Manufacturers are constantly changing and improving their products to increase sales, to compete with other manufacturers, and to satisfy new needs and demands of the consumer. In industry there are career opportunities for people who not only create new and unique products, but who are able to create a demand for these products.

The final link between the manufacturer and the consumer is the sales function. Selling is critical to the life of a company, and salespeople are those who have unique skills and creative abilities.

LESSON 1. PRODUCT DESIGN

GOAL

The students will know that leather is basic to modern living and that its uses are diversified.

UNIT GOAL

The student will be aware of some of the skills that are required in the use of tools, equipment, and materials in the world of work.

PERFORMANCE OBJECTIVE

After a review of skills for using leather tools and woodworking tools, the learner will design and construct a functional product.

Learning Activities

POSSIBLE APPROACHES

This unit can be incorporated with on-going programs of industrial arts, career awareness, social studies, art, or the activity can take place during a special season of the year. The unit also is suitable as part of an enrichment-type program in summer school or other period.

ENTRY LEVEL SKILLS

The students should have a basic experience in using leather tools and in using woodworking tools. The following lessons are suggested:

1. Leather — Introduction and Experimentation
2. How to Start Construction in the Elementary School Classroom (practice with tools)

TEACHER PREPARATION

Attend a teacher workshop to:

1. Learn proper and safe use of tools.
2. Make sample projects and teaching aids.

Obtain the leather tools and the woodworking tools for the class.

Order the supplies for the unit.

Organize the supplies for class use.

Locate a leather craftsman to demonstrate tool skills to the students.

Formulate a list of careers related to the work in this unit.

Make note of the possible correlations between the activity and other subjects, such as math, language, social studies, art, etc.

INTRODUCTION

Let the students know they are going to design and construct wood and leather projects that have a useful purpose at home, school, or office. When completed, the products can be used as gifts, or they might be sold at a special school event.

Let the students know the purposes of the unit:

1. To extend their knowledge of leather and the leather industry.
2. To consider some of the career opportunities in manufacturing and product design.
3. To increase skills in the use of tools.
4. To discover new interests and abilities.
5. To be more conversant about the world of work, industry, and technology.

<u>Period 1</u>

Demonstrate and review how to stamp and carve vegetable-tanned cowhide.

Organize the room for leatherwork. Pass out the tools and scrap leather, and let the students work on skills and designs. Evaluate the results of the practice experience.

Period 2

Review the skills and safety in the use of woodworking tools.

Organize the room for construction and let the entire class build a practice project from scrap lumber. Evaluate the results of the practice and review any skills that are necessary.

Period 3

During the next work period, have the pupils design projects that can be made out of small pieces of wood and leather. Show the learners the materials that are to be available for the products.

Make the students aware of the category of products to be designed. These are items that would be useful at home, school, or the office. Use the following suggestions.

a. Holders for letters
b. Holders for notes, memos, scratch pads, etc.
c. Desk calendars
d. Holders for pencils, pens, paper clips, etc.
e. Box for card files, etc.
f. Key racks
g. Napkin holders
h. Wooden trivets
i. Picture holders

Show pictures and display models of products that others have made that fit this category. Have the students make several sketches of possible projects. Make sure the plans are made in terms of the materials that are to be used. Display the sketches and have the entire class evaluate the ideas and make suggestions.

Period 4

Have the pupils plan the working organization of the classroom. Provide facilities for both leatherwork and woodwork so each worker can move from area to area as the need arises. Set up work standards in the use of the various work stations and supply centers.

Let the students go to work. Part of the learners can start on leatherwork and the others can start by working with wood. Circulate among the students to help individuals and smaller groups. Determine if progress is being made according to the general plans. Stop the group as needed for problem-solving and for necessary review.

Continue the work periods until each worker has made two or three products. Encourage good workmanship by setting salability as the standard.

Summary

Hold an evaluation of the products that were constructed. The following questions may be discussed:

1. What do you think of the finished products? Do they represent your best work?
2. Did you enjoy working with leather and wood? Do the two materials go together?
3. Is the workmanship good enough to make the products salable? Who might purchase your work?
4. What makes a product salable?
5. How would you determine the cost of a product? How about the selling price? What is profit, and how much is a fair profit?
6. Do you enjoy designing products? What career opportunities are there for designers, engineers, model makers, artists, etc.?
7. Do you want to try to sell part of the products that you have made? How?

LESSON 2. PRODUCT SALES

GOAL

The students will become aware of some of the abilities required to promote and sell manufactured products.

PERFORMANCE OBJECTIVE

After completing the wood and leather products, the learners will be able to sell them at a profit.

Learning Activities

TEACHER PREPARATION

Refer to "T-73" unit titled Careers in Product Design, Lesson IV, Product Promotion and Sales for more detail on this subject.

INTRODUCTION

Let the students know they are going to plan an advertising campaign to promote the sale of the wood and leather products. The actual sale is to be held as soon as a time and place can be arranged.

TEACHER/STUDENT TASKS

Have the class suggest possible times and places for a sales event. Try to plan the sale to fit the school calendar. The following suggestions are:

1. Halloween Carnival
2. School Christmas Program
3. Education week — open house
4. Spring festivals
5. P.T.A. meeting (father's night, career education speaker, rummage sale, pot luck supper, etc.)
6. Cooperate with a local retail merchant. (Ask for guidance from the Advisory Council)

Divide the class into several groups to plan the details of the advertising and promotional program. They should consider the following:

1. Posters
2. Sales brochures
3. Pre-sale displays
4. Written announcements in the school bulletin, the school intercommunication system, and P.T.A. newsletter.
5. Publicity written to a local newspaper.
6. Individual sales pitches and spiels.

Make final sales plans and divide up the work among individuals and groups. Carry out the promotional and sales campaign when the materials are ready. Hold the sale. Record the number of sales made and the amount of money taken in.

Summary

Hold an evaluation of the sales campaign by discussing some of the following questions:

1. Was the advertising campaign a success? Was the sale a success?
2. How much money was taken in? Was there profit?
3. What could have been done to improve the general campaign?
4. Did you enjoy the advertising and sales activity? Would you like to be a salesman?
5. What abilities does a salesperson need? What education is needed for sales work?

Mr. Wonacott is Supervisor of the Division of Career and Continuing Education, Los Angeles City Unified Schools, CA.

The Performing Arts and Related Careers

Wayne A. Wonacott

LESSON I. THE PERFORMING ARTS AND RELATED CAREERS

INTRODUCTION

Make the students aware that there are many and varied careers in the performing arts industries for people who have abilities in the arts and skills in certain technical fields. Industries which make up this category are:

1. The radio and television industry.
2. The motion picture industry.
3. The theater (drama, dance, music)
4. Industrial shows and exhibitions

Let the students know that they are going to have the opportunity of exploring some of the performing arts careers by constructing animated wooden puppets. The puppets are to be used in producing a dramatic or musical show for the class or for the school as a whole. The puppets are to be designed, constructed, painted, and dressed by the students, using the various tools that are needed for the job.

As the work progresses, let the learners know that they will be responsible for identifying various careers in the performing arts field and the tools that are needed by each artist and craftsman to carry out his responsibilities.

Outline the order and priorities of the project with the children and let them know the time schedule for completing the work. A suggested outline is as follows:

1. Plan a play, skit, or musical.
2. Determine the need for various characters and performers.
3. Design and construct the puppets (characters).
4. Paint and provide costumes.
5. Produce a dramatic or musical puppet show.

TEACHER/STUDENT TASKS

Plan a simple play, series of skits, or musical production. Every learner should construct a puppet for the production. Let each student decide whether his puppet or character is to be a man, woman, boy, or girl.

Plan the room layout for constructing, painting, and the grooming of the puppets.

1. Show the motion picture film titled "How to Convert the Elementary School Classroom Into an Industrial Arts Laboratory."
2. Group the classroom tables to make floor space for the sawhorses.
3. Plan a specific place for the tool cart, lumber, nails, glue, painting supplies, etc.

Demonstrate how to cut a piece of lumber 1/4 inch x 5 3/4 inches x 8 3/4 inches for the puppet face. The sequence is as follows:

1. Measure the 8 3/4 inch length with a foot ruler.
2. Draw a guide line for sawing, using a try square.
3. Cut off the piece on the line with a crosscut saw.

Demonstrate how to cut a piece of lumber 1/4 inch x 2 7/8 inches x 8 3/4 inches for the ear piece in the same way. Demonstrate how to lay out the puppet face, using a foot ruler and a try square. This includes the eyes, nose, mouth, and the shape of the head and the jaw. Draw the lines for the mouth slide.

Have the students set up the tools and equipment, and let them go to work. The learners will:

1. Measure and cut off a piece of lumber for the face.
2. Measure and cut off a piece of lumber for the ear piece.
3. Layout the features and contours of the face and head.

Plan a routine for cleanup:

1. Discuss the sequence of cleaning up the work area.
2. Find places to store each item.
3. Make each learner feel a responsibility for the total job.
4. Set a time limit.

SUMMARY

Hold an evaluation of the first work period. The following points should be discussed.

1. The accomplishments of the first day's work.
2. The ability to cut a piece of lumber to length properly and safely.
3. The room organization and the ability to work as a group.
4. Problems in laying out the face and head of the puppet.
5. Plans for the next work period.

LESSON 2. THE PERFORMING ARTS AND RELATED CAREERS

INTRODUCTION

Let the students know that work is to continue on the construction of the puppets. Before putting the learners to work, discuss the following points:

1. Changes needed in the room organization for more efficient group work.
2. Problems in designing and starting the puppet.
3. Review of the proper and safe use of tools.
4. Note the new tools that are to be demonstrated by the teacher.
5. Note the additions to the lumber and supply inventory.

Have the learners think about the importance and properties of each tool as they are used during the work period to construct the basic puppets.

TEACHER/STUDENT TASKS

Have the students set up the room for work, making any changes decided upon by the entire class.

Demonstrate the methods of shaping the puppet head as follows:

1. How to clamp the puppet head for shaping.
2. How to make angular cuts in a piece of lumber, using a crosscut saw and a guide block (safety block).
3. How to make contour cuts of the head, using a coping saw.
4. How to shape and round the head of the puppet, using a sandblock and #80 garnet cabinet paper.

Let the students go to work cutting and shaping the puppet head. Circulate among the learners and assist individuals having difficulty in clamping and cutting the puppet head.

Stop the group. Demonstrate to the entire class how to cut out the mouth slide of the puppet head, using a coping saw and a coping saw jack. Demonstrate how to complete the mouth slide.

1. Cut the flange.
2. Glue the flange to the mouth piece to complete the mouth slide.

Allow the work to continue. Follow up the demonstrations with individual assistance.

Demonstrate how to cut the ears and attach the ear piece to the back of the head as follows:

1. Place the ear piece horizontally across the back of the head and sketch the shape of the ears.
2. Cut out the shape of the ears with a coping saw. Smooth the ears with a sandblock.
3. Glue and nail the ear piece in position on the back of the head.
4. Cut the handling stick 3/4" x 3/4" x 13-1/2" using a crosscut saw in a bench hook. Longer lengths may be cut if a taller puppet is to be made.
5. Nail and glue the handling stick to the center of the ear piece at the back of the head.
6. Check to be sure the mouth slide moves up and down freely in front of the handling stick.

Continue the work period, observing the general progress. Demonstrate how to cut and attach the shoulders to the handling stick.

1. Cut a piece of lumber 1/4" x 5 3/4" x 8".
2. Draw lines which mark the angle of the shoulders.
3. Cut and smooth the shoulders.
4. Attach the shoulders to the handling stick.

Have the students clean up the work area and put away all tools, supplies, and projects.

Summary

Hold an evaluation with the learners, discussing the following points:

1. Progress made on the puppets in the first two work periods.
2. Problems in the construction of the puppets.
3. Problems in the proper use of tools and safety.
4. Difference in the properties and importance of the various tools
5. Skill development in the use of various tools.
6. Discuss some of the careers in television, motion pictures, and the theater. What abilities and skills are needed by the people in these careers?

LESSON 3. THE PERFORMING ARTS AND RELATED CAREERS

INTRODUCTION

Let the students know that during this work period the puppets are to be completed, along with the plans for a dramatic or musical production. As each person works on his puppet, have him try to plan ahead for the finishing details, such as:

1. Hair style
2. Skin color
3. Color of the eyes
4. Costume (painted or tailored)
5. Other features which give character to the puppet.

Ask the students to think of some of the skilled artists and craftsmen in the performing arts field who support the actors and performers. (Costume designers, hair stylists, writers, makeup men, directors, electricians, sound technicians, etc.).

Discuss some of the tools used by the various artists and craftsmen in the performing arts field and how important safety is in their daily use. What happens when a person has an accident and cannot work?

TEACHER, STUDENT TASKS

Have the students set up the room for work. Demonstrate how to cut a nose for the puppet, using a crosscut saw in the bench hook or mitre box. Allow the class to go to work finishing up the puppets. Stop the students as the need arises to discuss the following:

1. The hook-up and operation of the mouth slide.
2. Eyes and eyebrows.
3. Lips
4. Painting and mixing colors.
5. Hair (painted or yarn)
6. Costumes (painted or tailored)

Stop the entire class when any tools are used improperly. Discuss the consequences. Have the students clean up the work area and store the materials and the tools.

Summary

Ask the students to display the puppets and hold an evaluation of the work that has been completed. Have the students ask themselves the following questions.

1. Do the finished puppets measure up to the original plans?
2. Did each person do his best?
3. What tool skills were learned?
4. Was tool safety a problem?

Have the learners make final plans for a dramatic or musical production. Ask each child to consider taking the responsibility of doing the work of an artist or craftsman in the class production. Selections may be made from the following careers.

Producer	Dramatic Coach	Narrator
Technical Director	Advertising & Poster Designer	Music Director
Writer	Photographer or Cameraman	Lighting Technician
Scenery Designer	Costume Designer	Sound Technician
Prop Man	Wardrobe Director	Electrician
Scenic Artist	Miniature Set Constructor	Choreographer
Stage Manager	Art Director	Special Effects Technician

Mr. Nonacott is Supervisor of the Division of Career and Continuing Education, Los Angeles City Unified Schools, CA.

The Learning Experiences in Technology Project

Paul Kuwik

OVERVIEW

The Learning Experiences in Technology Project (LET) is designed as an innovative model elementary school project designed to integrate knowledge of technology and career education into the elementary classroom. The project has been developed by the School

District of Royal Oak, Michigan, in cooperation with Eastern Michigan University. The purpose of the project is to develop a student activity-based education model which could be utilized by Royal Oak and other school districts throughout the state and nation. The model which has been developed identifies interdisciplinary concepts and objectives that are used to teach throughout grades K-8. A delivery system has been identified which includes student learning activities, occupational role models, role playing, parent and community involvement, and field observations.

The project is used to enrich, reinforce, and give meaning and purpose to academic education. It provides students with a means of utilizing the basic skills in a practical way, using real-life situations. It is an attempt to encourage parents to become involved in the school, to involve the community in the classroom, and to extend the classroom into the community. Our society is complex and is constantly changing. LET provides a means for the school curriculum to keep pace with these changes and also provides experiences where students will be more aware, involved, and gain a greater understanding of our society and community. Technology, as used in this project, is defined as the knowledge of man's practice, or the knowledge of the way of doing things in society. Career education, as defined by this project, is preparation for life which maximizes the future options in life for youth and adults.

GOALS

The Learning Experiences in Technology project has established goals which will be accomplished by the end of the pilot three-year funding period.

The project will:

1. Teach knowledges, attitudes, and skills, using a methodology which will evolve from and be integrated with the existing school curriculum.

2. Include the involvement of the total community: parents, people resources, occupational role models, and physical resources.

3. Expose students to the identified concepts of technology and career education.

4. Involve the total school staff in the development and implementation of a model which could be used by other school districts.

5. Help students to understand and deal with the social, political, economic, and educational aspects of modern technology.

TEACHER EDUCATION

Pre-School

A minimum of 30 hours of pre-school workshop time was required for all volunteer teachers who entered I.E.I. Throughout the workshop, the participants were exposed to sessions which:

a) Examined theories of career development.

b) Introduced teachers to technology and its role in our society.

c) Applied theoretical models of career development and technology to the classroom curriculum.

d) Allowed each teacher the opportunity to acquire a basic knowledge and skill in the use of various tools and materials.

e) Integrated subject matter into teaching units.

f) Oriented teachers to effective means of utilizing community resource people.

g) Explained organizational matters such as budget and procedures for purchasing tools, materials, etc.

During School

Bi-weekly in-service meetings throughout the school year were offered for all first-year project teachers to augment summer workshop objectives, to plan, revise, and evaluate integrated teaching units, and to further expose the teachers to methods and materials pertaining to the project. Second- and third-year project teachers attend monthly in-service sessions, either within their school building or at the project office. It has been the experience of the project staff that a minimum of one-half day per month should be allocated for in-service, regardless of the experience level of the teacher. Teacher planning, material pilot testing, and evaluation are important components of teaching career education which require teacher development.

PROJECT ACCOMPLISHMENTS

Students. More than 5,000 elementary and 1,600 junior high school students have participated in the project during the three-year funded phase. Currently there are 2,600 elementary and 1,000 junior high school student participants. These students are actively involved in over 450 Integrated Teaching Units. Each unit integrates academic and career education and technology objectives, involves a role-playing experience, involves an activity-centered approach to learning, and involves the assistance of parents and a

community representative in either assisting with the supervision of students or discussing their career role. In addition, a field observation is also an important element in a teaching unit. Our students have participated in 100 field observations this school year.

Each year parents, teachers, and students are asked their opinion of Project LET. Their responses have been extremely positive. Indeed, we have not had a single parent comment that was negative. Teachers inform us they are excited about the program because it is an enrichment of the present curriculum, provides a variety of learning alternatives, children are excited and want to come to school, the self-image of students is improved, it provides continuity in the school curriculum, it provides learning that is more concrete, it encourages parental involvement in school, it provides good public relations, and it provides good communications between parent and child.

Teachers. There are currently 105 volunteer elementary teachers from 15 schools and 33 teachers and counselors for the four junior high schools who are participating in Project LET. Each of these teachers have agreed to produce and/or implement at least four teaching units during the course of the school year.

Parents and Community. Over 400 parents and 140 community representatives have assisted project teachers by discussing their career roles with students. There are two basic purposes for involving parents and community people in the program. 1) Parents and community will be more supportive of schools if they become involved in and have a positive experience with students and teachers in the classroom, and 2) Parents and community representatives have a great deal of expertise that is readily available to broaden student experiences.

DISSEMINATION

The project has produced 5 publications to date. Two implementation service guides are The Learning Experiences in Technology K-6 Guide for Implementation and The Learning Experiences in Technology 7-8 Guide for Implementation. Approximately 1,500 copies of our K-6 Guide have been disseminated since the project began. Eastern Michigan University uses this publication as a text for a required undergraduate course.

In addition, three integrated teaching unit handbooks were developed by classroom teachers to explain and show the structure of integrated teaching. Integrated Teaching Handbook K-2, Integrated Teaching Handbook 3-4, and Integrated Teaching Handbook 5-6.

Several school districts are now using Project LET materials to implement programs in their districts. If we can be of any assistance to you or your school district, we would be happy to try.

Dr. Kowik is an assistant professor at Eastern Michigan University, Ann Arbor, and Teacher Education Director of the LET Project.

Career Education in the Elementary Classroom

Ronald M. Frye

I am attempting to relate the material in this presentation as closely as possible to industrial occupations in the elementary school. This does not say that we are not covering other occupations in our program of career education. We do, in one way or another, cover all of the clusters listed by the U.S. Office of Education as being important to career education.

Career education is viewed, not only on a local level but on a national scale, as being supplemental to the existing curriculum. I like a quote from a project operating in the Portland, Oregon, schools. "Not to teach different things, but to teach differently." If we look at career education in this way, then it is easy to see that career education enhances the 3R's. It is not something that is going to replace the 3R's. We have very little hard evidence that career education is really enhancing the 3R's, but we have a great deal of empirical evidence to show that career education is making school more meaningful to many children throughout the United States. It is important to have a clear understanding of the definition of "industrial." In our program, and I think in any program of elementary industrial arts, it is vital that the definition of industrial be the broadest sense of the word. If, for example, you cannot believe that the making of candy is an industrial process, then I think you, as the teacher, are in trouble, and most certainly in the little community which I represent, the making of candy is vital to the economy of that community. If you were to attempt to tell a third grade student in the Cashmere School System that candy making was not an industrial occupation, he would differ with you, because his father or a neighbor may be employed at the Aplets and Cotlets Plant. Not only is it important to define industrial in the broadest sense of the word, but it is important for a teacher to maintain an open mind to industrial occupations. I have often said that the only thing that limits career education is the classroom teacher and the imagination possessed by that teacher. This, of course, can be said about any teacher. Your best teacher has a good imagination as well as a dedication to working with young people.

Any person working with elementary teachers must realize that these teachers have biases concerning industrial arts in the classroom. If it is approached as career education, and is looked at as being supplemental to the existing curriculum, some of these biases can be overcome, but we should realize they are there.

The first one is the bias of the over-crowded curriculum. If you approach a teacher about adding some material to her curriculum, you are in trouble, because her curriculum is already so crowded that it is difficult to add anything new.

The second bias is the image of industrial arts, or, "I have no training in woodworking." The teacher is of the opinion that industrial arts is woodworking and possibly a little bit of drafting, and she can't see that woodworking is going to enhance her program in any way. This, of course, goes back to defining industrial in the broadest sense of the word.

The third bias is clutter in the self-contained classroom. If the teacher looks upon industrial arts as being woodworking, then most certainly she is going to say that she does not want hammers, saws, chisels, planes, etc., operating in her self-contained classroom where it is going to cause sawdust on the floor and all of the things that would go along with the sawdust. When approaching an elementary teacher, you must realize that these biases probably exist.

The three communities of Cashmere, Peshastin, and Dryden are located on the eastern slope of the Cascade Mountains in North Central Washington. The economy is dominated by agriculture, largely apples, but also pears and some soft fruit like peaches, apricots, etc. We have incorporated career education into almost every classroom in the two school systems involved. From kindergarten to grade six, it is safe to say that every teacher has exposed every student, in one way or another, to career education.

On the elementary level, we are attempting to expose students to a variety of occupations, to inform them of occupational requirements, and where possible, involve students in experiencing, in one way or another, some of these occupations. At the elementary level we are attempting to stress career awareness, but we are also trying to make that awareness a little more meaningful and to get students involved in "hands-on" experiences wherever possible.

At the kindergarten level, the teachers have always worked on attitude development regarding the young student entering school. One method for the student to express attitudes, which has been used in our project, is to have the student express these attitudes through a puppet. Children will say many things when they have a hand puppet talking that they would not otherwise say.

Other attitudes necessary at the kindergarten level are sharing, individual understanding, and importance. Another thing we have done is played a little "What's My Line" type of deal, where we would bring in the elementary counselor, another teacher, secretary, principal, janitor, etc., have these people be identified by the students, and then have them talk a little about what they do as far as the school is concerned.

In the first grade, the teacher zeroed in on the janitor and constructed a bulletin board showing how the janitor is a worker and some of the tools he uses in his particular occupation. She then had the janitor take the students out and work with them so that they had an opportunity to use the buffer, a carpet sweeper, etc. Also, he took them into the lavatories and showed them that there are some disagreeable aspects of occupations that they should be aware of. After the janitor, we had the students walk down to our little 12-unit motel in Cashmere, and they got to talk with the manager. She showed them how she cleans and gets the rooms ready for guests when they came in. They then returned to the school and hired out to other teachers to do little jobs, such as cleaning desk tops, etc. They were paid for this in play money, and this then was related to their math or arithmetic program. To relate this to language arts, the students all wrote letters to the janitor. It is rather interesting that many of the students said such things as, "Dear Mr. Blake, I used to throw gum on the floor in the school, but now I know how hard it is to get off of the floor, so I won't do that any more." "Dear Mr. Blake, I used to walk in the school without wiping my feet, and track mud into the hallway, but I know how difficult it is to clean the floor now so I won't track mud in and I will be sure I wipe my feet every time I come into the school."

In relating it to art, they had the students draw pictures of Mr. Blake in operation, and in relating it to industrial processes, the teacher had the students construct little caddys and paint them. These caddys were made from coke boxes of six-pack carriers. The students would put in cleanser, polish, etc., and carry them with them, and then took them home and did some of the cleaning operations for their mothers.

The second grade set up a simple production line and made some Christmas decorations. Each student was assigned a task, and they got to see the importance of cooperation to get a job done as far as industry is concerned. Another thing done in the second grade was that the teachers had the students go home, discuss the occupation of the father and or the mother with the parent and bring some of the tools that parent used to school. The student would explain the parent's occupation to the classroom. One little girl's father was an electrician, so she brought some lineman's pliers, screw drivers, etc., things representing her father's occupation. This same little girl's mother was a beautician, so she brought some things that represented what her mother did. Another boy has a father who is a carpenter. He brought hammer, nails, saw, etc., and talked about what his father did.

The third grade has studied transportation for years. One of our third grades zeroed in on air transportation. With some disadvantaged funds, we had a group of students fly from the Wenatchee Airport to the Yakima Airport. Half of the students took the bus from Peshastin to Hakima, then they switched, and the second group flew from Yakima back to Wenatchee. While they were in the terminal, instead of talking only about the glamorous occupations of the pilot and the stewardess, the teacher made the total airplane revolve around people. The mechanic and his importance to the airplane getting off the ground; the baggage man, the ticket seller and their importance to getting the passenger on the airplane, the flight operations man and why he was important to air travel. Only one of the 35 students involved in this particular classroom had ever been on an airplane, and through an arrangement with Hughes Airwest and some disadvantaged funds, it only cost each student $5.00 to fly either from Wenatchee to Yakima or Yakima back to Wenatchee. If the student could not afford it, then it was picked up by Rotary, Kiwanis, or one of the service clubs in the area.

The fourth grade in our system really covers two areas, the health cluster and the industrial cluster. The fourth grade has operated on a panel basis. For one full week prior to bringing in the panel, the teachers have the total curriculum revolve around the industrial cluster. Then people are brought in as a panel. These people represent both labor and industry, as far as the various occupations are concerned. In the industrial cluster, for example, electricians, bricklayers, architects, contractors, etc., are brought in. These people make a short presentation about their particular occupation to the class. This is limited to approximately 5 minutes. Then two students are designated to ask questions which have been written out by the students prior to the arrival of the person on the panel. Most of the people who come for the first time are totally amazed by the questions fourth graders ask regarding their occupation. Some of the questions asked, for example, of an architect were: Have you ever designed anything that has fallen down? Do you every make any mistakes? Is math important in your particular occupation? After the panel is completed, arrangements are made for students to go in small groups with the particular person making the presentation. Those interested in what the architect would have to say on an individual basis would go with the architect, he would go into a little more depth about his particular occupation and let the students look at some of the tools of his trade. If it is an electrician, they would get a chance to look at the instruments he might use, such as a volt-ohm-meter, or work with some of his tools. One person we had in was a man who finishes dry wall. This particular man brought not only himself, but one of his helpers. He took a group of kids out on the playground and showed how a dry wall is finished and how the material that is gunned on a ceiling to make it at least semi-acoustical is gunned on. As a follow-up to the industrial cluster, the students are taken out to the playground. If you have ever seen confusion, it is a group of fourth grade children with three teachers who know nothing about industrial occupations, but yet with the imagination to allow kids to experiment and do some things that make learning meaningful. For example, a boy who is not particularly turned on by math really realized that if he s going to have a stool with four legs that are somewhat even, he must understand measurements.

Another thing we have done that has proven very rewarding is a little exchange with fourth graders from the metropolitan area in Seattle and the fourth graders at the Peshastin-Dryden Elementary School. The children, actually from Bellevue, which is just across the lake, came over and stayed two nights with the children in Dryden and Peshastin, and this Spring the children of Peshastin-Dryden will go over and spend two nights in a metropolitan setting. Many of them have never been in a metropolitan setting.

Our fifth grade students have a candy store. As I indicated earlier, candy is important to our little community because the Aplets and Cotlets Plant, the only one in the United States, is located in Cashmere. The students go to stores in the local community and find out about the importance of a proper attitude for a salesperson, greeting the public, traffic control in a store, and the display and packaging of items. Also, they visit our Aplets and Cotlets Plant and see automated machinery in operation, or the packaging, the cutting, etc., of the Aplets and the Cotlets. They then go back to their room and set up their little business for making candy, with the idea that these candies will be sold in the hallway to all of the students in the elementary school.

The sixth graders establish a corporation. This is really the way social studies is taught for a period of one trimester. The students decide on the name of the corporation and what they are going to manufacture. Such names have been used as The Dipsy Doodle Decal Company, The Wacky Wacky Candle Company, and the one used for the manufacture of pillows was Fluff and Stuff. I think that you can see that these names have quite a lot of student appeal. A total corporation is established, with a corporate head, a board of directors, finance staff, and all of the things necessary to operate this corporation. The students decide on a product which will sell, and then they go and sell stocks. The stocks are sold for 10¢ a share, with a limit of not more than 25 shares purchased by any one student. The product is then manufactured, and the sales team takes over. In the manufacturing process, there are workers, quality control at various stages, and the total production line.

With this corporate set-up, the students are enthused, the teacher is enthused, and the total process is one of learning and involvement. Any teacher could do it, at any grade level. It is a fantastic experience for a group of kids.

What did we do to get the teacher involved? We had a workshop involving every teacher in the system. We started out by telling them about career education, why it operated, how it operated, gave them some examples, had some people who were doing some career thing come in and show what they were doing. Then, we got the teachers writing. We merely stated that the teachers should begin with what they would do tomorrow, try to relate that in some way to a job, and then from that, get a career concept that they could teach to a group of young people.

We did two other things that were rather interesting. One, we taught a workshop entitled "Technology in a Shoebox." Basically, this is an individualized instructional package, but it is a manipulative type of instructional package, and it is truly contained in a shoebox. This shoebox is all decorated up so it has some student appeal, and when the student takes the lid off, the instructions for whatever might be contained inside are on the lid. The student merely has to read the instructions. We had eighteen teachers involved in this workshop. Each teacher produced three individual learning packages contained in a shoebox.

Another thing we did was to get the teachers out into all of the local industries we could possibly get them into. The administration provided some money for teacher substitutes, and teachers could take a day and spend it visiting one of the local industries, but it did not work because teachers, for the most part, were afraid to leave school and go out and visit industry. They were afraid of the criticism which would be leveled at them by persons in the community. So again, we organized a workshop, and had the teachers go out and visit various industries in the community and in the neighboring communities, such things as a machine shop, manufacturing processes, an apple juice company, mortuary, two of the local automotive agencies, a greenhouse-florist operation, and several other manufacturing concerns. The feedback from the teachers was almost unbelievable. The first places we visited, the teachers were rather lethargic and didn't ask too many questions, but then they realized that the people making the presentations and showing them through the various establishments were really not critical of education, but were happy to see educators visiting their particular concerns. The teachers opened up and felt that this was one of the most rewarding experiences they had ever had.

Dr. Frye is Director of the Career Education Project, Cashmere, Washington.

ACIAS

American Council of Industrial Arts Supervisors

Retirement and Depreciation of Industrial Arts Equipment

Joseph A. Prioli

School building design has changed considerably during recent years as a result of many ever-changing programs, and with these changes in building design, it becomes apparent that equipment needs must also be re-assessed. Recommendations for new equipment in some communities may be relatively easy, but it can be assumed that in most communities they just become recommendations until someone with perseverance convinces school committees of their needs.

In view of reassessing, it becomes incumbent upon those people whose sphere of responsibility covers shop equipment to search out all possible avenues of getting the most out of every dollar spent.

This means that a department head or a supervisor must present facts and figures to substantiate the expenditures of many dollars in order to properly equip shops that can provide students with programs that can prepare them for our industrial society.

Full consideration must be given to the fact that the large number of learners in the schools and the repetitive type of training experience causes school shop equipment to become worn or damaged much faster than the same equipment would in the hands of tradesmen.

In most mechanical devices, lubrication is necessary to minimize friction between moving parts. As a teacher or supervisor, you should consult with original manufacturer's specifications to ensure prolonged operating life of all equipment.

An analysis of the curriculum will help to determine the equipment needs. Educational specifications on types of equipment needs must be determined by competent staff who will consider long-range planning where possible and the life span of certain equipment and the type of constant use or abuse it may be subjected to. Advice or suggestions from a trade or occupational advisory committee can be of great value to school administrators in determining the value and analysis of many types of equipment.

Equipment will wear out in time, and replacement becomes necessary. In order to retire a piece of equipment because of wear, age, abuse, or breakage, the type of future use must be considered before a replacement is purchased. This again means that the expertise of school personnel who have had experience in certain areas should be put to use. It would be futile to accept a recommendation for replacement without finding out how much long-range planning lies ahead. It would also be futile to allow for a low bid on an inferior piece of equipment.

Depreciation factors and values can be set by formula if so desired, and many studies have been made to try to arrive at an accepted method. However, all situations and all schools are not alike. The following pages will show the results of one of the study groups consisting of industrial arts teachers.

Mr. Prioli is the Director of Occupational Education for the Brockton Public School System in Brockton, Massachusetts.

MECHANICAL DRAWING

#	Description	Value	Year	Life Span	Daily Number of Students
14	Planning Benches	$ 350 ea.	1970	20 years	100
1	Cabinet Drawing	600	1970	20 years	100
1	Table - Tracing	490	1970	10 years	10
1	Machine - Drafting	175	1970	5 years	10
1	Cutter - Paper	87.75	1970	5 years	10
20	Stools	10 ea.	1970	10 years	100
1	Table Drafting	450	1970	10 years	10
1	Machine - Drafting	247	1970	5 years	10
1	Projector - Overhead	90	1970	5 years	Teacher Use
1	Machine - Copy	1000	1970	10 years	Teacher Use
1	Machine - Blueprint	800	1970	10 years	10

HUMAN SERVICES CRAFTS LAB

#	Description	Value	Year	Life Span	Daily Number of Students
1	Frigidaire Refrigerator - Coppertone	$ 374	1974	10 years	25
1	Frigidaire Range - Coppertone	350	1974	10 years	30
1	Singer Sewing Machine - Tailor Head 31 - 15	325	1973	10 years	15
1	Singer Sewing Machine - Touch & Sew Model 639	160	1972	10 years	20
4	Singer Sewing Machines - Touch & Sew Model 629	160 ea.	1972	10 years	20
4	White Sewing Machines	110 ea.	1973	8 years	25
1	Steamaster Iron - Tank & Iron	225	1973	Approx. 15 yrs.	15
1	Kitchen Aid Dishwasher - Coppertone	210	1973	15 years	15

GRAPHIC COMMUNICATIONS LAB

#	Description	Value	Year	Life Span	Daily Number of Students
1	Rubber Stamp Machine	$ 400	1970	5 years	10
2	Letterpress Machines	5000	1970	Rollers only (1 year)	8
	Offset Machine 360	5000	1970	Every 6 mos. (check up)	5
	Paper Cutter	2000	1970	Blade repaired every year	5
	Scott Engraver	350	1970	3 years (broken) 1974	15
	20" Horizontal Camera	2500	1970	Lights repaired every year	5
	Bogan Enlarger	250	1970	Lights every 6 mos. - 4 years	15
1	Proof Press	1000	1970	Rollers Every Year	10
	Plate Exposure Unit	1500	1970	Lights every year	5
	Scott Stamping Machine	400	1970	5 years	5
2	Light Tables	250 ea.	1970	Lights about 5 yrs	10

PLANNING ROOM

#	Description	Value	Year	Life Span	Daily Number of Students
16	Drafting Desks	$ 350 ea.	1970	20 years	85
2	Metal Cabinets	108 ea.	1970	20 years	0
1	Wooden Cabinet (drawing supply)	1100 ea.	1970	20 years	0
1	Portable T.V. and Stand		1970	20 years	85
1	Paper Trimmer	87.25 ea.	1970	20 years	0
1	Desk	170 ea.	1970	20 years	0
1	Drafting Table	525 ea.	1970	20 years	0
20	Chair Stools	10 ea.	1970	20 years	20

GENERAL SHOP I

J-120	Band Saw	$ 950	1970	20 years	2 groups 100 each
J-110	Sander - Belt and Disc	500	1970	10 years	"
Rockwell	Planer - Thickness 18"	1600	1970	15-18 years	"
J-136	Jointer - 6"	420	1970	15-18 years	"
FA 88	Kiln	650	1970	10-15 years	"
Rockwell	Saw - 10" Circular	600	1970	20 years	"
23-612	Grinder - 6"	100	1970	20 years	"
70-628 Rockwell	Drill Press	700	1970	20 years	"
J-170	3 Wood Lathes	50	1970	25 years	"

SMALL ENGINES

Description	Value	Year	Life Span	Daily Number of Students
Drill Press (Bench Type)		1970	20 years	10
Drill Press (Floor Type)		1970	20 years	15
Valve Grinder		(Old High School)		
Bench Grinder (Bench Type)		1970	20 years	27
Magnetic Base		1971	25 years	5
First Aid Blanket		1972	30 years	40
Acrotime - Model 705		1973	30 years	5
Merl-o-Tronic - Model 98		1973	20 years	5
Tach & Dwell - Model 60	$ 30	1973	20 years	3
Drill - Electric - 0-3/8 chuck	23	1973	3 years	25
Reamer, Adjustable	200	1972	50 years	5
Dynometer	600	1971	35 years	10
Vise - Float Lock	40	1973	20 years	20

POWER MECHANICS

Description	Value	Year	Life Span	Daily Number of Students
Bench Transformer	Approx. $ 450	1970	25-30 years	8
Hampden Power Panel	Approx. $2000	1970	20-30 years	Instructor's use only; used every day by all in shop
Bench Motor	Approx. $ 300	1970	20 years	10
D.C. Machine	$ 40	1970	10 years*	10
Synchronous Alternator	Approx. $ 80	1970	10 years*	10
D. C. Generator	Approx. $ 80	1970	10 years*	10
Capacitor Start Motor	$ 35	1970	10 years*	10
Split Phase Motor	$ 35	1970	10 years*	10
Induction Motor	$ 35	1970	10 years*	10
Repulsion/Induction Motor	$ 35	1970	10 years*	10
Vega Hydraulic Bench	$1280	1970	15 years*	6
McKnight Power Trainer	$ 500	1973	15-25 years	2
Meter Panel	$ 250	1970	indefinite	By Instructor

*Subject to repair

ADVANCED WOODWORKING

#	Description	Value	Year	Life Span	Daily Number of Students
1	18" Planer	$2000	1970	20 years	40
1	12" Jointer	1800	1970	20 years	30
1	20" Table Saw	1200	1970	20 years	30
1	14" Radial Arm Saw	950	1970	20 years	25
1	17" Drill Press	400	1970	20 years	5
1	15" Drill Press	350	1970	20 years	5
1	12" Disc Sander	300	1970	15 years	20
1	24" Jig Saw	345	1970	15 years	20
1	20" Band Saw	1000	1970	15 years	30
1	Mortiser	900	1970	15 years	0
1	12" Lathe	750	1970	15 years	10
1	Mitre Box	100	1970	5 years	40
1	Tool Cabinet (with tools)	1500	1970	10 years	75
5 5	6' sq. Tool Benches 2' x 10' (with cabinets)	340 ea. 1150 ea.	1970	15 years	75
2	Wooden Storage Cabinets	300 ea.	1970	15 years	40
2	Metal Storage Cabinets	250 ea.	1970	15 years	75
1	Teacher's Desk	200	1970	15 years	
1	Lumber Rack	300	1970	15 years	Constant

BUILDING CONSTRUCTION

#	Description	Value	Year	Life Span	Daily Number of Students
#225 Powermatic	24" Surfacer	$3100	1969	20 years	90+ Adults
#GHN-E Tannerwitz	36" Band Saw	3000	1965	20 years	90+ Adults
#12 HD Northfield	12" Jointer	1200	1969	20 years	90+ Adults
#63490 Northfield	16" Table Saw	1100	1969	25 years	90+ Adults
Model 24 Powematic	Single End Tenoner	900	1969	20 years	Not in use No cutters
#S P Northfield	Shaper	800	1969	20 years	Not in use
#VS-61 Blunt	36" Lathe	750	1969	20 years	90+ Adults
4S-1C Blunt	36" Lathe	650	1969	20 years	90+ Adults
Boice-Crane	Bedor Drum Sander	900	1969	15 years	90+ Adults
Model J, Wilton	Spindle Sander	550	1969	15 years	90+ Adults
Type L, Powematic	Mortiser	850	1969	20 years	90+ Adults
#17 Rockwell	17" Drill Press	390	1969	20 years	90+ Adults
Dewalt	10" Cutoff Saw	180	1966	15 years	90+ Adults
Northfield	16" Unipoint Saw	1200	1969	20 years	Adults only
Dewalt	Panel Saw	700	1969	20 years	Adults

AUTOMOTIVE LAB

#	Description	Value	Year	Life Span	Daily Number of Students
	Engine Analyzer	$ 990	1970	10 years	12
	Brake Drum Lathe	1800	1970	15 years	4
	Valve Grinding Machine	400	1970	20 years	5
	Radiator Repair Tank	1600	1973	15 years	2
	Degreaser Tank	550	1970	20 years	6
2	Wheel Balancer	350	1970	10 years	2
2	Battery Charger	275		10 years	4
2	Jack Lifts	350		15 years	6
	Portable Front Wheel Aligner	950		10 years	2
	Engine Chain Fall	200	1970	20 years	2
	Drill Press	250	1970	20 years	4
	Lubrication Equipment	2800	1970	15 years	12
	Electric Bench Grinder	300	1970	10 years	6
	Tire Breakdown Machine - Elec.	700	1970	10 years	15
3	Hydraulic Floor Jacks	200 ea.	1970	5 years	6
	Hydraulic Transmission Jack	300	1970	10 years	5
	Electric Welder	400	1970	20 years	5
	Steam Cleaner	600	1972	10 years	10

RESTAURANT TRAINING

#	Description	Value	Year	Life Span	Daily Number of Students
2	Stainless Steel Range 10 burner & oven	$ 875	1970	10 years	60
	Ceramic broiler Black ceramic broiler	450	1968	10 years	60
	Charcoal broiler - Stainless steel hood & lava stones	395	1968	10 years	60
	4-hole gas burner and 1 oven Black range	425	1970	10 years	60
	Griddle - Stainless steel front	150	1970	10 years	60
	Pitco fryolater tubes run through oil	275	1970	5 years	60
	Vulcan fryolater tubes in bottom of oil	325	1968	5 years	60
	Refrigerator - Stainless steel 2-door reach-in	750	1965	10 years	60
	Walk-in chest refrigerator	1500	1970	10 years	60
	Garbage disposal Stainless steel front	450	1970	10 years	60

METAL FABRICATION

#	Description	Value	Year	Life Span	Daily Number of Students
5	10" Rockwell lathes	$1480 ea.	1970	5 years	8
2	14" Rockwell lathes	3304 ea.	1970	8 years	8
1	Vertical Miller	1510	1970	8 years	8
1	Horizontal Miller	3700	1968	10 years	4
2	Drill presses	800 ea.	1968	15 years	20
1	10" South Bend lathe	1700	1964	5 years	N/O
1	Hardinge Bench Lathe	3200	1968	10 years	2
1	Sanford surface grinder	1100	1968	15 years	4
1	Lee cutter grinder	3900	1970	20 years	N/O
1	Keller power hacksaw	859	1970	10 years	16
1	Bench grinder	230	1970	20 years	20
1	Foot squaring shear	645	1965	20 years	10
1	Box & Pan Brake	38'	1965	20 years	6
2	Wall Benches	182 ea.	1970	20 years	160
1	Wall bench	340	1970	20 year	75
4	Soldering benches	124 ea.	1964	20 years	80
3	Metal benches	368 ea.	1970	20 years	100
1	Tool storage cabinet	1591	1970	8 years	160

WOODWORKING

#	Description	Value	Year	Life Span	Daily Number of Students
3	Blount Wood Lathe	$ 550 ea.	1970	15 years	3
1	14" Tilt-arbor saw	1200	1970	20-25 years	25
1	10" Tilt-crbor saw	300	1960	20-25 years	25
1	20" Band saw	700	1970	20-25 years	6
1	12" Disc sander	250	1970	10-15 years	5
1	8" jointer	500	1970	20-25 years	35
1	18" planer	1500	1970	20-25 years	35
1	24" scroll saw	350	1970	5-10 years	25
1	7" drill press	150	1970	5-10 years	10
1	Portable saw	100	1970	2-5 years	2
1	Finish sander	50	1970	2-5 years	10
2	Belt sanders	200	1970	2-5 years	10
1	Hand drill - 3/8"	70	1973	2-5 years	15
2	Routers	50 ea.	1965	10 years	4

ELECTRONIC LABORATORY

#	Description	Value	Year	Life Span	Daily Number of Students
1	Weston model 80-VOM Ammeter	$ 105	1971	20 years	5
1	Weston model 8h AC Ammeter	90	1971	20 years	5-10
1	Telequipment Oscilloscope	595	1971	25-30 years	10
1	RCA Frequency Generator	102	1973	20 years	2-3
1	RCA Signal Generator	76	1973	20 years	2-3
1	EICO DC power supply	59	1973	15 years	5
2	Simpson VOM's	130	1972	10-15 years	20-30
1	EICO 1020-W DC power supply	20	1973	15 years	1-2
3	Weston AC Ammeter	270	1972	20 years	10
1	EICO 1030-W DC power supply	128	1973	20 years	5
1	Weston Digital meter	394	1973	30 years	1-5
2	Simpson VOM	130	1973	10-15 years	20-30
1	VOH Ohmyst - RCA	112	1973	20 years	2-4
1	Weston Clamp-Ammeter	61	1971	30 years	1-2
1	Heath Capacitor checker	40	1973	20 years	3-5
1	Heath ACVTVM	42	1973	20 years	5
1	Heath RF Generator	70	1973	20 years	2-3
1	Heath Audio Generator	50	1973	20 years	2-3
4	Heath VTVM	160	1973	15-20 years	20
1	Heath 50 VDC supply	80	1973	20 years	2-5

NURSING ASSISTANT LAB

#	Description	Value	Year	Life Span	Daily Number of Students
2	Hospital Beds - Manual Gatch	$ 500	1968	5-6 years	100
2	Mattress, Twin Size, Innerspring	120	1968	10 years	100
2	Bed-side Stands, Metal	300	1968	15 years	100
1	Overbed Tab	100	1971	15 years	100
2	Wheelchairs	200	1971 1973	10 years	100 (But used about 4 times per yr.)
1	Bedcradle		1971		
1	I.V. Pole		1971		
1 pair	Bed Side-rails, Metal		1971	15 years	100

GENERAL SHOP II

#	Description	Value	Year	Life Span	Daily Number of Students
J-120	Bandsaw	$ 950	1970	20 years	100+
J-170	3 Lathes, Wood	750	1970	30 years	100+
J-110	Sander, Belt and Disc	440	1970	15 years	100+
Rockwell	Planer, Thickness, 18"	1600	1970	20 years	100+
J-136	Jointer, 6"	420	1970	20 years	100+
Rockwell	10" tilt-arbor circular saw	600	1970	20 years	100+
70-628 Rockwell	Drill Press	700	1970	20 years	100+
23-612 Rockwell	6" Grinder	100	1970	20 years	100+
3636-131 J-Line	Spray Booth	645	1970	30 years	100+
#10	Plastic Work Center	1665	1970	10-15 years	100+

ENGINEERING GRAPHIC

#	Description	Value	Year	Life Span	Daily Number of Students
15	Drafting tables (dual students)	$ 350	1970	20 years	100
1	Mayline (desk-o-matic) drafting table, steel	450	1970	20 years	8
1	Hamilton (autoshift) drafting table, steel	450	1970	20 years	8
1	Mayline drafting table with drawers, wooden	300	1970	15 years	8
1	Tracing table with 4-40 watt fluorescent tubes	490	1970	10 years	15
1	K&E Paragon Auto flo drafting machine	247	1970	10 years	8
30	Vemco 24" drafting machine	60c	1970	5 years	100
1	Large paper shear	87.75	1970	5 years	30
33	Drafting stools	10	1970	10 years	100
1	Overhead transparency projector	90	1970	5 years	Teacher use

RELATED AUTOMOTIVE

#	Description	Value	Year	Life Span	Daily Number of Students
1	Tool Kit	$ 850	1973	20 years	45+
1	V-8 Chev. Engine	450	1973	10 years	45+
1	Chev. Auto Trans.	150	1973	10 years	45+
1	Rear end assembly	100	1973	10 years	45+
1	6 Cyl. Display Engine	25		20 years	45+
15	Drawing Tables	8 at $350 ea.	1970	10 years	
1	Tracing Table	490	1970	20 years	
1	Drawing Table	1100	1970	20 years	
1	Drawing Table	450	1970	20 years	
	Drafting machine	175	1970	10 years	

ACIATE

American Council of Industrial Arts Teacher Educators

Competency-Based Industrial Arts Teacher Education and Certification: A Status Study

Stanley E. Brooks
Jack C. Brueckman, Jr.

This nationwide status study is the result of several conversations which occurred at the 1973 American Industrial Arts Association Convention in Atlantic City. The writers have been involved with the formulation and implementation of New York State's Industrial Arts Trial Certification Project for the past two years. It became apparent as we spoke with the numerous people in Atlantic City that many institutions were getting involved with the CBTE movement. Furthermore, if there were several industrial arts teacher education institutions actively engaged in this study of CBTE, then they may have materials which could be of help to institutions who are beginning their own CBTE study.

The 1972-1973 Industrial Teacher Education Directory, sponsored by ACIATE and NAITTE and compiled by Dr. Ervin Dennis, was used as the source for the institutions surveyed. A total of 198 questionnaires were distributed to colleges and universities which indicated that they had industrial arts teacher preparation programs. One hundred and forty returns were received, reflecting a 70% return. However, useable data was found on 136 returns.

Despite the 70% return, the resulting data did not include responses from some institutions which are known to have made substantial progress in the development of a CBTE program.

THE STUDY

The results of the first two questions on the questionnaire indicated that over 50% of the institutions responding have staffs who are currently studying CBTE and, more importantly, 34 (25%) of the staffs indicated that they were engaged in an operational CBTE program.

1. Is your staff currently studying CBTE?
   Yes 72 No 64
2. Is your staff engaged in an operational CBTE?
   Yes 34 No 99

For obvious reasons of clarity and definition, it was necessary to attempt to identify the specific format and direction for the previously indicated implementation. The responses indicated that the efforts of implementation are primarily concentrated in the following areas:

Individual course	-	24 institutions
Profession sequence	-	25 institutions
Technical sequence	-	18 institutions
General sequence	-	3 institutions
Total Industrial Arts Program	-	36 institutions

Approximately 20% (28) of the respondents indicated that CBTE was a total staff project at their institutions. However, with the additional institutions reporting that the commitment involved a few staff or at least one staff member's efforts, the commitment increases to 50% (68).

These 68 institutions also reported that their efforts in CBTE are primarily directed toward undergraduate programs (50), and only two reported a graduate-level emphasis. The remaining 16 did, however, indicate that at their institutions efforts were being made at both the graduate and undergraduate levels.

The current status of involvement at the responding institutions is best indicated by the following tabulation of their appraisal according to these categories:

Cautiously Watching	-	12 institutions
Beginning	-	48 institutions
Well Along	-	8 institutions
Done and Waiting	-	3 institutions

This indicates that over 50% of the institutions responding to this survey have at least taken note of the potential ramifications of CBTE to their industrial arts programs. Included among these institutions are at least six which indicated that they have or will soon have printed materials available. Apparently these materials vary in scope from D. L. Jelden's "Learning Activity Packages for Electronics" to copies of an entire program, in prototype form, from Millersville State College. Our next step in attempting to gain more information concerning IACBTE will be to visit many of the previously-listed institutions to obtain first-hand knowledge about their program developments.

It is also interesting to note the small number (15) of industrial arts departments that have been represented at the various regional and national meetings during 1972-1973. It is quite evident, from several comments, that the lack of institutional financing contributed greatly to this apparent lack of participation. However, these organizations have either had entire programs or have focused a major portion of their sessions on CBTE. The attendance by organizations is as follows:

No. of I. A. Departments Participating	Organization	Date	Location
14	American Assoc. for Colleges of Teacher Education	February	Chicago
4	Assn. of Teacher Educators	February	Chicago
9	American Society for Curriculum Development	March	Minneapolis
14	AACTE 7 Regional Clinics	November	Salt Lake City
		November	St. Louis (2)
		January	Dallas
		March	Atlanta
		April	Boston
		May	San Diego

One of the basic requirements for any CBTE program appears to be a consortium of representatives from such agencies as the public schools, colleges and/or universities, professional associations, bargaining units, and the community. These representatives usually form the policy-recommending unit for certification procedures and educational decision-making. It is for this reason that the following agencies were identified and the respondents were requested to indicate to what degree their institutions are involved with these agencies.

	Degree of Involvement			
Agency	None	Some	Considerable	Total
Public School I. A. Teachers	10	31	9	1
Professional I. A. Assn.	14	22	6	1
I. A. College Students	5	33	14	
Public School Administrators	15	29	6	
Public School Guidance Personnel	22	14	3	
Inter-Disciplinary Department—College	12	16	16	3
Lay Advisory Groups	18	17	5	
Others	1	5	4	

Many (79) respondents did not record any degree of involvement and, therefore, are not represented in the previous chart. If, as Stanley Elam[1] and others[2] indicate, a broad base for decision making is an essential characteristic of CBTE, much must be done to open the channels of discourse and interaction among these contributing agencies.

The most frequent unsolicited comment, other than congratulatory, centered around a request for continued communications and involvement by the responding agencies.

It is apparent to the authors that there is a pressing need for increased dialogue concerning CBTE within the industrial arts discipline and among our other professional colleagues. This, hopefully, will take place initially in the follow-up and reactions to this status study. Our national association might well consider the feasibility of becoming involved in the promotion of regional and national efforts to study, coordinate, and serve as a clearing house for IACBTE. We also support Dean Howsam's (University of Houston) position that

> Probably no educational movement of recent times has shown so much promise as this application of a common principle — competency-based instructional — simultaneously to practice in the schools and to the education of teachers for the schools. The prospects for teacher education seem nothing short of phenomenal.

REFERENCES

1. Stanley Elam, "Performance-Based Teacher Education. What Is The State of the Art?" Washington, D.C. American Association of Colleges for Teacher Education, 1972.
2. W. Robert Houston and Robert B. Howsam, Eds. "Competency Based Teacher Education· Progress, Problems and Prospects" Palo Alto, California: Science Research Associates, 1972.

Dr. Brooks and Dr. Brueckman are members of the faculty of the Industrial Arts Division of State University College at Buffalo, NY.

One College's Approach

A. Dean Hauenstein

Florida International University is a state institution that has developed a competency-based curriculum for all of its School of Education offerings at both the undergraduate and graduate levels. FIU is an upper-division graduate institution that opened its doors in 1972 and will graduate its first two-year program students in the Spring Quarter, 1974.

About 80% of the students enter FIU as juniors from Miami-Dade or Broward Community College with an Associate of Arts or Associate of Science degree. FIU has no dormitories and thus has a commuter population, of which about 60% of the students work. The University opened with about 5,600 students and has about 9,800 students in its second year of operation. Enrollment projections for 1980 approach 30,000 students. The evening program is as large as the day-time program.

The University has one college, Arts and Sciences, and five professional schools. Education; Business and Organizational Sciences, Technology, Health and Social Services; and Hotel, Food and Travel Services. The School of Education and the School of Business have masters degree programs. The University also operates a large continuing education program which services the South Florida community.

The School of Education is organized into five divisions. 1) Vocational and Adult Education, which includes programs in Industrial Arts Education, Vocational Industrial Education, Technical Education, Home Economics Education, and Adult Education, 2) Curriculum and Instruction, 3) Special Education and Pupil Services, 4) General Professional Education and Educational Administration, and 5) Health, and Physical Education, Recreation and Athletics. Faculty with strong CBTE interests were recruited to develop and teach the school's programs. At present, the school has 42 full-time faculty members.

CBTE PREMISE

Efforts have been directed toward establishing programs that would be:

1. Developed to performance-based specifications.
2. Anchored in criterion-referenced evaluation.
3. Much less campus-bound and much more set in the field.

4. Committed to individualizing instruction.
5. Characterized by a multimedia-based instructional process with high incidence of self-instructional possibilities. (1)

The teacher education programs were built on the premise that the actual competencies required of the trainees for program completion must be identified and spelled out for all to see. The trainee would know beforehand exactly what he/she must achieve and be able to do. The trainee would have to demonstrate his/her ability to facilitate desirable learning situations and positive learner outcomes.

In addition, the trainee would be held accountable for a knowledge base about curriculum, teaching, and evaluation as derived from the literature. It was also felt that the instructional process should be varied and include alternate routes to achieving competencies.

FORMAT AND TERMINOLOGY

One of the initial assignments of the 1971-72 planning staff was to decide on the format and terminology of the CBTE delivery system. A survey of the literature revealed nearly as many different formats and terms as there were CBTE programs. For example, teachers are being trained from WILKITS, LAPS, and UNIPACs, to name a few. Further, each of these delivery packages are comprised of behavioral objectives, competencies, tasks, etc. The staff felt it was necessary to establish a schoolwide set of common terms and format that would communicate the instructors' intents to students, faculty, trainees, and the teaching profession. It was decided that, within the course structure of the State University System, the most appropriate format would include modules, tasks, enablers, instructional resources, and entry behavior. Each course offered by the school is composed of a set of modules with the following format. (2)

Module — A cluster of related tasks. (The module title describes the competency to be learned).

Introduction — A general description of the content and purpose of the module.

Goal — A short, concise statement of the over-all objective of the module.

Task — The instructional competency (stated in behavioral terms) to be demonstrated by the trainee.

Enabler — An objective or set of objectives prerequisite to the successful completion of the task. Through the accomplishment of the enablers, the trainee demonstrates that he/she has the necessary knowledge and/or skill to complete the task.

Instructional Resources — A list of required and/or suggested instructional materials and learning experiences that would lead to the successful completion of the particular task(s) and enablers(s).

Entry Behavior — A description of the necessary prerequisite skills of the module.

INSTRUCTIONAL PROCESS

At the first class meeting the student is supplied with a handbook which contains the modules for the course. The first class meeting is used to describe the course, objectives, activities and tasks, schedule field experiences, and develop class calendars. From this time on, instructors hold regularly scheduled class meetings, conduct seminars, and organize discussion groups and laboratory work that students may attend. The extent to which class attendance is mandatory varies with the course. The pattern of the instructional process for a module is shown in Figure 1.

When a trainee completes all of the tasks at the specified criterion level, he/she receives a grade of CR (Credit). If a student does not meet the criteria, he/she receives a grade of NC (No Credit) and is recycled through the instructional process until the task criterion level is achieved. Students can also receive HCR (Honors Credit) by contracting with the instructor for modules which exhibit higher criterion levels of quality and quantity.

CBTE PROGRAM DESIGN FACTORS

The Florida legislature has strongly urged that all teacher education programs should be competency-based by 1975. FIU was approved to develop and implement programs on an experimental basis, to see if CBTE makes a difference in teacher effectiveness.

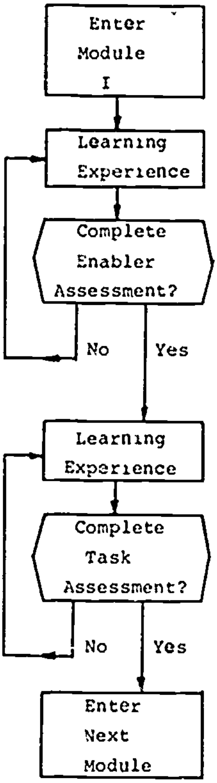


Figure 1. Instructional Process.

In designing programs, three major factors had to be considered: state legislation and teacher certification requirements, the goals of the university, and the identification of competencies.

Questions such as the following had to be answered. What are the competencies that should be developed for all teachers? For industrial arts teachers? Do the competencies fall within present certification requirements? Will certification need to be changed? Will the goals of the university and school be met? Are funds available for developing and implementing CBTE programs? Figure 2 shows the relationship of the factors that had to be recognized in program design.

UNDERGRADUATE PROGRAM/COMPETENCIES

During the 1971-72 planning year, the author's task was to plan the undergraduate and graduate industrial arts teacher education programs. Many intra-division meetings produced agreed-upon common professional undergraduate teaching competencies. All trainees in the School of Education would develop basic knowledge and skill proficiency in teaching in three core courses: Schooling in America (basic knowledge and exposure to schools), General Teaching Laboratory I (basic teaching skills), and General Teaching Laboratory II (human relations and cultural differences). Specific knowledges, attitudes, and skills would be developed by each division. For example, all vocational division students develop more specific competencies in: course planning, instructional media, and teaching techniques. In addition, industrial arts students develop competencies in special methods of teaching industrial arts. The minimum professional education component for industrial arts is 45 quarter hours.

Technical competency areas were identified in relation to the body of knowledge developed by the Industrial Arts Curriculum Project ($2.5 million research project), state and national trends in industrial arts, legislation, and state certification requirements (45 quarter hours in 4 of 6 areas). In 1971, the Florida certification areas were: woods, metals, graphic communications, electricity/electronics, power and transportation, and arts and crafts.

In deciding priority competencies, the following rationale was used. If students had only one course in industrial arts, what would be the most important knowledges, attitudes,

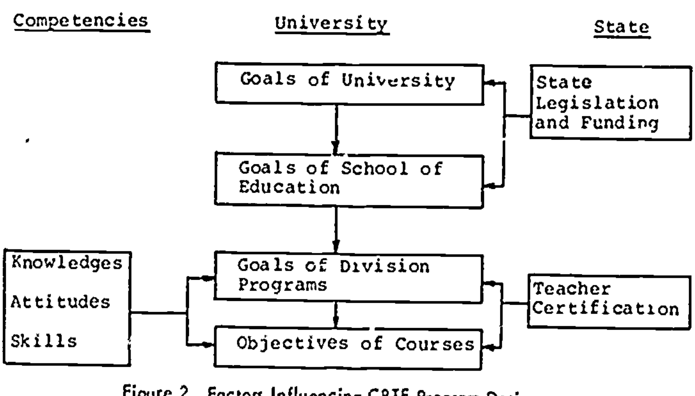


Figure 2. Factors Influencing CBTE Program Design

PROGRAM OF STUDIES

FOR

BACHELOR OF SCIENCE IN EDUCATION

SPECIALTY: INDUSTRIAL ARTS EDUCATION

1. FOUNDATIONS OF EDUCATION
   Psychological and Sociological foundations taken in the lower division.

2. PROFESSIONAL EDUCATION PREPARATION

		CREDITS
EDU 305	Schooling in America	5
EDU 311	General Teaching Laboratory I	5
EDU 312	General Teaching Laboratory II	5
EVO 306	Course Planning in Vocational Education	5
EIA 405	Instruction in Industrial Arts	5
EVO 406	Special Teaching Laboratory	5
EVO 425	Student Teaching	15

3. TECHNICAL PREPARATION
   A. Required: A minimum of 45 quarter hours are required for certification with a minimum of 10 quarter hours in each of the following areas.

CONSTRUCTION		
IAT 305	Contruction Technology	5
IAT 405	Construction Processes	5
*IAT 420	Architectural Drafting	5
MANUFACTURING		
IAT 306	Manufacturing Technology	5
IAT 419	Materials Processing	5
IAT 415	Drafting I	5
or		
IAT 416	Drafting II	5
*IAT 409	Materials of Industry	5
*IAT 406	Industrial Research and Development	5
GRAPHIC COMMUNICATIONS		
IAT 307	Reprographics	5
IAT 407	Planographics	5
*IAT 408	Photographics	5
POWER		
IAT 417	Mechanical Power Systems I	5
IAT 418	Electrical/Electronics Systems	5
*ENT 325	Review of Electronic Concepts	5
*IAT 422	Mechanical Power Systems II	5

   B. Technical Electives - See asterisked courses above and other courses offered by the School of Technology.

4. ADVISED ELECTIVES
   Coursework to make the total of 1, 2, 3 and 4 equal to a minimum of 90 quarter hours

*Courses which are electives.

Figure 3. Industrial Arts Education
Bachelor of Science Degree Program at FIU.

and skills they should know and be able to demonstrate? If they had two courses, what should they know and be able to do? Three courses? Four, five, six, seven, eight, etc., courses? Forty-five quarter hours? Figure 3 shows the present undergraduate industrial arts program at FIU.

The competency areas of construction, manufacturing, industrial research and development, materials processing, graphic communications, and power (electrical and mechanical) were submitted to the state industrial arts certification subcommittee for consideration. Under the leadership of Dr. Ralph Steeb, State Supervisor of Industrial Arts, a dual track for industrial arts teacher certification was approved to accommodate FIU and other state universities and school districts moving in this direction.

Most students entering FIU enter at the junior level with an A.A. or A.S. degree from the community colleges. Thus, FIU has two years or 90 quarter hours to develop professional teaching competencies and technical industrial arts competencies (45 quarter hours each). The professional teaching competencies are taught by the Division of Vocational

PROGRAM OF STUDIES FOR MASTER OF SCIENCE IN EDUCATION SPECIALTY: INDUSTRIAL ARTS EDUCATION			
1.	REQUIRED CORE		CREDITS
	EVO 506	Trends and Issues in Vocational Education	4
	EVO 507	Curriculum Development in Vocational Education	4
	EVO 616	Research in Vocational and Adult Education	4
	EDU 506	Analysis of Teaching	4
	EVO 696	Seminar in Vocational Education	4
2.	AREA OF PROFESSIONAL EMPHASIS		9-13
	EIA 605	Analysis of Industrial Arts Education	4
	Students, under the direction of their advisor, may develop professional competencies in their area of emphasis via school-based field experiences, seminars, methods courses, workshops, or independent study.		
3.	TECHNICAL ELECTIVES		8-12
	Students are encouraged to select courses that will increase their subject area technical competence.		

Figure 4. Industrial Arts Education Master of Science Degree Program at FIU.

and Adult Education, while the technical industrial arts competencies are taught by the School of Technology, Division of Industrial Technology, in accordance with the course specifications developed by industrial arts teacher educators.

GRADUATE PROGRAM/COMPETENCIES

As graduate programs primarily service in-service teachers, several assumptions were made for program design.

- Certified teachers possess the technical area skills under which they were certified.
- Teachers desire to increase or update their teaching and technical skills.
- Some teachers desire to gain administrative and supervisory skills.
- Teachers want higher degrees for higher salaries.
- Teachers not fully certified desire full certification.
- There is a body of instructional competencies common to all teachers.

With these assumptions in mind, research was conducted at the local level on the needs of industrial arts teachers and junior and senior high school programs. As a result of the research, two 45-quarter-hour graduate track programs were designed. Curriculum and Instruction, and Administration and Supervision.

The curriculum and instruction program is designed to develop competencies which increase effectiveness and efficiency in relation to knowledge of the field, curriculum development, teaching skills, technical skills, problem solving and professional interaction. Field experiences allow students to demonstrate their knowledge and skills in school situations. See Figure 4 for the curriculum and instruction program.

PROGRAM OF STUDIES FOR MASTER OF SCIENCE IN EDUCATION SPECIALTY: ADMINISTRATION AND SUPERVISION OF VOCATIONAL EDUCATION		
1. REQUIRED CORE		CREDITS
EVO 507	Curriculum Development in Vocational Education	4
EVO 517	Supervision and Coordination of Vocational Education Programs	4
EVO 526	Community Relations and Resources for Vocational Education	4
EVO 606	Administration of Local Vocational Education Programs	4
EVO 696	Seminar in Vocational Education	4
EDA 605	The Organization and Operation of Public School Systems	4
EDA 607	The Administration of a Secondary School	4
EDA 608	Supervision in Education	4
EDA 609	Curriculum Development and Evaluation	4
2. AREA OF PROFESSIONAL EMPHASIS		
EVO 695	Supervised Field Experience	4-8
Course work in specialized field to make total of 1 and 2 equal to a minimum of 45 quarter hours.		

Figure 5. Administration and Supervision of Vocational Education Master of Science Degree Program at FIU.

The administration and supervision program is designed to develop initial operational competencies in relation to knowledge of the field, decision making, curriculum and program planning, supervising teachers, coordinating work, utilizing community resources, and administering programs. Field experiences allow students to participate and practice administrative and supervisory skills in school environments. See Figure 5 for the administration and supervision program.

MODEL FOR COMPETENCY DEVELOPMENT/IMPLEMENTATION

Each course title in a program identifies a broad area of competency. A model needed to be developed to systematically delineate the competencies (modules of each course), the tasks, and the enablers. The author developed the model shown in Figure 6. (3)

Each course was analyzed in terms of the process required to achieve a broad understanding and skill in the competency area. These process steps are the modules or competencies to be achieved.

In effect, a behavioral body of knowledge for each competency area was delineated. The criteria used for identifying modules was as follows:

1. The terminology must be expressed in gerund nouns (ING endings indicating doing).
2. The modules must be totally inclusive of the competency area.
3. The modules must be mutually exclusive of each other (little or no overlap).

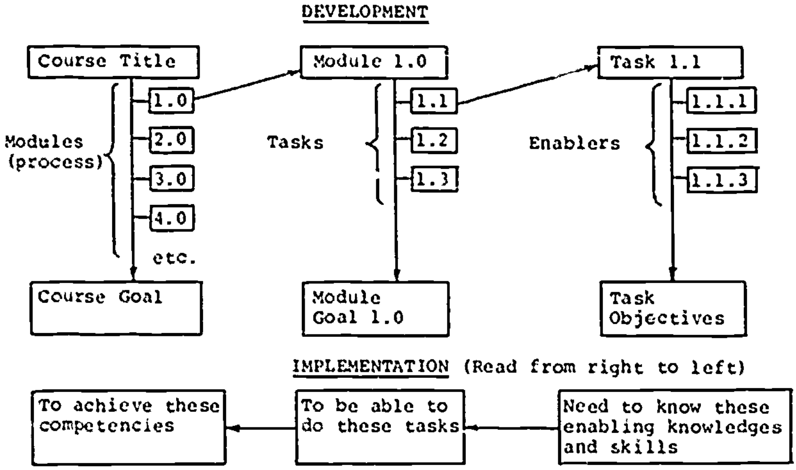


Figure 6. Competency Development and Implementation Model

4. Terminology must be arranged in a logical order.
5. The modules must be functionally adequate (be able to be implemented).

After the modules were identified, the course goal statement was written. Each competency (module) was then analyzed for the tasks required to achieve proficiency. The same criteria was used, that is, ING endings, total inclusiveness, mutual exclusiveness, logical order, and functional adequacy. Once the tasks were delineated, they could be expressed in behavioral performance terms with criterion levels.

Each task was then analyzed for "what one needs to know to be able to perform the task." This effort resulted in enabling knowledges and skills. Enablers may take the form of cognitive information or smaller sub-tasks which contribute to the larger task. Enabler statements were then written as objectives and procedures.

It is vital to express the modules and tasks in gerund nouns (ING endings) including action or doing – thus observable behaviors which also become the act or task term for the behavioral objectives and provide a logical sequence for achievement. One needs only to add the conditions and criterion level to suit the local situation. (3)

Some courses in the program provide cognitive knowledge of the field, which are essentially enabling courses to other more physically-oriented performance courses. These knowledge courses are developed the same way as the performance courses. The knowledge competencies are usually demonstrated on paper, verbally, or in role-playing situations.

FIELD EXPERIENCES

Undergraduate students are introduced to field experiences early in their program and continue field relationship with schools and the community throughout their two-year program. Initial contact is made and continued throughout the three core teaching courses. The special teaching laboratories (operated by the division in the local schools) ready the trainee for the student teaching experience. The field experience culminates with student teaching.

The graduate program field experiences are continuous because the teachers are in the schools. However, the culminating field experiences require the student to work with other teachers or schools on curriculum and instructional problems or to be an administrative assistant and supervisor of other teachers in the school system.

CONCLUDING REMARKS

Although EIU is only in its second year of operation, from our experience CBTE appears to be a viable alternative for industrial arts teacher education and teacher education at large. Administrators who have employed the few industrial arts students who have graduated (we expect to graduate about 30 students in Spring 1974) indicate that the teachers are indeed very competent. A three-year follow-up study has begun to gather data on our graduates. It is too early at this point to draw any conclusions. However, School of Education research data indicate that about 95% of the students enrolled in CBTE programs school-wide strongly favor CBTE as opposed to traditional programs.

REFERENCES

1. Sowards, G. Wesley, Dean, School of Education. "One Year in Retrospect." PBTE, Vol. 2, No. 5, November 1973. Multi-State Consortium on Performance-Based Teacher Education.
2. Gallagher, Paul D., Assistant Dean for Instructional Systems. "Module Format and the Instructional Process." PBTE, Vol. 2, No. 5, November 1973, Multi-State Consortium on Performance-Based Teacher Education.
3. Hauenstein, A. Dean, "Educational Reform through Performance-Based Curriculum." Industrial Arts and the Challenge of an Urban Society. American Industrial Arts Association, Washington, D.C. 1973.

Dr. Hauenstein is an Associate Professor in the Division of Vocational and Adult Education, School of Education, Florida International University, Miami, Florida.

The Role of the Public School in CBTE

Carl W. Heiner

> Is it necessary that practicing professionals at all levels share in the governance of professional preparation? Will classroom teacher unions call the shots? Will professors in the educational foundations no longer be needed? Will the college of education be moved off campus?[1]

These questions depict major controversial issues in the CBTE movement. The issues relate directly to public school personnel being included in CBTE and their sharing in the decision-making processes which effect certification requirements. The issues are centered around the concept of collaboration between the public school teachers and college educators. Collaboration involves "a sharing of power, sharing in the planning, organization, operation, and evaluation of programs, and sharing in the commitment of resources."[2] Collaborations between the college and public school has not been a common goal. Larry Swift of Western Washington State College has indicated in his article, "A Swan, A Pike, and A Crab in Search of a Management System," that

> many faculty members at colleges and universities have seen the development of the new certification process as an invasion of their teacher training domain."[3]

Teachers, he further states,

> have had some unfortunate experiences in working with colleges. At times they have seen themselves as having been manipulated by colleges to provide classroom space and labor for student teaching programs without being permitted to contribute any expertise to such programs."[4]

Despite the impact of this lack of collaboration, the educators must compromise.

Many states[5] are mandating CBTE programs where a collaborative effort is required in order to govern the program.

Collaboration between teacher-training institutes and public schools have demonstrated its value to education. If the two parties can develop a partnership, respecting each other's views, rights, and responsibilities, the rewards are numerous. Wendell C. Allen, in his article, "Comments on Collaboration in Teacher Education," states that

"The rewards of collaboration must be in program improvement and in professional growth and satisfaction of participants and their clients."[6] Among the values which Allen includes are:

1. Mutual commitment tends to stimulate efforts to resolve differences among participants.
2. The time and energy spent in collaboration increases mutual respect among participants, fosters openness and ready feedback, and leads to a realistic approach in decision making.
3. Participants' sense of responsibility is promoted by the openness of collaborative processes.
4. Collaboration in teacher preparation enhances the likelihood that provisions for internal and external evaluation of programs and their management will be helpful and thorough.[7]

Collaboration can emerge as a cooperative effort to produce enormous results for the improvement of education. Failure of the groups to collaborate may result in tragedy not only to the educational system, but also to public school pupils. Robert Houstan and Robert B. Howsam in their article "C.B.T.E.. The Ayes of Texas" write:

> Failure to involve the affected parties and interests in serious dialogue and collaborative effort results in win, lose controversy where the loser can be the schools, the society, and most immediate the teachers and students.[8]

NEW YORK STATE MANDATES PUBLIC SCHOOL INVOLVEMENT

In the spring of 1971, the Division of Teacher Education and Certification of the State of New York introduced a paper entitled A New Style of Certification,[9] which mandated CBTE programs in the state. This paper discussed four process standards which described the requirements and procedures which would develop CBTE certification programs.

Process Standard I deals directly with the issue of collaboration. It states

> Trial projects leading to state certification must be planned, developed, monitored, and evaluated by cooperative agencies acting as a Policy Board. Representatives of the following agencies must be included:
> a. public schools—representatives approved by the board of education.
> b. institutions of higher education—representatives approved by chief administrative officer.
> c. teachers—representatives selected or elected by teachers in the district.
> d. teacher education students—representatives selected from and approved by students.
> Representatives from other groups may be included.[10]

Process Standard II addresses the questions of the participating public school objectives and priorities, and the competencies required of a teacher in that district. Process Standard III discusses the evidence and manner which will determine whether the candidate has achieved the specific level of competence. Process Standard IV deals with the management system which will serve as the basis for program evaluation.[11] With these process standards, the Industrial Arts Trial Certification Project evolved.

The IATCP Policy Board is currently represented by five segments of the professional domain. These include the following:

West Seneca Central School District in New York – 3 members.
West Seneca Central School Administration – 1 member.
Western New York Industrial Arts Teachers Assoc. – 3 members.
Industrial Arts Student Organization – S.U.C. Buffalo – 3 members.
Industrial Arts Education Division – S.U.C. Buffalo – 4 members.[12]

The Policy Board established early in its operation the understanding of parity, whereby, regardless of representative number, each segment was allowed one vote, thus providing equal partnership of all groups in any decision making. The public school segment shared equal representation and began playing a leading role in the development of the certification program.

THE ROLE OF THE PUBLIC SCHOOL IN I.A.T.C.P.

Involvement of the public school teacher began with the initial development of Process Standard II. Process Standard II dealt with stating objectives and priorities of the school district. Public school teachers had the sole responsibility for undertaking and completing the task of stating objectives because the task dealt specifically with general school district goals and general goals for the secondary and early secondary industrial arts programs. Once this was completed, the policy board undertook a project which developed General Industrial Arts Teacher Competencies.

The General Industrial Arts Teacher Competencies evolved into the identification of:

> important general teaching competencies which all prospective industrial arts teachers would need to possess in order to receive initial licensure to teach in New York State. Believing in the often-overlooked value of input from practicing teachers, the Project undertook the task of seeking reaction from the state's industrial arts teachers.[13]

Therefore, not only the teachers on the Policy Board were included, but more important, the teachers of the state were included.

Public school teachers were also involved in reviewing the initial selection of the general industrial arts teaching competencies. This group of teachers represented the disciplines of mathematics, science, foreign language, music, social studies, and vocational and industrial arts education. Once this group completed their reviewing process, a teacher from the Policy Board led a subcommittee to develop the instrument used to canvas the state's industrial arts teachers. This subcommittee clustered the general teaching competencies into three groups, Instructional Competencies, Professional and Personal Competencies, and Management Competencies. Developed within each of these groups was a series of statements reflecting certain aspects of a teacher's performance.[14] The statements included the following:

Instructional Competencies

Rank

1. Stimulate and maintain student interest throughout the instructional process.
2. Perform basic manipulative skills necessary to teach in all industrial arts content areas.

Professional and Personal Competencies

Rank

1. Develop and maintain a healthy teacher-student relationship to enhance the learning situation.
2. Demonstrate an acceptable level of knowledge and performance in his field.

Management Competencies

Rank

1. Show evidence of classroom discipline and control.
2. Evaluate a student's performance level in a manner which allows for student understanding and participation.[15]

The results of this survey provided a reliable indicator of the needs of teachers in the field.

Teachers were later involved in a second project of the Policy Board. Public school teachers in the West Seneca School District were requested to identify competencies for a given area of technical subject matter. This project involved not only the identification of competencies, but also the evidences which showed whether the prospective candidates had reached the accepted level of competency. Therefore, teachers have become involved in Process Standard III and in the actual evaluation of the prospective candidate.

A teacher was appointed as a workshop coordinator to oversee the development of the competencies and prospective candidate's evidences. A subcommittee of Policy Board members developed the format which was used to identify the competencies. The format developed follows:

> Each of the participating junior and senior high school industrial arts teachers would identify the instructional objectives for his course. This was followed by a consideration of the competency(ies) requisite for a beginning teacher, in order that he would be able to achieve the previously-stated instructional objectives. A third dimension was included so that the public school teacher could recommend the evaluative criteria which, in his mind, would indicate to him that the prospective teacher actually possessed the minimum level of competence required.[16]

As a result of that subcommittee, the following Technical Industrial Arts Competency Lists were or are being developed:

Early Secondary (Junior High School) – Forest Products, Ceramics, Graphic Arts, Electricity, Drawing, and Manufacturing.

Secondary (High School) – Electricity-Electronics, Forest Products, Metals, Plastics, Power and Technical Drawing.

Teachers were contracted to develop course instructional objectives for their students. The teachers were to prescribe the technical competencies they felt were required of the candidate in order to fulfill the instructional objective. Finally, the teachers were requested to write the evaluative criteria which they felt would insure the candidate's attainment of each competency. The teachers were requested to develop the technical competencies which related to the psycho-motor skills, but also those related to the cognitive and affective domain.

The excerpt on page 69 is from the early secondary forest products program. It includes the competency, evidence, and sample competencies from the psycho-motor, cognitive, and affective domain.

This excerpt illustrates the scope of the role played by public school teachers thus far in the development of competencies and candidate evidences for the IATCP.

The involvement of public school teachers will remain a vital function of this project. The IATCP's future plans indicate greater teacher involvement in the completion of the General Industrial Arts Teaching Competencies and the development of general teaching competencies for all teachers. The project will continue to request the assistance of public school teachers in the evaluation and review of all competencies, and in the development and operation of a management system for the Project.

SUMMARY

The role of the public school teacher has been that of a leader in the development of the Industrial Arts Trial Certification Project. Public school teachers have solely developed many of the competencies and evidences identified through this trial certification project. They have been leaders in setting up the governance procedures in the project. Public school teacher involvement is planned to continue in this project because of their important contributions.

The success of the public school involvement is largely due to the establishment of group parity, whereby each group was able to cooperate in the development, planning operation, and evaluation, as an equal partner. The teachers were able to share views and responsibilities in order to collaborate in the development of a CBTE certification program.

This collaboration shows the kinds of results which can be obtained if the controversial issue between the teacher-training institutes and the public schools is compromised.

Teachers do not want to call the shots or take over the professorships in the educational foundations. They would like to share their expertise with the expertise of the college personnel in the belief that a new, exciting, and beneficial approach to teacher training can be developed.

FOOTNOTES

1. William H. Drummond, "Does P.B.T.E. Mean Reform?" Educational Leadership (January 1974), 292-3.
2. Wendell C. Allen, "Comments on Collaboration in Teacher Education," P.B.T.E. Published by the Multi-State Consortium on Performance-Based Teacher Education, February 1974), p. 3.
3. Larry Swift, A Swan, A Pike, and A Crab in Search of a Management System," P.B.T.E. (Published by The Multi-state Consortium on Performance-Based Teacher Education, September 1973), p.2.
4. Ibid.
5. Theodore E. Andrews, "Competency-Based Certification," Competency-Based Teacher Education: Progress, Problems, Process (Published by Science Research Associates), p.20.
6. Allen, p.3.
7. Ibid.
8. W. Robert Houston and Robert B. Howsam, "C.B.T.E.. The Ayes of Texas," LV(January 1974), p.301.
9. Division of Teacher Education and Certification, CBC Newsletter (The University of The State of New York, The State Education Department, June 1972), p.1.

Forest Products Technology[17]

STUDENT OBJECTIVES	TEACHER COMPETENCIES	CANDIDATES EVIDENCE
III. The student will be able to identify the bark, inner bark, cambium, sapwood, and heartwood in a cross section of a tree, and describe the function of each.	III. A. The teacher will identify the bark, inner bark, cambium, sapwood, heartwood, in a cross section of a tree. B. The teacher will describe the function of each.	III. A. The candidate will, given a cross section of a tree, label the bark, inner bark, cambium, sapwood, and heartwood. B. The candidate will write a description of the major function of each. To be completed before the internship. 90% attainment.
XII. The student will be able to demonstrate proper attitude in an Industrial Arts Forest Products Laboratory, which will include: A. responsibility to report to class on time and receive directions for the day's activity. B. responsibility of controlling oneself as a mature middle school aged individual in the following situations: 1. formal classroom instruction 2. demonstrations 3. laboratory work activity; group activities; individual activities 4. clean-up activities 5. field trips	XII. The teacher will establish an atmosphere that will encourage proper student attitudes in an Industrial Arts Forest Products Laboratory. A. The teacher will provide a list of rules and procedures for the classroom which will structure the student to be responsible for the following: (See Student Objectives)	XII. After completing a model of instruction (in the college) on Developing Classroom Atmosphere and after observing an early secondary Forest Products program for at least two one-hour observations, the candidate will present a plan for developing classroom atmosphere that will include philosophy, rules, procedures and alternatives which will encourage proper student attitudes in that observed classroom. This plan will structure students to be responsible for the following: (See Student Objectives)
XIII. A. The student will be able to demonstrate the safe and proper use of power equipment, hand-operated machines, hand tools, materials, and supplies in a Forest Products Laboratory. Safe and proper use of power equipment, hand-operated machines, hand tools, materials, and supplies will include: (See Candidate Evidence)	XIII. A. The teacher will demonstrate to the students the safe and proper use of power equipment, hand-operated machines, hand tools, materials, and supplies.	XIII. A. At the college Forest Products Laboratory, the candidate will demonstrate to the instructor upon consultation with the public school teacher, and his standards, the safe and proper use of the following: 1. Power equipment list 2. Hand-Operated Machines List 3. Handtool List 4. Materials and Supplies List

10. Andrews, p.23-25.
11. Ibid.
12. The New York State Industrial Arts Trial Certification Project, Competency Based Industrial Arts Teacher Education (Industrial Arts Education Division, State University College at Buffalo, New York, January 1974), p.3.
13. The New York State Industrial Arts Trial Certification Project, A Study of The General Teaching Competencies Required for Initial Certification of Industrial Arts Teachers in New York State (Industrial Arts Education Division, State University College at Buffalo, New York, January 1974), p.4.
14. Ibid., p.4-5.
15. Ibid., p.7,9,11.
16. The New York State Industrial Arts Trial Certification Project, Technical Competencies: Power Technology — Internal Combustion, Piston, and Rotary Engine (Industrial Arts Education Division, State University College at Buffalo, New York, January 1974), p.5.
17. The New York State Industrial Arts Trial Certification Project, Early Secondary Forest Products (Industrial Arts Education Division, State University College at Buffalo, New York, January 1974).

Mr. Heiner is the Industrial Arts Department Chairman in the East Seneca Jr. High School, West Seneca, N.Y., and Workshop Coordinator for the IATCP.

Description of a Competency-Based Undergraduate Curriculum in Industrial Arts Education

Philip D. Wynn

Traditionally, industrial arts teacher education programs have been structured in terms of material areas, such as metalworking, woodworking, drafting, electronics, and graphic arts. Traditional programs have been characterized by emphasis on manipulative skills, lack of curriculum flexibility, decreasing relevance to modern technology, and limited appeal to non-majors.

In recent years the Industrial Arts Education Department at Millersville had expressed growing concern about such deficiencies, and had implemented certain curricular changes designed to keep the program aligned with contemporary thinking. For example, virtually all courses had undergone a shift in emphasis from manipulative to technical. Certain new courses had given students the opportunity to explore diverse areas of special interest and to apply the techniques of independent research and study. Students had been encouraged to take advantage of pertinent interdisciplinary offerings through an active departmental advisement program.

However, although these innovations had been partially successful in meeting departmental objectives, it was felt that a more complete revision was necessary.

RATIONALE

There were four specific reasons for this curriculum revision.

1. Recent changes in teacher certification and program approval structured in terms of competency-based standards by the Pennsylvania Department of Education.

2. The adoption of a uniform curriculum plan by the Teacher Educators Council of the Industrial Arts Association of Pennsylvania.

3. An increasing demand for certified industrial arts teachers.

4. An increasing demand for service to other curricular areas such as elementary and special education, adult enrichment courses, and course offerings which are more appropriate to the interests of non-majors.

UNDERGRADUATE PERFORMANCE-BASED COMPETENCIES

The performance-based competencies on p. 72-73 are those competencies considered essential in the undergraduate preparation of industrial arts teachers. These competencies are consistent with the "The Ten Goals of Quality Education" (1965) and are designed to provide a balanced program of general education, technical studies, and professional education. More specifically, these competencies are designed to enable the industrial arts teacher to provide for his students the type of instruction that is concerned with:

a. contributing a unique and necessary segment to the total program of the student's education,

b. developing self-concepts pertaining to the changing requirements for optimum participation in an industrial-technological culture,

c. developing technological literacy,

d. exploring occupational opportunities,

e. discovering and encouraging tool-machine abilities and problem-solving techniques, and

f. providing research experiences at a level of intensity appropriate to student ability.

OUTLINE OF MAJOR FIELD REQUIREMENTS

The major field requirements are divided into four categories: industrial materials, visual communications, power technology, and professional courses. Certain courses are required in each category. (See diagram.) Students must elect, within certain limitations, 200 and 300 level courses from each technical category, and may then specialize by choosing free electives from one or more categories appropriate to their interest and ability.

	Industrial Materials	Visual Communications	Power Technology	Professional
Required	101 102 271 or 281	103 104	105 106	391 491 492 or 493 or 494
Elect 2 courses in each area 200-300 level	one 200 level one 300 level	1 graphic art 1 drawing/design	1 electricity/electronics 1 power technology	
Elective	Two courses in elective area (any level)			

Courses at the 100 level are required for IA majors (except IA-107) and are open to non-majors on an elective basis. Technical courses at the 200, 300, and 400 level are elective for any student demonstrating prerequisite competency. The 500 level courses are highly specialized courses for the advanced undergraduate or graduate student demonstrating competency.

Specifically, the following points should be made clear:

1. All courses are competency-based, and a student may receive credit by demonstrating competency in that subject through appropriate evaluative techniques.

2. Areas of specialization within the major are to be determined by each student in consultation with his adviser. Such specializations will be reflected on his transcript, but not on the instructional certificate.

3. IA-491, Principles and Practices of IA Education, is a professional seminar which is taken concurrently with student teaching (3 sh) and is counted under Degree Requirements with student teaching.

4. The areas of special education and elementary education are not included in the list of course titles. Appropriate courses are being jointly developed by Industrial Arts Education and those departments, and will be offered and taught by those departments on an elective basis for industrial arts majors.

PERFORMANCE-BASED COMPETENCIES

Industrial Arts Undergraduate Program
Millersville State College

Performance-Based Competencies	Learning Activities and Experiences	Evaluation
A graduate of this program shall demonstrate general academic, technical, and professional competencies and a mastery of: 1. Fundamental knowledge of the historical development of technology; the tools, processes and materials of modern industry; and their impact on man and society. (The interdisciplinary nature of industrial arts is especially relevant to the development of this competency.)	Specific learning activities and experiences used to develop these competencies may be summarized by listing appropriate course parameters. 1. Graphic Reproduction Engineering Graphics Man and His Electrical Environment Energy, Power, and Transportation Basic Woodworking Techniques Basic Metalworking Techniques History of Technology	The degree of attainment of each competency may be evaluated by one or more of the following methods: 1. written examinations demonstrated proficiency in psychomotor abilities and laboratory performance, through the use of basic tools, machines, and materials direct observation and anecdotal records of laboratory activities performance-based testing demonstrated ability to solve content-related problems.
2. Technical abilities developed in the major categories of power technology, visual communications, and industrial materials. a. Power technology 1. energy sources 2. working fluids 3. energy converters 4. transmission 5. controls 6. applications 7. other appropriate areas b. Visual Communications 1. graphic representation 2. symbolism and color 3. reproduction processes 4. aesthetic visualization 5. electronic multi-media 6. other appropriate areas c. Industrial Materials 1. materials 2. manufacturing processes	2. a. Electronic Components and Circuit Analysis Automotive Systems Solid State Electronics Electronic Communication Systems Fluid Power Instrumentation and Controls Logic Circuits and Applications Electro-Mechanical Systems b. Application of Process Photography to Industry Technical Sketching and Design Still Photography Screen Process Printing Photo-Offset Printing Industrial Design Technical Drawing Architectural Drawing and Design Autographic Processes Descriptive Geometry Process Color Separation Projective Graphics	2. written examinations demonstrated proficiency in psychomotor abilities and laboratory performance, through the use of basic tools, machines, and materials direct observation and anecdotal records of laboratory activities performance-based testing demonstrated ability to solve content-related problems self-reporting interest inventories counseling techniques aptitude testing

3. construction techniques 4. production methods 5. research and development 6. other appropriate areas	c. Forest Products Technology Cold Metal Technology Utilization of Materials for Construction Utilization of Materials for Manufacturing Utilization of Materials for Crafts Production Techniques in Wood Production Techniques in Metal Production Techniques in Ceramics Materials Testing and Analysis Tooling for Production	
3. Knowledge of the history, philosophy, current trends, nd methods of instruction pertaining to industrial arts in elementary, middle, junior, and senior high schools. Related professional competencies include studies and experiences that develop abilities in the techniques appropriate to teaching industrial arts, such as: a. organize a program b. administer and teach a program c. purchase supplies d. plan and maintain laboratory facilities and equipment e. select and organize subject matter data f. provide a variety of approaches to teaching g. develop an awareness of instructional methods used to teach exceptional children h. genuine concern for the safety and well-being of pupils i. awareness of research and new developments in the field j. knowledge and ability to use appropriate teaching techniques and media k. appreciation of craftsmanship l. recognition of the industrial arts contributions in general education m. ability to work with professional groups concerning educational matters peculiar to industrial arts programs n. research and development techniques, study of industrial problems, research and experimentation in solving problems, and study of ways to supervise students in studying and solving technological problems.	3. Orientation Seminar and Field Experience in Teaching Industrial Arts Curriculum Analysis and Development Principles and Practices of Industrial Arts Group Studies in Industrial Materials Group Studies in Visual Communication Group Studies in Power Technology Aviation Education Industrial Arts Field Experience in Elementary School Industrial Arts Field Experience in Middle School Industrial Arts Field Experience in Secondary School Industrial Arts Field Experience with Exceptional Students Independent Study in Industrial Materials Independent Study in Visual Communication Independent Study in Power Technology Current Trends in Industrial Arts The undergraduate student is required to demonstrate basic competencies in all areas and given the opportunity to develop advanced competency in an area appropriate to his abilities and interests. Existing competencies of all undergraduates are considered in planning individual programs of study.	3. written examinations demonstrated proficiency in psychomotor abilities and laboratory performance, through the use of basic tools, machines, and materials direct observation and anecdotal records of laboratory activities performance-based testing demonstrated ability to solve content-related problems. self-reporting interest inventories counseling techniques aptitude testing personality evaluations evaluation of actual teaching experience demonstrated participation in professional activities demonstrated professional relationships with students and peers

NEW CURRICULUM COURSES

Required Courses
101 Basic Woodworking Techniques
102 Basic Metalworking Techniques
103 Graphic Reproduction
104 Engineering Graphics
105 Man and His Electrical Environment
106 Energy, Power, and Transportation

271 or Ceramics Technology
281 Plastics and Synthetics Technology

492 or Group Studies in Industrial Materials
493 or Group Studies in Visual Communication
494 Group Studies in Power Technology

391 Curriculum Analysis and Development
491 Principles and Practices of Industrial Arts (with student teaching)

Industrial Materials Courses
200 - Level
251 Wood Technology
261 Cold Metal Technology
262 Hot Metal Technology
271 Ceramics Technology)
281 Plastics and Synthetics Technology) one required above
300 - Level
381 Utilization of Materials for Construction
382 Utilization of Materials for Manufacturing
383 Utilization of Materials for Crafts
Elective - all the above, and
451 Production Techniques in Wood
461 Production Techniques in Metal
471 Production Techniques in Ceramics
582 Tooling for Production
588 Problem Seminar in Industrial Materials

Visual Communications Courses
Graphic Arts
211 Application of Process Photography to Industry
311 Still Photography
312 Screen Process Printing
313 Photo-Offset Printing
411 Autographic Processes

Drawing - Design
221 Technical Sketching and Design
321 Industrial Design
322 Technical Drawing
323 Architectural Drawing and Design
421 Descriptive Geometry

Elective - all the above, and
511 Process Color Separation
518 Problem Seminar in Visual Communications
521 Projective Graphics

Power Technology Courses
Electricity-Electronics
231 Electronic Components and Circuit Analysis
331 Solid State Electronics
332 Electronic Communication Systems
431 Instrumentation and Controls

Transportation
241 Automotive Systems
341 Fluid Power
441 Aviation Education

Elective - all the above, and
531 Logic Circuits and Applications
538 Problem Seminar in Power Technology
541 Electro-Mechanical Systems

AREA: Visual Communications
COURSE NO: 104 SEMESTER HOURS: 3 CONTACT HOURS: 6
TITLE: Engineering Graphics
PREREQUISITE: None

Catalog Description:
This is an introductory course dealing with lettering, engineering geometry, multiview representation, auxiliary, sectioning, pictorial representation, dimensioning, and reproduction of drawings.

Primary Course Objective(s):
1. To become cognizant of the relationships of the methods of communication (written and spoken language, the symbolic language, and the graphic language)
2. To develop competence in using graphical expression both for communication and as a means for analysis and synthesis.
3. To develop an awareness of the impact of rapid technological advances such as automation in drafting and design, miniaturization, etc., on engineering graphics.
4. To develop an understanding of the principles of orthographic projection and a knowledge of conventional practices used in graphical communication.
5. To become familiar with drafting tools and equipment, including drafting machines, X-Y plotters, 3-D drafting devices operated mechanically, by computer, and photographically, and their impact on drafting personnel.
6. To develop the ability to visualize and solve space problems graphically.
7. To develop an awareness of the increasing importance of accuracy, exactness, and positiveness both for representation and in problem solving.

8. To become familiar with drafting standards (American Drafting Standards, etc.) and be able to relate them properly to drawing and industry.
9. To become familiar with reproductive processes and their function in visual communication.
10. To develop an understanding of surface finish characteristics and relate them to drafting and production.

Topical Course Outline:
1. Engineering graphics lettering
2. Drawing instruments and equipment — care and use
3. Reproductive methods used in drafting
4. Engineering geometry
5. Principles of orthographic projection and multiview drawing
6. Auxiliary views
7. Sectioning and conventional practices
8. Pictorial drawings
   A. Axonometric
   B. Oblique
   C. Perspective

COURSE NO. 104 BEHAVIORAL COMPETENCIES

Competencies	Learning Experiences	Methods of Evaluation
After students participate in the learning experiences of this course, they will be able to:	These learning experiences and activities will be used to develop each competency.	The degree of attainment of each competency will be evaluated in the following ways:
1. Select, use, and care for drafting tools and equipment. 2. To record information through hand and mechanical lettering. 3. Solve multiview problems. 4. Solve mechanical pictorial drawing problems. 5. Solve problems involving the principal sectioning techniques. 6. Solve primary and secondary auxiliary view problems. 7. Apply national drafting standards to drawings. 8. Describe appropriate surface finish conditions. 9. Solve problems involving intersections and developments. 10. Reproduce drawings by the various available methods. 11. Dimension for mass production—selective fits. 12. Relate the various drafting methods (hand-machine-automatic) to technology	1. Select, care for, and use drafting tools and equipment. 2. Letter drawings by hand and machine. 3. Solve multiview problems. 4. Solve pictorial drawing problems. 5. Solve internal detail problems—sectioning. 6. Solve primary and secondary auxiliary problems. 7. Solve problems including intersectic , and developments. 8. Apply the various finish marks to drawings. 9. Make the various reproductions of drawings. 10. Make microprints from drawings.	1. Teacher evaluations 2. Performance testing 3. Student self-evaluations 4. Written and oral testing 5. Standardized tests 6. Team testing 7. Evaluations by specialists

Dr. Wynn is Assistant Director, Industrial Arts Education, Millersville State College, Millersville, Pa.

A Model for Reform in Teacher Education

Lawrence S. Wright

From the criticisms that abound and from the many innovations visible in teacher education today, it hardly seems necessary to question why reform in teacher education might be necessary. On the other hand, one might inquire as to why we would be interested in a model for such reform.

There are several reasons why we need to develop a systematic model for reform in teacher education. Perhaps the first of these is that curriculum design is a complex process. In reducing it to its simplest form, it requires use of the highest levels of the cognitive processes. In examining Bloom's taxonomy, curriculum design and reform certainly require all aspects of the knowledge, comprehension, and application levels with respect to the discipline being studied. Beyond this, it requires analysis of elements, synthesizing these into new patterns, and evaluation of effectiveness. These, of course, are the highest levels of the cognitive domain.

Secondly, a systematic model becomes an indispensable tool to managing the curriculum design process. Principles from many fields are brought to bear at the right time. A model should keep the curriculum developer aware at all times of the problems with which he is dealing and his location in the model.

It also has the effect of placing the emphasis on designing the curriculum substantially right the first time.

Many of you may be familiar with Murphy's Law. It says. "Anything that can possibly go wrong will go wrong." I'm not sure who this Murphy is — or was — but there are two more laws variously ascribed to him. These seem to have direct relevance to curriculum work:

- The chances of being accidentally successful are very small.
- There are enough ways to fail that one had better plan to insure success.

This would seem to say that a systematic model is highly desirable.

There are many models or systems used in curriculum design. Let me identify two and spend most of my time on a third that we are using for study of our industrial teacher education program at UW-Stout.

These models include the intuitive, the discipline; and the behavioral analysis model.

THE INTUITIVE MODEL

Intuitive, as you know, means knowing or perceiving by intuition. This is the quickest and ordinarily the least scientific way to go about reforming the curriculum. It is also the curriculum trap into which we are most likely to fall.

Let me call to your attention several examples of the use of the intuitive model.

1. When you say, "I've always wanted to teach a fourth course in architectural drafting" and then add it to the curriculum, you are using the intuitive model.

2. When you perceive that teachers in the field are using the same old learning activities and because of this perception you recommend a course in Selection of Learning Activities in Industrial Arts, you are using the intuitive model.

3. When you examine offerings in other universities and add some of these apparently useful offerings to your offerings, you are using the intuitive model.

4. When a special-interest group identifies drugs and their use as a problem and you add a course such as Use and Abuse of Drugs, you are using the intuitive model.

5. When the latest LPDA guidelines come out and you build a curriculum proposal to fit these guidelines, you are using the intuitive model.

I submit that the intuitive is the most frequently used model in curriculum development, but that it is imprecise and lacks the direction that more systematic models can provide. Moreover, if you add courses using the intuitive model, it is only on the rarest of occasions that the deadwood in the curriculum is removed.

THE DISCIPLINE OR CONCEPTUAL ANALYSIS MODEL

The discipline or conceptual analysis model is familiar to most of us. In it we systematically study the body of content and attempt to analyze it and structure its constituent elements. On the basis of the structure discovered, we devise an array of courses, probably subject-matter-oriented, so that one may be exposed to the discipline and/or the concepts through a series of experiences. The use to which the discipline may later be put is not the central objective. Learning the discipline or concepts is the central objective. It is assumed that the study of the discipline will provide the learner a wide fund of knowledge and concepts upon which he can draw in the solution of most any problems with which he may subsequently be confronted.

There are plenty of examples of discipline analysis. The structure in the American Vocational Association's Guide to Improving Instruction in Industrial Arts is a discipline analysis. The American Industry Project at Stout developed a very thorough analysis of the socio-economic institution of American Industry. Many of the academic subjects have undertaken careful discipline analyses. Dr. Paul DeVore in his outstanding studies at West Virginia has examined technology as a discipline.

Discipline studies are believed by many to be the most scholarly and the most generalizable of the curriculum models. Among the problems associated with discipline study are those cited for transfer of learning. Unless we teach for transfer, transfer may not take place. Unless we teach uses for the discipline, we may fail to use the information, even when it is appropriate.

THE BEHAVIORAL ANALYSIS MODEL

The behavioral analysis model is based (as are other models) on assumptions. Two of these are:

- That the desired post-instructional behaviors can be identified.
- That instruction to produce these post-instructional behaviors can be provided.

Opponents of this model claim:

- That to identify performances in a particular work-role leaves out what should be in that work-role.
- That there are too many fragmented and not enough synthesizing experiences in behavioral-oriented instruction.
- That once analysis has been completed, because of the complexity of making the analysis, it is not likely to be updated.

I would dismiss the first of these by building into the behavioral analysis model a function which deals with what the post-instructional behavior should be — insofar as any human or set of humans can predict them. The fragmentation problem is not necessarily confined to behavioral analysis. The way to overcome it is to see that a proper balance of analysis, synthesis, and evaluation level instruction is included. With respect to the third problem of keeping the content current, that is not a fault reserved only for this model.

The model presented here is one of many. It is not the model, it is a model. We believe that it will work for us. It is a fifteen-step, cyclical model that provides for entry at any step. The cyclical nature of this model may suggest that curriculum reformers go round in academic circles, but I will leave judgment on this point to each of you.

We will start with the point of origin in the curriculum development process. I will be talking about curriculum development and reform in teacher education.

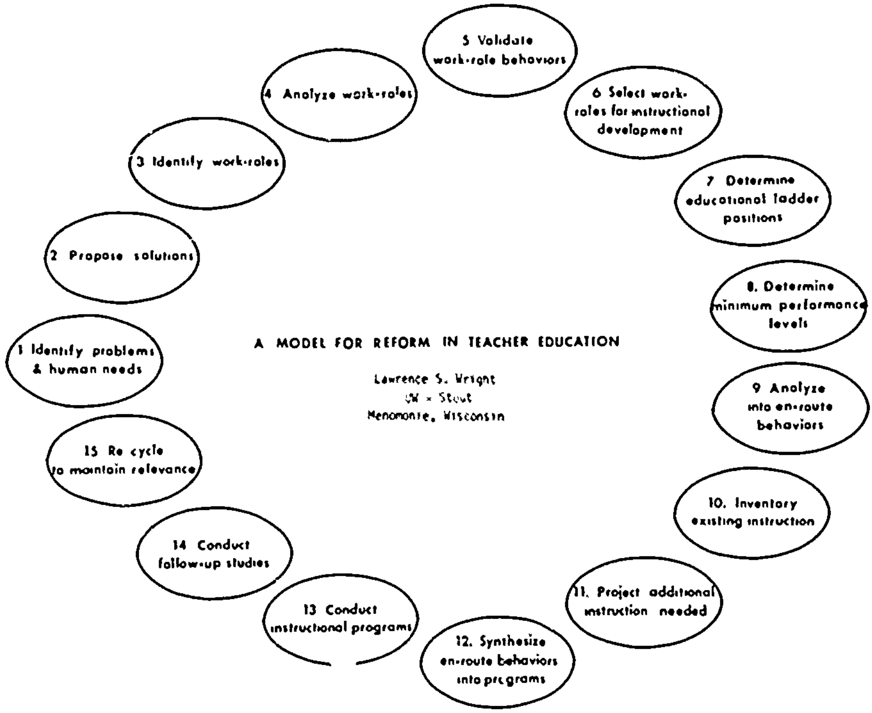
1. Identify environmental and societal conditions which create problems to be solved and human needs to be satisfied

This step calls for systematic study of societal conditions and problems. Like many other steps in this model, it takes time and effort. Having once completed such a study, there is need for a planned program of updating, with perhaps a thorough new effort every five years. Should we fail to take this step, we run the risk of developing programs that may not be relevant. How can one propose a solution to problems and needs which have not been identified and spelled out? This leads to the next step in the model.

2. Propose solutions to these problems and needs

The combination of steps one and two should result in a rationale upon which programs may be developed. A position paper identifying the particular societal problems and needs toward which a program such as teacher education is aimed provides a written record of the reasons for its development and existence.

Programs which do not or cannot be related to environmental conditions which create problems, societal conditions which create problems, and/or human needs to be satisfied, stand rather well assured of being irrelevant.



On the other hand, carefully-thought-out solutions to existing problems and needs provide the possibility of reaffirming previously stated goals, the possibility of having envisioned appropriate new goals, and confidence in the relevance of the program(s) conceived.

3. Identify work-roles within which personnel can solve problems and meet needs

As we approached this problem at Stout, we obviously would select work-roles appropriate to our mission. In my case, it was the Industrial Education Teacher, and we confined our study to the professional teacher education level. This would include teacher education for both industrial arts education to support the general education function and industrial-vocational education to support the specialized education function.

We believe our model to be sufficiently generalizable that any occupation or profession might be identified for study and development.

4. Analyze work-roles into post-instructional behaviors required for success in each work-role

The reason for this step would seem self-evident. If we can identify the post-instructional behaviors required in the work-role, then an instructional program can be developed to assure possession of those behaviors.

As a matter of the procedure which we followed, we developed ten post-instructional behaviors (which act as classifiers), and which a committee of us believed were required for success in the previously identified work-role of industrial education teacher. For other work-roles, perhaps anywhere from five to fifteen behaviors would be appropriate.

The ten which we agreed upon were these:

(a) Improve Individual's Competencies
(b) Design Programs
(c) Design Instruction
(d) Nurture Humaneness

(e) Facilitate Learning
(f) Manage the Learning Environment
(g) Provide Professional Service
(h) Utilize Research
(i) Evaluate Instruction
(j) Evaluate Programs

These behaviors might be applicable to teachers in any discipline and at any level from pre-school through university.

These behaviors are not in sufficient detail to permit their management at this stage into programs. They must be further analyzed into their constituent elements.

Identify the second-level post-instructional behaviors which define each of the ten first-level behaviors. Then identify the third-level post-instructional behaviors for each of the second-level behaviors. This ordinarily will yield sufficient detail to permit one to proceed with the steps in the model for reform in teacher education. We found 57 second-level and 327 third-level behaviors.

5. Validate work-role behaviors by obtaining frequency and importance data from practitioners and importance data from select jury

The practitioners are teachers functioning in their work-role. Data from this study suggest the frequency of performance of each behavior as well as the importance which the practitioners attach to the behavior. However, this is not enough. We need to know not only what the practitioner does and believes, but also what an informed jury perceives the importance rating for each behavior to be.

The study which we expect to complete soon includes as practitioners, the 1971-72 population of Wisconsin teachers as follows:

- Junior high school industrial arts teacher
- Junior-senior high school industrial arts teacher
- Senior high school industrial education teacher
- Capstone industrial education teacher

Our select jury was drawn nationally:

- Selected leaders in industrial teacher education
- The fifty state consultants or supervisors of industrial arts, or if none existed, the state consultant or supervisor of industrial education
- The state education officer in each of the 50 states (the person in whose office the state certification of teachers is done)

6. Select work-roles and their component behavioral tasks for which instructional programs are to be developed

This step involves a complex assessment of the data gathered in the previous validation step. Obviously, behaviors which are not performed and are not believed to be important can be eliminated. Those believed to be both performed and important must be included in instructional programs.

A decision may be made as to whether separate programs need to be developed for each group or whether various behaviors are common to each group and can be provided in one program. Though the process is an involved one, the least that might be said is that this should result in the program developer having something more to go on than intuition and hearsay in making his decisions.

7. Determine the "educational ladder" positions and location for each behavioral task in which provisions will be made to attain specified performance levels

This may be done by submitting groups of behaviors to a teacher educator who is a specialist in the field of the behavior group. He may validate his responses through interviewing another teacher educator specialist. This study can be much more heavily formalized, but from a practical point of view, we think this approach to be workable for us. After all, we will need to invite the consideration of our colleagues to these determinations.

We have identified these "educational ladder" positions:

(a) Lower division instruction
(b) Upper division instruction
(c) First graduate instruction
(d) Advanced graduate instruction
(e) Highest level of instruction

Many behaviors are learned and strengthened on-the-job, our purpose here is to develop reform in our formal teacher education program. Some behaviors will be formalized through student teaching, internship, practicums, and the like.

8. For each behavioral task and for each of its positions on the "educational ladder," determine the performance level to be attained by those who experience the instruction

The teacher education specialist includes this step along with the previous one, as he makes his judgments and validates his efforts.

We are thinking in terms of the following performance levels:

(a) Instruction in this behavior is introduced and the learner uses this as a basis for making other experiences meaningful.
(b) Instruction in this behavior is developed to the level of practice under supervision.
(c) Instruction in this behavior is developed to entry-level practice and can be performed successfully as a beginning professional with minimum supervision.
(d) Instruction in this behavior is developed to the point where the practitioner initiates this behavior, understands the theory, and has developed speed and accuracy through practice.
(e) Instruction in this behavior develops the practitioner into a professional leader based on maturity and practice. He may supervise others.

Behavior Write behavioral objectives for lesson plans

Performance levels

Educational ladder positions	Behavior introduced at the knowledge and awareness levels	Practice under supervision	Perform at the entry level under supervision	Initiates behavior and performs with speed and accuracy	Leadership based on maturity and experience
Highest level of instruction					X 421-940
Advanced graduate instruction					X 421-811 421-890
First graduate instruction				X 190-738 421-750	
Upper division instruction			X 190-404 190-408		
Lower division instruction	X 190-205	X 190-205			

A model which may be used to record the educational ladder positions as well as the performance levels may be seen in the accompanying figure.

The post-instructional behavior, Write behavioral objectives for lesson plans, is introduced and developed to the second performance level in the lower division. In the upper division, it is believed appropriate to develop the ability to perform as an entry-level professional with minimum supervision. At the first graduate level, the learner will be brought to a point of a more full understanding of the theory of behavioral objectives and will develop speed and accuracy through practice.

9. Further analyze each post-instructional behavioral task into its component, en-route, behavioral objectives

This step will be recognized as the operationalizing of the post-instructional behaviors into the constituent behaviors which will produce them. These en-route behaviors are manageable and teachable. Like most of the other steps in this model, it is time-consuming, to say the least. On the other hand, its advantages include the assurance of relevant instructional content which permits learners to progress toward rather clearly-defined goals.

Procedures include identifying the en-route behaviors, specifying the conditions under which these behaviors are to occur, and detailing the standard of acceptable performance so that we n s know when the en-route behavior has been satisfactorily accomplished.

10. Anal ze existing instruction, if any, to ascertain for which behavioral tasks instruction is already available

This inventory should provide data both on instruction which is available and on instruction which should be available through the existing structure of departments, schools, and the like. One might return to the records developed in steps 7 and 8, in which educational ladder positions and levels of performance were identified. Enter the courses or other experiences that provide the instruction to the level specified. Using the same example, we now find that the post-instructional behavior, Write behavioral objectives for lesson plans, is introduced in the student's lower division work. In our analysis, it is accomplished in our 190:205 Methods of Teaching course. The student who microteaches does so on the basis of accomplishing at least one behavioral objective which he writes. He is again exposed to writing under supervision in our 190:404 Curriculum Development course. In his 190:408 student Teaching experience, he performs with minimum supervision. In the 190:738 Course Construction course, he develops his understanding of the theory and develops speed and accuracy. He might then move to the level of leadership and supervision through advanced graduate work, but according to the example model, this may be a part of the next step.

11. Pro ct additional instruction needed

Obviously, instruction not inventoried as present is needed. Our validation process accompanied by the decision-making process of step 6 have provided the base from which to proceed. This would be the point at which additional decisions would be made as to whether, for some behavior levels of performance, it might not be appropriate to the mission and objectives of the institution. At Stout, for example, we are not permitted at the present time to offer instruction beyond the Education Specialist Degree program.

12. Synthesize and organize behaviors into instructional programs for each work-role for which an instructional program is to be provided

This is the point at which curriculum development all too frequently starts. Even from this point, the synthesizing of behaviors into instructional programs is a lengthy process. Failure to have followed a systematic process and simply starting here may result in development of a well-organized program that is not relevant to current societal problems or needs.

Essential elements of synthesizing behaviors into programs include identification of courses or other modules of instruction, organization of the instruction; selection of learning activities, media, resources, teaching strategies, and plans for evaluation, and all of the mechanics of obtaining approvals within the institutional system.

13. Conduct instructional programs

It would seem that any program developed this systematically should be put into practice. Hopefully, it will function as planned—though we are not so naive as to think that experience will fail to lead us to changes that should be made.

14. Conduct follow-up studies to obtain feedback for improvement

15. Maintain relevance to current problems and human needs by recycling

This brings us the full cycle of a model for reform in teacher education. Other models may function more effectively for you. We are now in the model at the point of typing the results of the validation study. This should be complete in May.

We have begun the work of steps 6, 7, and 8 as preliminary to identifying en-route behaviors. We are not unique with in developing this model through a federally-funded program. This has been a matter of local effort over a fairly long period of time. Since, as has already been pointed out, the model is cyclical in nature, there may not be any end to our work. Perhaps we have discovered perpetual motion.

A model for reform in teacher education. You might ask, as one of my colleagues did, "Aside from having kept you off the street and out of trouble, what real value does this have?"

To sum it up, it seems to me that the value lies in having identified a procedure which may be generalizable.

The procedure is logical and systematic, thus assuring relevance to societal needs insofar as these can be projected.

The model permits accountability in that we spell out in advance, in behavioral terms, what is expected. Having done so, we can measure whether we have accomplished what we set out to do.

While it is true that we have not completed our experience through an entire cycle of the model, we believe it holds much promise. We are looking forward to the challenges that unfold as we continue to work.

Stronger undergraduate and graduate programs to prepare both industrial arts teachers and industrial-vocational education teachers at our institution should be the output of our development and implementation experiences with this model for reform.

Dr. Wright is Professor and Director, M.S. Degree Program, University of Wisconsin-Stout, Menomonie, Wisconsin.

Designing Teacher Education Experiences at UW-Stout

Lawrence S. Wright

I have been asked to report on how we have gone about designing teacher education experiences at UW-Stout to meet stated performance objectives. We started by developing a model for reform in teacher education. This model, it was thought, was sufficiently generalizable to permit its use with the three components of the program: the professional, the technical, and the general education components.

To develop each of these components simultaneously seemed like too much to expect. We chose to begin our work in the professional teacher education component, since this appeared to be most manageable for our purposes.

A program committee developed a task listing of those professional tasks believed to be performed by industrial education teachers. The tasks in this list were subsequently validated by the industrial education teachers in Wisconsin and a national jury of educators. This validation study was reported in a series of eight reports which were published in August of 1973.

Our next step was to hold a conference on our campus that would involve our teachers of technical subjects. This was done with considerable success, and a report called "University Forum on Competency-Based Content in Business, Industry, and Education" was completed and distributed.

In the meantime our university, along with its sister institutions, was charged with identifying major thrusts for the next ten-year period of time. A twelve-member team from our Academic Affairs Division identified four Academic Thrusts:

Thrust #1:
: Development of a competency-based instructional system.

Thrust #2:
: The development of a management system that will improve the effectiveness and efficiency of the university as it moves to a competency-based instructional system.

Thrust #3:

Humanize instruction.

Thrust #4:

Outreach program and continuing education.

At about the same time, our Chancellor and Assistant Chancellor charged our Teacher Education Council with identifying those competencies which are common to all teacher education programs and those believed to be unique to each program. We are "in process" at this time.

Our Industrial Teacher Education Department has a four-man committee which is looking at each of the professional education tasks to break them down, where necessary, to insure that they are manageable in teaching situations. Hopefully, this step will be completed this spring. Then we will inventory the extent to which these tasks are being cared for and find out what instruction, if any, needs to be added.

Additional plans for the immediate future include the development of a faculty position paper and the planning of in-service activities for university faculty for next fall.

In closing, let me suggest that we only foresee two problems: money and people. Perhaps both problems can be overcome by taking on manageable bits of the over-all design and evolving a competency-based program. A management and supportive system different from that now in existence will have to be developed. How is the transition made from "credits and grades" to lists of "competencies held"?

It is believed that the approach holding promise for us is an evolutionary one where those who are to be involved eventually are involved in the planning stages. With this in mind, although it is not the fastest approach, it is the one that seems most likely to produce lasting results.

Dr. [illegible], Professor and Director, M.S. Degree Program, Industrial Education, UW-Stout, Menomonie, Wisconsin.

Performance Objectives in a CBTE Program

John D. Bies

Performance and competency-based instructional systems have been widely discussed and implemented. The essential components of these systems have been the identified performance objectives and the delivery systems used to initiate them. In the competency-based teacher education (CBTE) program at Wayne State University, the use of performance objectives is a vital part of the total teacher education program.

The CBTE program at Wayne State University is divided into two interrelated systems—the management information system and the instructional system. "The major purpose of the ... Management Information system is to select, store, process, and transmit information to the faculty and students at a time when it can most effectively be used, enabling them to make more knowledgeable decisions."[1] The instructional system is the process through which students demonstrate their attainment of identified competencies. This system is made up of five interacting components—competencies, performance objectives, needs assessments, delivery systems, and evaluation.

The intent of this paper, therefore, is to show how meaningful performance objectives are developed in the CBTE program at Wayne State University.

COMPETENCIES

The differences between "competency," "goal," and "performance" are difficult to specify, since persons in the field use the terms interchangeably when discussing CBTE. In order to alleviate any confusion, a working definition has been developed for a competency. Thus, competencies are those "...knowledge, skills, and judgments which the student will demonstrate at a predetermined proficiency level..."[2] and are derived from subject matter, educational philosophies, and student characteristics.

The list of professional competencies used in this program were formulated from 255 competencies identified in a study by Calvin J. Cotrell at the Ohio State Center for Vocational and Technical Education.[3] The Wayne State list has been modified several times and is presently comprised of 50 pre-certification competencies (undergraduate program), 18 professional development competencies (continuing teacher certification program), and 3 competencies for the master's degree program. In all, there are 71 teacher education competencies which are hierarchically arranged in the program. (See Appendix A.) Currently, a set of competencies is being developed for the educational specialist certificate and the doctorate degree.

These competencies have been rated and evaluated by over 3,000 individual businessmen, persons in industry, Wayne State University graduates, school administrators and supervisors, and teachers. A doctoral dissertation, conducted by N. John Popovich, determined the validity of the pre-certification competencies for industrial education teachers.[4] The results of the study identified all competencies as being significantly valid. Furthermore, it was found that there was no significant difference in the ratings of competencies between industrial arts and vocational-industrial teachers. As a continuation of the Popovich study, there are several dissertations being planned and in progress that are testing the validity of these competencies in the curriculum areas of Business Education, Distributive Education, and Family Life Education.

PERFORMANCE OBJECTIVES

Identified competencies and performance objectives are inextricably combined in any CBTE program and must be carefully matched with one another. If instruction were to be based upon competencies alone, it would be extremely difficult to establish program consistency and a valid evaluation procedure. Thus, a systematic process has been designed to identify performance objectives and to match them to specific competencies.

There have been several attempts to develop an effective identification and matching system. These attempts can be categorized into the following systems:

1. Matching course objectives to competencies
2. Writing performance objectives for competencies
3. Identification of competency products
4. Use of a performance objective hierarchy

The first system was a method of writing performance objectives for established courses and attempting to match them with specific competencies. This method proved to be ineffective and contradictory to the underlying philosophies of CBTE. Matching course objectives to competencies places emphasis upon completion of courses, while the acquisition of competencies is relegated to a secondary function.

The second system demanded the identification of performance objectives for each competency, as viewed by the instructor, and then their implementation into the various courses. This proved to be much more effective than the first system—it was competency-oriented. The one major problem that arose with this system was the selection of realistic criteria for the completion of each performance objective. A number of objectives had to be changed or modified after the course was taught because of the inappropriateness of the criteria. This may not seem like a difficult task, but one must remember the class problems for the instructor and student who must work with unrealistic objectives.

The designation of performance objectives for the professional development and master's degree competencies proved to be a catalyst in the evolvement of a third system of identifying performance objectives and matching them to competencies. The third system required the faculty to identify those products that would be representative of demonstrated competency, after which performance objectives were written for each product. As a result, the entire professional development and master's degree programs were changed, new courses were added and established courses were modified. For the first time, the faculty were not thinking of courses as a vehicle for accomplishing competencies, but rather the use of performance objectives as a method of achieving competence. However, the problem of defining satisfactory criteria still plagued the implementation of effective objectives.

The use of an objective hierarchy is still new to the CBTE program and was the outcome of much faculty discussion and implementation of performance objectives. Before discussing the use of this system, it becomes necessary to discuss briefly the hierarchical arrangement of objectives.

Objectives specifying only behavior or performance are called enabling objectives, for they enable the student to determine what he must know or be capable of doing in order to achieve the objective — no criterion is specified.[5] Objectives specifying student outcomes and their criteria are called terminal or instructional objectives. An enabling objective might read:

> The student will evaluate a piece of instructional material and describe the relevancy of the material to his teaching specialization.

This objective only describes the performances expected of the student without stating specific criteria.

In contrast, a terminal objective would read:

> Given an evaluation form, an individualized instruction packet, and a hypothetical laboratory situation, the student will identify (a) the number of students that could fully utilize the package, (b) which students would successfully complete the package, and (c) the number of activities that could be taught using the package. Criteria for acceptability will be a correctness factor of 100%.

This objective tells the student exactly what is expected of him, on an evaluation form he will identify a, b, and c, and that the minimum criteria will be a correctness factor of 100%. It should be evident that there may be a number of terminal objectives for each enabling objective.

The use of a hierarchy is the process used in the fourth system. Similar to the previous method, products are identified for each competency, but instead of writing terminal objectives for each product, enabling objectives are used and taught. The use of enabling objectives, for initial trial in a course, allows the instructor flexibility in identifying meaningful criteria. In this system, the instructor and student are not hampered by the criteria which may prove ineffective.

USE OF PERFORMANCE OBJECTIVES IN THE TOTAL INSTRUCTIONAL SYSTEM

This paper has demonstrated how performance objectives can be developed for meaningful teacher education experiences. In retrospect, it becomes necessary to explain how objectives can be used within the total instructional system of the CBTE program. Competencies and performance objectives are the first two components of the instructional system and logically are the apparatus by which needs assessment, delivery systems, and evaluation operate.

Needs assessment serves as a process that determines if a student has the prerequisite skills for a given unit of instruction, or if the student already possesses the skills and knowledge necessary to complete a unit of instruction. The use of the assessment instruments are left to the option of the instructor and/or student. If the student believes that he is capable of passing all or a few of the performance objectives in a course, he may take an "exit" test. Both the prerequisite skills test and exit test contain written and performance sections based upon the performances and criteria set forth in the objectives. If the student demonstrates mastery of all objectives, he can then exit from the course and receive credit without putting in "seat time." If a portion of the course objectives are successfully passed, the student is then released from duplicating those objectives. It is, therefore, possible for a student to exit from the entire precertification program by examination — this includes student teaching.

No attempt is being made to standardize the delivery system used in the CBTE program. This component of the instructional system is left to the prerogative of the professor. In so doing, it is the intent of the faculty to exclude all reference to specific delivery systems and text materials in the writing of performance objectives, e.g., given a lecture on safety, the student will.... The faculty has, however, implicitly and explicitly agreed that all competencies need not be attained through formal courses.

All evaluation is based upon the theories of criterion-referenced testing. Thus, grading on an A,B,C,D, and E basis is possible if criteria are specified in each objective for each letter grade. Product evaluation is presently being conducted in the public schools, whereby a follow-up study is made of our students to determine if they are demonstrating the program competencies on the job. It is planned that a follow-up study will be made of the students of our graduates, but as of yet it is too soon to begin.

It is obvious that performance objectives are the backbone of Wayne State University's CBTE instructional program. The identification of performance objectives to meet meaningful teacher education experiences is necessary if educators are to turn out competent teachers, and if they are held accountable for their graduates. To protect oneself from the weaknesses of existing programs, it is essential that industrial arts teacher educators become familiar with the processes involved in the specification of objectives and their implementation.

FOOTNOTES

1. Neuhauser, Charolette. "The Design and Implementation of a Management Information System to Facilitate the Functioning of a CBTE Program," paper presented at the Annual Meetings of the American Educational Research Association, April 1974, p. 1.
2. Cook, Fred, and Rita Richey. "Two WSU CBTE Models: A Model for a Competency-Based Instructional System," Competency-Based Teacher Education Series, No. 2. Detroit, MI: Wayne State University, November 1973, p. 2.
3. Cotrell, Calvin J., et al. Model Curricula for Vocational and Technical Teacher Education: Report No. II—General Objectives—Set I, Columbus, OH: The Center for Vocational and Technical Education, 1971.
4. Popovich, Nova John. "A Validation of Selected Teaching Competencies for Industrial Teacher Education," Unpublished Doctoral Dissertation, Wayne State University, 1973.
5. Davis, Robert H., et al. Learning System Design. New York. McGraw-Hill Book Company, 1974, pp. 43-44.

APPENDIX A

Competencies in the CBTE Program at Wayne State University

Pre-Certification Competencies

The teacher will:

1. select and develop program goals
2. determine student needs and goals
3. identify from an occupational analysis the skills and information to be taught for an appropriate occupation
4. analyze a task or activity
5. select and develop instructional content for a course
6. select and develop instructional content for a lesson
7. formulate behavioral objectives for lessons, units, and courses
8. analyze and organize the sequence of learning tasks (skills, operations, procedures)
9. develop instructional units
10. construct a lesson plan
11. select teaching strategies and delivery system
12. determine in-school learning experiences
13. determine and select appropriate instructional resources
14. develop a system for recording and filing subject matter information relevant to course planning
15. prepare directions for substitute teachers
16. select and/or design instructional materials and procedures for individualized learning activities
17. use a systems model in planning and managing the learning environment
18. reproduce instructional material using appropriate available equipment
19. set up display materials for instructional purposes
20. teach a lesson
21. demonstrate a variety of methods and techniques
22. present a lesson using appropriate multi-media equipment and material
23. supervise student laboratory experiences

24. supervise the use of individualized instructional equipment and materials
25. establish and demonstrate regular procedures for the safe use, storage, and maintenance of tools and equipment
26. formulate a plan for grading accommodating policy and criterion-referenced procedures
27. establish criteria for evaluation of lessons, units, or courses
28. evaluate the delivery system's effect in terms of pre-stated objectives
29. provide for the student's assessment of progress in class, home, and laboratory assignments
30. monitor student progress and provide constructive feedback
31. work with guidance counselor to provide services
32. refer students to qualified personnel agencies and/or provide occupational and educational information
33. refer students to qualified agencies and/or provide assistance with personal, social, or scholastic problems
34. devise means of determining student attitude
35. participate in student-parent conferences
36. interpret cumulative student records
37. organize class at beginning of term
38. establish order of business each day
39. define the operating rules and responsibilities of both the learner and the teacher-manager
40. provide for the physical management of the learning environment
41. handle hostile acts decisively
42. express displeasure in the act and not the person
43. design behavior modification systems which produce desired changes in the classroom behavior
44. interpret current educational thrusts within the school and community through oral and written communication
45. demonstrate knowledge of the ethical procedures of a profession
46. use correct oral and written communication
47. demonstrate a commitment to teaching
48. demonstrate awareness of the purpose and programs of appropriate professional associations
49. keep abreast of professional developments, societal needs, and technological advances
50. demonstrate a respect, love, empathy for learners as growing, developing, and feeling human beings

Professional Development Competencies

The teacher will:

1. relate instruction to present and future trends and events
2. develop and identify instructional materials for exploratory, general, and occupational curricula
3. allocate time to the various activities of each learning task
4. develop and implement an accountability model
5. construct situations that will stimulate learning
6. motivate students to develop salable skills in his instructional area
7. design application experiences for students
8. devise and use instruments to secure evaluation of his teaching by students and others
9. assist students to solve psychological, physiological, or sociological problems which adversely affect learning
10. assist the student to assess his capabilities and interests with respect to the world of work and take appropriate action
11. provide a classroom environment whereby career guidance information will be readily available for student's and teacher's use
12. synthesize data on the need for equipment, facilities, and supplies to facilitate the desired action
13. develop policy for use of facilities by other school personnel
14. develop policies and procedures for record-keeping systems

15. establish management procedures with concern for teacher liability
16. make appropriate classroom management decisions to augment a variety of delivery systems
17. identify the purposes and practices in developing and maintaining a student vocational or applied arts or organization as an integral part of the program goals
18. demonstrate current occupational skills in his area of concentration

Master Degree Competencies

The teacher will:

1. recognize, produce, and use instructional research to increase competency in instruction
2. communicate scope, sequence, and content of a multi-disciplinary career education approach
3. write and submit program evaluation reports

Dr. Bies is an assistant professor of industrial education in the Division of Teacher Education at Wayne State University, Detroit, Michigan.

Preparing Industrial Arts Teachers: A Chairman's Perspective

Michael J. Dyrenfurth

ENVIRONMENT AND QUALITY: WHY ALL THE FUSS?

Arguing against quality and professionalism seems like arguing against motherhood. The pursuit of excellence is one of the ideals inculcated by the very meaning of "professional" as promulgated by leading teacher educators and associations. Although some would argue with the following, professionalism is a tradition that we must not let die. Instead, if we are to meet current challenges, it seems that there is enough evidence pointing to a need for increased efforts toward this goal.

In contrast to professionalism, the importance of environment seems not at all obvious. My point is simple. While many discussions, articles, and presentations have dealt with the constituent elements of programs in terms of the obvious categories such as courses, content, and sequence, it seems the over-all picture has been somewhat neglected. What is the big picture? How do all our components, courses, buildings, policies, etc., merge, and what kind of environment is created as a result of all of the influences?

This rather encompassing notion of environment is delineated by Astin, who defines college environment as "All those things capable of action as a stimuli to a student (1968a)."

Well, that takes care of the what of environment. Now for the importance of this concept.

A. The importance of improving the educational process by which young students develop into aspiring professionals has already been established. Clearly, the environment, by virtue of its impinging stimuli, plays a major part in this process. To improve the profession, we must improve the environment.

B. The present seemingly hostile and certainly difficult situation faced by teacher education institutions necessitates a clear understanding of the effects of changing environment on the quality of the educational experience and hence the graduate. How can institutions and departments facing faculty cuts, decreased enrollments, and tighter budgets modify their behavior so as to minimize inroads on quality and perhaps even increase quality?

OVERVIEW OF ENVIRONMENT

Astin's (1968 a) Classification

1. Student Behaviors (college environment)
   a. Peer Environment
      i. interpersonal environment (competitiveness and independence vs. cooperativeness and cohesiveness)
      ii. Non-interpersonal environment (e.g., career indecision)
   b. Classroom Environment
      i. instructor behavior
      ii. student behavior
      iii. classroom organization
   c. Administrative Environment
   d. Physical Environment
      i. location of college
      ii. climate of college community
      iii. geographic arrangement of campus
      iv. student living quarters
2. Student Perceptions (college image)
   a. Academic Competitiveness
      i. pressures for grades
      ii. fellow students are perceived as able
      iii. tense environment
   b. Concern for the Individual Student (accounted for most variance)
      i. how freshmen see faculty
      ii. upperclassmen helping freshmen
      iii. correlates inversely with size
   c. School Spirit
   d. Permissiveness
      i. informal classes
      ii. more theoretical classes
      iii. more avant garde
   e. Snobbishness (intellectual)
   f. Emphasis on Athletics
   g. Flexibility of Curriculum
   h. Emphasis on Social Life
3. Student Personal Characteristics

Eldridge's (1973) Environmental Subsystems

1. Natural Environment
2. Man-Made Physical Environment
3. Societal Environment
   a. stratification system
   b. family-community feeling
   c. economic system
   d. political environment
4. Cultural Environment
   a. self-realization
   b. creativity
   c. creation and display
   d. perform and consume

ACIATE Research Committee's classification of variables in the National Status Study of IA Teacher Education (1972)

1. Administration
2. Staff Load and Assignments
3. Degree Patterns
4. Course Offerings
5. Relationships with Other Units

Reichard's (1971) classification

1. Economic Aspects
2. Social Psychological Aspects
3. Learning Environment

Many of you are charged with the responsibility of making key programatic decisions. Knowing environmental characteristics and their effects will help in the optimal allocation of limited resources. In addition, it is hoped that useful information will emerge to assist you in your efforts to attain the quality you seek.

I feel this symposium is important because it will undoubtedly attack some of the stereotypes and myths that are prevalent today, particularly with respect to size and its implications.

The notion of environment is useful for examining the differences between departments and colleges, particularly with respect to quality. By developing an insight into the concept of environment, we may realize why some colleges are more effective than others in encouraging students to take graduate study (Astin, 1968a).

The traditional justification, identifying needed research, also serves as cause for investigating environment. This is particularly important so that we can fill in the gaps as demanded by the increasing concern for accountability.

PERTINENT DEFINITIONS

Excellence. A concept that seems to imply an improved state or condition over the present; therefore, in a changing situation, excellence is also always changing. Typical indices may be found in Astin (1968a).

Environment. "Any characteristic of the college that constitutes a potential stimuli for the student, i.e., that is capable of changing the student's sensory input" (Astin, 1968a, p. 3). While Astin stringently defined environment to exclude such intangibles as student perceptions and characteristics, for the purposes of this symposium, ours will be a looser, more encompassing interpretation.

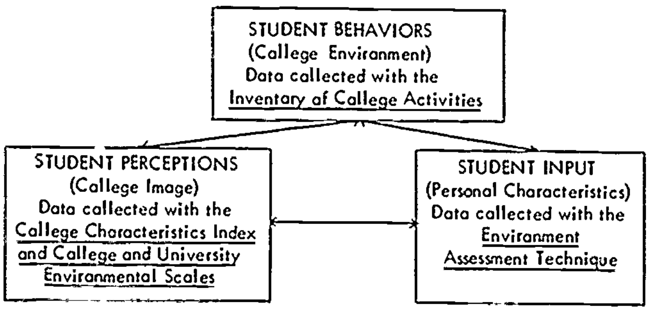


Figure 1. Adapted model of Astin's College Environment (1968a).

ENVIRONMENT AND EXCELLENCE: FROM THE PERSPECTIVE OF A CHAIRMAN OF A SMALL DEPARTMENT

The outlined perspectives provide us with the overview necessary to examine the environments created, either consciously or not, in our departments. So, let us look at environment and program quality from the perspective of a chairman of a small department. Being involved in the building and development of what amounts to a new thrust in our college and at the same time being faced by financial exigency and its effects, I have recently come face to face with the larger concept of department environment and its effects. Clearly, there is more to a student's college experience (in the professional domain) than the sequence of courses he takes. It is my contention that this environment has a significant, if in fact it is not the significant, influence in our students' development.

I wish to address myself to this aspect of a department's environment. As typical administrators of industrial education departments, we sometimes become engrossed in the tangible, hard-core reality of monetary, hardware, and programatic factors. Unfortunately, we may thereby tend to ignore those other typically less regulated aspects of our department.

Lewin's force field model of psychological causes of behavior (Hill, 1963) describes how such things as faculty attitude toward their profession and the public's perceptions of industrial education can influence departmental environment greatly. Much simplified, Lewin's theory suggests considering all factors (influences) on a student in a similar manner to force vectors in physics. The effect of the forces is determined by the resolution of their magnitude and direction. With respect to the department, then, what factors may be manipulated in order to contribute to "a positive environment?"

I have attempted to summarize my review and impressions of the effect and variables of departmental environment by using the five categories of:

a. People and their relationships (other than instructional) as environmental influences
b. Administrative influences
c. Learning and instructional influences
d. Physical influences
e. Professional influences

PEOPLE AND THEIR RELATIONSHIPS AS ENVIRONMENTAL INFLUENCES

Typically, one considers the variable of size as important to this set of influences. Reichard (1971) summarizes this viewpoint by stating that, "The great bulk of the social psychological literature focusing upon institutional size appears to favor the environments associated with the smaller institutions (p. 17)." Reichard's views are consistent with Hodgkinson's (1970) earlier findings that size typically has a negative relationship to individual participation, involvement, and satisfaction.

Many administrators strive to create a cohesive feeling of participation in an exciting profession. One interesting finding is Astin's (1968 a) discovery of a negative correlation (r -.42) between size and cohesiveness. He also reported a similar and—I suspect—a related finding of instructor familiarity being inversely correlated (r -.52) with the size of the student body. Also, Astin's analysis indicated this factor of familiarity was distinct from classroom-related influences. Now, it seems reasonable to caution administrators of large departments to consider positive actions to combat the discovered negative correlations if they suspect that such an effect is operative. To this end, Reisman (1960) has suggested a diagnostic technique that may be of assistance. Reisman's thesis is that a group, student body or faculty, is too large when either refers to the other as "they." Do you?

One method that can contribute to creating the desired cohesive atmosphere is the enlistment of students to assist in the recruitment efforts that many of us engage in. Another technique is the deliberate creation of an image (and hopefully fact) of a developmental thrust that typically involves students by a process of identification. The result is a momentum that can contribute greatly in "tense" situations.

Another variable in this domain is student input. It is my firm belief that a heterogeneous student body is another of the "intangible" aspects of environment that contributes positively to the quality of a program. Obviously, manipulation of this variable relates directly to recruitment activity. Typically, equal access laws confound the problem, but undoubtedly positive approaches can be developed.

Once the students are enrolled, the advisement procedure also injects a vital influence in this domain. Clearly, the more one knows about a student, the more likely is the result of a positive influence. With the aforementioned correlations between size and familiarities, the advantage again must be given the small department. A key feature of the advisement process is the over-all treatment of the seemingly prevalent phenomenon of career indecision. Does your department ignore career indecision? Does it program against it (for example, by not providing a program to assist undecided students in "sorting themselves out")? Or does your department employ an "affirmative action" type program? The influence of any of these situations must be recognized.

Finally, in this domain dealing with people and their interrelationships, the influence of the peer environment must be observed. Student and faculty inputs are involved here. The faculty's attitude forms a key "stage setting" function in creating the department environment. This value system is exemplified by such things as if students count as people and whether students are perceived as fledgling professionals (rather than mere recipients of knowledge). One of the major variables interacting with this influence is the students' value system as exemplified by their intragroup reward system, their degree of competitiveness, the degree to which seniors are willing to help freshmen, and the like.

Also worth noting, as many others probably have done previously, is the importance of consistency. I suspect that many small positive contributions toward the desired environment are more helpful than "far left and far right" over-compensated approaches.

ADMINISTRATIVE INFLUENCES ON THE ENVIRONMENT

From a chairman's perspective, administrative influences on environment must be vitally important. Often these are his most direct inputs to the over-all environment. Again, size of the organization suggests several relationships. Chickering's (1969) notion that organizations should be big enough to have a ball game but small enough so all can play is an early consideration. The relation of size to economic efficiency is another frequently debated issue. According to Reichard (1971), it seems that economic efficiency does increase as an institutional enrollment of 2000 is approached. This finding refers to institution size rather than departmental size. A search for the effects of the latter proved fruitless. One would suspect that as far as departments are concerned, any enrollment could be optimum (and thereby demonstrate efficiency) provided that proper resource allocation is planned and defended.

Perhaps an even more crucial environmental influence, particularly where planning-programming-budgeting systems are adopted, is the relationship between organizational structure and size. Reichard (1971) has suggested that a direct correlate of institutional size is the inability to offer evidence of an over-all rationale as to the administrative organization. Extrapolating this to the departmental level, one can ask the question:

> Is the department's administrative organization consistent with the rationale of the discipline as espoused by the department, or is the structure based upon outmoded ideas and tradition?
>
> e.g.: Woods, metals, plastics, and ceramics laboratories and administrative responsibilities, when actually the rationale requires the more global "materials processing approach."

Small size may also have the effect of increasing the department's susceptibility to environmental influence. My own notion is that small colleges and their departments, probably regardless of the latter's size, are more susceptible to community and state influences. We must recognize our responsibilities to state and local needs. We cannot be as isolationist and self-sufficient as larger departments. Hence, if we survive, I would suggest that we would tend to be more accountable than larger departments. Fortunately, the increased susceptibility of small departments is counter-balanced by being able to accomplish change more easily due to their tighter communication loop and lesser amount of inertia due to faculty numbers. I am sure all of you are aware of how difficult it is to obtain the active agreement of a large group of faculty. These factors have the effect of allowing change to occur more quickly in small departments.

Administrative inputs to, and the recognition of, faculty environmental influences is crucial. Askew (1972) pointed out that his review indicated tensions for faculty at small colleges between their writing-research aspirations and their teaching and committee responsibilities. It seems that the administrator sensitive to his environment would take pains to communicate his value system clearly to the faculty. Obviously, instructors should know what rewards are possible for what kinds of performance. Does your evaluation, promotion, and tenure system reflect the prevailing values?

A discussion of administrative influences on department environment must also include the two general areas of routine policies and rules and political realities. The former comprises a set of influences that is frequently determined solely by the administrator. To assess the effects of these mechanical aspects, one must be quite attentive, because the normal tendency is to take them for granted. You might consider:

a. The existence of a secretarial gauntlet.
b. Open door — easy access policies.
c. Seminars — rap sessions — open dialogue mechanisms.
d. The existence of needless and/or outdated rules.
e. Honest provision for student input into departmental affairs.

The political aspect of environment is one that few surviving chairmen have ignored. These aspects frequently dictate the proportion of resources allocated to your department. In addition, the ramifications of such influences are extremely diverse, and therefore I will not deal further with them. Suffice it to say that they are crucial.

LEARNING AND INSTRUCTION-BASED ENVIRONMENTAL INFLUENCES

I suspect that the environment created by singular classroom-related influences are somewhat more structured and predetermined than the over-all department environment. It is important to recognize that the cumulative effects of each classroom's environment will greatly influence the over-all department context. Also, in a similar vein to the consistency principle detailed in the interpersonal relations section, classroom environment planners must consider consistency at the departmental level.

Some key variables in this domain include:

a. The extent of implementation of humanizing processes.
b. The knowledge of what "actually" takes place in the classroom (typically investigated by using interaction analysis).
c. The extent of individualized instruction.
d. The basis for the operational rules for instruction (fear, reward, respect, etc.)
e. The accuracy of the match between student needs and course and/or program

needs. For example, with respect to student teaching, the match between a student's needs, a cooperating teacher's characteristics, the station's characteristics, and the college supervisor's skills and insights.

While many of these variables are obviously within the sole domain of each individual professor, their combined effect certainly must be considered!

Size, as a variable, has generally had conflicting reports as to its effects on the learning environment. When using various GRE examinations as indices of achievement, size was a correlate for institutions with relatively high income per student, while this relationship did not exist for institutions with a low income per student (Rock, Centra, and Linn, 1970). Strict economics alone, however, do not directly facilitate student achievement according to Astin's (1968b) study.

PHYSICAL INFLUENCES ON DEPARTMENTAL ENVIRONMENT

Physical environment is another variable we administrators can often get immersed in. Square feet, lighting, lounges, safety specifications, and the like are hard-core reality to us, as are buildings and laboratories. What about the "liveability of the labs"? Is all the equipment and supply money being spent on acquisition of new hardware, or is a significant contribution being made to rounding off the "rough edges" of a laboratory to truly convert it to an educational environment? Typical evidence of the latter is:

a. Multi-media software availability in the laboratories
b. Reference material availability in the laboratories
c. Ready access to a variety of media equipment
d. Minimum tool loss
e. Maximum visibility of tools
f. Preventive maintenance program and equipment technician

Typically, I would concur with the common notion that the larger a department, the more support services (maintenance personnel, media technicians, research support, etc.) are available. The likelihood of a significant multiplier effect between institution and departmental size must also be recognized. However, there does not seem to be an obvious relationship between the degree of equipment and laboratory "quality" in terms of hardware. To be sure, most of us would probably give lip service to the notion that better laboratories and more equipment means better programs, but I simply have not seen empirical evidence thereof.

PROFESSIONAL INFLUENCES IN THE ENVIRONMENT

What efforts are you making to assure that your graduates assume "proper" professional values? What variables in your environment contribute to achievement of this goal? While professional commitment is an equally difficult concept to define as excellence, it may just be the single most important effect of our preparatory programs. Some influences with potential for positive contributions include:

a. Opportunities for activity in associations such as Epsilon Pi Tau and professional committees.
b. Deliberate exposure of students to regional and national meetings.
c. Participation in state curricular efforts.

SUMMARY

To review all possible environmental influences is obviously not feasible, nor were all in fact dealt with. Undoubtedly many others remain to be identified and considered. The major categories of environmental influences can, however, be given easily:

a. People and their relationships as environmental influences
b. Administrative influences
c. Learning and instructional influences
d. Physical influence
e. Professional influences

In addition to this categorization, four important precepts emerged from the analysis of environmental influences. These were:

a. The necessity for considering all environmental influences as a total stimulus input to the student.
b. The necessity for deliberate, positive action to create certain environmental influences.

c. The necessity for consistency in the environment.
d. The importance of the affective domain.

REFERENCES

Astin, Alexander W., and Lee, Calvin, B.T. The invisible college: A profile of small, private colleges with limited resources. New York: McGraw-Hill, 1972.
Carnell, Paul H. Federal support for the small college. August 1968. 18 p. Santa Fe, New Mexico. ERIC #ED 023-189.
Dunham, E. Alden. Colleges of the Forgotten Americans. New York. McGraw-Hill, 1969.
Gross, E., and Grambsch, P.V. University Goals and Academic Power. Washington, D.C.: American Council on Education, 1968.
Piele, Philip. Number and subject index of selected documents on higher education. Oregon University, Eugene. 81p. ERIC #ED 012-110.
Stobaugh, Cynthia E. The effect of college environment on student output. Washington University, Seattle. Department of Psychology. Office of Education (DHEW), Washington, D.C. Bureau of Research. January 1972. ERIC #ED 070-420.
Trivett, David A. Small college management. Key to survival. Research currents. Kellogg Foundation, Battle Creek, Michigan, National Institution of Education (DHEW), Washington, D.C. March 1973. 4p. ERIC #ED 074-980.

BIBLIOGRAPHY

ACIATE. A national status study of industrial arts teacher education. Washington, D.C.: American Council for Industrial Arts Teacher Education. 1972. 73 pages. ERIC #ED 069-886.
Askew, Thomas A. The preparation of an annotated bibliographical guide to selected research studies related to the small college, 1965-1971. National Center for Educational Research and Development (DHEW/OE). Washington, D.C. December 8, 1972. 13 pages. ERIC #ED 071-630.
Astin, Alexander W. The College Environment. Washington, D.C.. American Council on Education, 1968a.
Astin, Alexander W. Undergraduate achievement and institutional "excellence." Science. 1968b. 161(August 16), 661-668.
Chickering, A. W. Education and Identity. San Francisco: Jossey Bass, 1969.
Eldredge, H. W. The environment of urban society. Industrial Arts and the Challenge of an Urban Society. Washington, D.C.. American Industrial Arts Association, 1973.
Hill, Winfred. Learning: A survey of psychological interpretations. San Francisco. Chandler, 1963.
Hodgkinson, H. "Ideal governance structure would be larger and smaller simultaneously." College and University Business. 1970, 48(4), 65-68.
Reichard, Donald J. Campus size. A selective review. Southern Regional Education Board, Atlanta, Georgia. 1971. ERIC #ED 052-686.
Reisman, D. Some problems of assessing (and improving) the quality of a college in S.E. Harris, Higher Education in the United States. Cambridge. Harvard University Press, 1960.
Rock, Donald A., Centra, John A., and Linn, R.L. Relationships between college characteristics and student achievement. American Educational Research Journal. 1970, 7(1), 109-121.

Dr. Dyrenfurth is chairman of the Department of Industrial Education at Valley City State College, Valley City, North Dakota 58072.

Size Is Not Enough

Jerry Streichler

The basic literature on college and department environment has been reviewed by preceding panelists. This discussion attempts to describe one environment which you may choose to evaluate against the theory previously presented. This reports a series of guidelines and rationale which were formulated for the department's venture in creating what is seen as an appropriate environment. The environment which has resulted is reported with the qualification that this reporter's involvement may affect objectivity. Nevertheless, size of facilities, of budget, of faculty, and the like is important, but is simply not enough. There is an optimum size which is a condition for achieving certain ends—but without the other conditions, those ends are not likely to be achieved. I'd like to talk about those conditions as they pertain to the Department of Industrial Education and Technology at Bowling Green State University (Ohio).

The material is organized into: definitions of environment and excellence, the concepts of program and a view of content, department mission, and administrative organization. The context so represented is followed by a description of the environment of the department—the facility, the academic program, and peripheral but important opportunities which the program affords in research, field work, and student-faculty interaction.

SOME DEFINITIONS

The department environment includes all the physical elements as well as those intangible elements of esprit—attitude of faculty and students and other subtleties related to the atmosphere in which an academic program takes place. Physical elements of environment include buildings and facilities, laboratories, classrooms, equipment, instructional support as media, conference rooms, offices, lounges, secretarial support, technicians, graduate assistants, faculty work load, administrative support or commitment, and budget. The elements of environment which can be categorized as esprit can be observed when faculty are available to students in and out of class, when students have access to laboratories beyond regular class time, when respect is shown by students and faculty for facilities, equipment, and materials, and when concern for one another is observed in such activities as student clubs, service, and coffee hours.

Excellence pertains to an ideal level of attainment. For this topic, it refers to the highest level of quality to which a department and its members strive and succeed in fulfilling its mission within an institution. The extent to which excellence is achieved is often measured by the quality of its graduates (as industrial arts teachers.), the scholarly productivity of its faculty (do they engage in research publication—kinds, quality, quantity?), and the service the students and faculty perform to the community and within the university (consultations to schools and industry, offering expertise to community agencies, religious groups, service organizations, youth groups, membership on college and university-level committees and councils?).

The two terms, environment and excellence, may be considered as unrelated. It is possible to achieve a high degree of excellence in a limited physical environment, providing the other dimension of environment—the spirit of faculty and students—does exist in significant quantities. It is my contention, however, that an adequate physical environment provides a hothouse environment wherein endeavors of and toward excellence are nurtured, and grow and mature more easily. Obviously, I would want to place a competent and hard-working faculty in the latter environment, particularly if excellence in multiple activities and levels as described here is to be achieved.

CONCEPTS OF PROGRAM

The programs offered were rationalized from views of the dynamic which produces an environment for learning and a view of subject matter which is related to notions of appropriate university education and approaches to preparing teachers of industrial subjects.

The Industrial "Dynamic"

Industrial technology provided a source of content, but the dynamic of industry was scrutinized and selected as a basis for an effective learning environment in the technologies. Educators can benefit by carefully borrowing from the results of the profit-making, cost-effective, efficient resource utilization consciousness which has produced a dynamic which may have never before existed in any societal institution. Programs which contend with industry-derived content would be remiss not to allow this dynamic to flourish in the educational environment. An educational environment thus permeated with reality was believed to promise significant educational values for those who experience atmospheres of industry. The effort to manifest this dynamic was expected to produce.

1) flexibility than traditional courses—for example, ability to change content and instructional strategies with relative ease;
2) ability to institute "non-traditional" learning experiences—i.e., independent research, individualized instruction, availability of considerable alternate learning strategies;
3) alternatives in instructor assignment—teams—differentiated staffing modes, including use of graduate assistants and technicians;
4) research as an integral part of program: a) foster research activity for students at all levels, research as an instructional strategy, b) research and evaluation of curriculum, an indispensable component if one accepts the industrial model; c) continuous monitoring, correction, and improvement of process (curriculum) results in improvement of student performance (product). A possible consequence of this programmatic thrust was seen as: undergraduate, graduate students, and faculty engage in applied research and design in products, materials, processes, and training programs for and contracted with industry.

Interpreting the industrial dynamic provides one set of conditions. These are amplified by another set of conditions which emerge from views of appropriate university-level education.

University-Level Education

Almost seven years ago, a principal guideline for program development at Bowling Green was accepted. We took the position that university students who prepare to teach industrial subjects in the public schools should come in contact with the subject matter of their specialization at a level appropriate to their maturity and competency expectations. Thus, the duplication of elementary and secondary school exercises and activities as part of the technical subject matter on the university level was discouraged except in relation to methods studies. As a consequence, the content of the technologies became the same for all students, prospective teachers, technologists, or general students (taking into account, of course, their individual interests and capabilities). Such a policy was based upon the premise that courses would be more exciting and challenging. Those preparing as future teachers would need to cooperate and compete with as well as learn and teach students preparing for technology functions in business and industry or students majoring in arts and sciences.

Clearly, this view of technology as subject matter resulted in a clear delineation between courses which are technical subject matter and those which are intended to teach students how to teach—the professional methods courses. The professional methods sequence received the same attention as the technical subject matter component. It was viewed as possessed of a dynamic which can be interpreted and cast into a system of courses and experiences which would insure competency attainment of students. As with the subject matter component, quality courses and experience were viewed as attainable in an environment which fosters research, experimentation, evaluation, improvement, and modification. The known technologies of teaching could thereby be unfolded for the student in an experiential mode. The idealized concepts of content were then set against a framework defined by the missions of the department and the administrative organization in which the ideals would be accomplished. These, too, were formulated between six and seven years ago.

THE DEPARTMENT MISSIONS

A principal mission of the department would be to prepare teachers who could apply appropriate instructional technology in industrial arts, vocational-industrial subjects, technical-level industrial subjects, and industrial arts/special education programs.

Graduates of any one of the programs would be able also to function in training programs in industry and could rise to positions as directors of such programs.

The preparation of technologists would become another essential mission facilitated by the view of content. After satisfactory completion of four years of undergraduate work, students could receive a B.S. in Technology. They would be qualified to enter technical management positions in research, sales, production, and to work with engineering, scientific, and management personnel in industry.

The department would offer "service" courses in technology which could be helpful to or required in programs such as: vocational rehabilitation, special education, elementary education, management, art, and environmental science. Finally, courses in technology would be open to all university students on an elective basis. Any university student could gain insight into the technology of industry, man-machine technics, and organization which so greatly affect society.

Many of the above functions were also seen applicable to the graduate program in industrial education. The essential mission of the graduate program would become leadership development for industrial education or for the comprehensive field of vocational, technical, and practical arts education. (We call it Career and Technology Education.)

Research and Service

Under this heading, the department chose to offer in-service and continuing educational opportunities to industrial education teachers and to technologists, to provide consultant services to educators, school administrators, and industrial enterprises, and to encourage and provide opportunity for research to departmental personnel commensurate with their competencies and appropriate to their professional interests. The research effort was seen to include the technical areas, relevant instructional technologies, and the interface of industrial technology (content) and educational technology (method).

Changing the Mission?

These mission statements, when accomplished, would bring the department to a plateau of sorts. To provide perspective for those statements, a measure of accomplishment and of their relationship to endeavors after they were achieved, the department speculated on additional possible undertakings:

1) Associate degree technician preparation programs in industrial, engineering, and aerospace technologies and preparation of paraprofessional aides for industrial education and technology teachers and programs.
2) Add specializations or otherwise modify the baccalaureate teacher preparation program.
3) Add specializations or otherwise modify the baccalaureate technologist preparation program.
4) B.A. degree with a major and minor in Industrial Arts or Technology.
5) B.S. in Career Education (preparation of consultant teachers who will function from grades 1-12).
6) B.S. in Occupational Therapy
7) Offer courses for expanded professional program which prepares recreation specialists.
8) M.S. in Technology
9) Ed.S. and Ph.D. in Industrial Education or the comprehensive field of career education (vocational, technical, practical arts, and relevant facets of special education and guidance).

ADMINISTRATIVE ORGANIZATION

The administrative structure for the department issues from the approach of interrelating teacher education and non-teacher education programs. More importantly, it was seen as the vehicle for creating an atmosphere in which the various missions could be achieved most effectively. It attempted, also, to introduce new relationships among faculty and students, and delineated roles and responsibilities which they had not previously undertaken.

A line and staff administrative structure was planned. It delineated superordinate and subordinate responsibilities. At the time this administrative plan was introduced, the need to lodge specific responsibilities and roles in individuals was clearly recognized. But it was also clear that we wished to achieve an ideal of sorts which we described in a statement on peer-professional relationships. This implied a desirable set of behaviors among faculty, graduate teaching and research assistants, and student committee members which included consulting, discussing, recommending, and critiquing for decisions on an informal, constructive basis. Thus, it was envisioned that while the line and staff administrative structure was needed at the outset, more could be accomplished — even in an accountability system — if the professionals could come to hold themselves accountable. And as this happened, the line and staff structure, at least parts of it, would become unnecessary.

A system of committees was established as part of the administrative organization. Committees were seen as a first step to accomplishing the ideal of peer-professional relationships. Thus, each committee includes faculty members, undergraduate, and graduate students who contribute their time, talents, and energies to policymaking, advice, and review in appropriate departmental areas.

THE FACILITY

I trust that you will agree that the physical setting can contribute significantly to an environment that promotes goal and mission accomplishment. All that has preceded this section dealt with other than the bricks and mortar environment. Fortunately, about five years ago we knew that we would have a new building, and this happy circumstance allowed us to speculate — to mesh our program concepts, mission ideals, and staff relationships with ideals of a physical environment.

A key requirement of a functional facility for technology education was seen as flexibility. Innovation and change in technology as content and in educational technology which often is the vehicle for teaching subject matter called for a building in which space allocations can easily be shifted to facilitate the adoption of new developments. The university facility envisioned should accommodate, as a continuous enterprise, developmental activities in subject matter content, pedagogy, and facilities utilization research. Rapid, efficient movement of laboratory equipment to allow the use of simulation and replication in the solution of technology problems in instruction and research was specified. In brainstorming for this specification, such activities were called out as. facilities planning for schools, industrial engineering, production planning and control, production, quality control, and materials handling. Utilities were then specified to be installed to foster and not inhibit flexibility. We learned that such a specification would be initially costly, nevertheless, we insisted upon it as a worthwhile investment. A successful interpretation of this specification would require no major reworking of electrical or plumbing installations over the next forty to sixty year period, resulting in a significant long-term saving. In response also to the flexibility requirement, several laboratory areas were not separated by fixed walls of any kind, although they are so separated in buildings of traditional design. Other areas, in which the requirements of cleanliness or sensitive instrumentation so dictated, were closed off. The entire facility was environmentally controlled with respect to heat, ventilation, and sound. The building was designed to be expanded easily with removable curtain perimenter walls. If enrollment growth or new programs warrant, these walls will be detached, additional framework added to the building, and components can then be reattached to new framework.

Communications systems often receive short shrift in building plans for educational or other uses. Very early in our deliberations we saw communication as an integral component of subject matter — i.e., computers and television applications in inventory control, process control, instrumentation, data storage and retrieval — completely supporting instruction. For efficient instruction and use of instructor and student time, it was desired that communications bring the library to students anywhere in the building. It was required that varieties of information, including short lectures and individualized programmed instruction, would be delivered to students when and as required near laboratory stations and in various media as T.V., synchronized audio-visual filmstrips, slide systems, or pamphlets. Thus, a computer center and an instructional media center became integral parts of the building and its instructional program. Carrels, terminals, and a completely flexible system of two-way communications between those centers and all other parts of the facility were specified.

All these elements, communications, open areas, special utilities provisions, and locations of laboratories to intentionally achieve overlap or interface of certain specialized technical areas, permitted us to characterize the building as a living organism. An organism so constituted would respond, we believed, most effectively to the primary stimulus for which it was conceived: program.

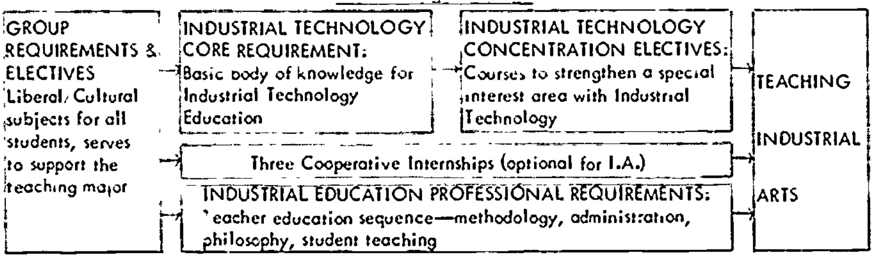
The basic laboratories would accommodate revolutionary changes in instructional programs in technology. Programs would be easily modified, eliminated, or added without major interior structural change other than possibly introducing different equipment.

You may well be asking, "How are all these ideals, concepts, and specifications evidence of the effects of environment upon excellence?" Of course, they are not evidence at all. not without additional information. Which of these ideals are reality today? How have these concepts supported the creation of an environment for excellence? Confessing bias, this reporter observes much progress toward excellence in several domains. Possibly you can make some value judgments of your own with the aid of brief descriptions of department characteristics, implemented industrial arts teacher education programs, and examples of curriculum enrichment.

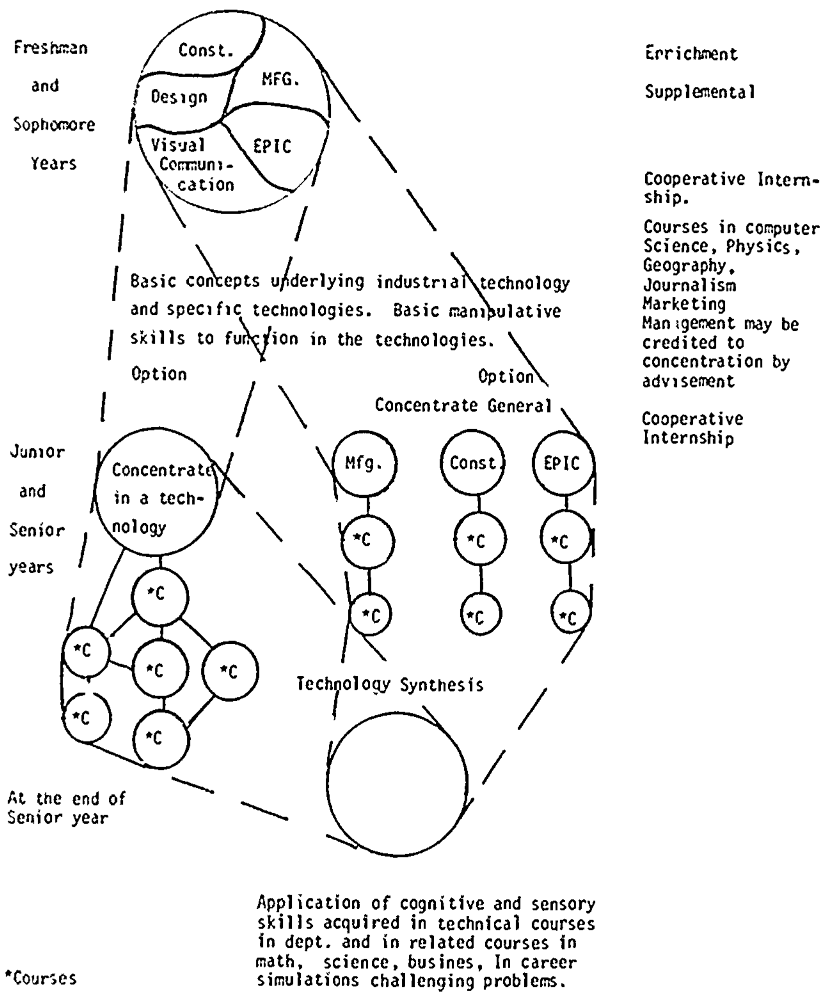
THE INDUSTRIAL ARTS TEACHER PREPARATION PROGRAM

The program is characterized graphically through schematics of the general program design, a model of the technical component, and one of the professional component.

General Program Design



A Model of the Technical Component



A Model of the Professional Component

	Offered by Department Industrial Education and Technology		
Freshman -	Foundations of Industrial Education and Technology		Technology? Careers? To Teach or Not to Teach? Rationale for I.A. Teach in Industrial Ed.?
	Field Experience		To teach Industrial Arts? To teach at what level?
Sophomore		Basic Psych.	
	Elements of Instruction		What is teaching-learning? What am I like? As a teacher? What are teacher behaviors?
	Field Experience		To teach or not to teach? etc.
Junior -	Scope and Sequence of Instruction		Organizing and Planning to teach —
	Career and Technology Education in Elementary Schools		What is elementary education all about: Can I work with younger kids?
	Educational Psych.		
Senior -		Tests and Measurements	
	Student Teaching	Foundations of American Ed.	Can I? Can I do it better? Am I a pro? Am I becoming?
		American Educational System	Do I have the professional equipment and skills? Can I use it?
		Organization and Administration of Industrial Education	

THE PROFESSIONAL SEQUENCE

The technical component has received space elsewhere. A brief description of the professional sequence should provide a better idea of what we have done. The importance of the professional sequence is increased because insufficient time has been left for "methodology" in the technical laboratory courses. Naturally, all courses serve important, but subtle, professional education purposes. they provide the prospective teacher with diverse teaching models. The prospective teacher should become sensitive to this fact and milk it for what it's worth. He is encouraged to talk with professors privately, identify with one or more of them, and consciously ask himself what it is they do which is effective and ineffective (and remember it).

Except for the modeling function described, professional needs and concerns (goal determination, content organization, program development, evaluation, methodology, resource identification, professional associations, field experience, etc.) are the province of the teacher education courses. Some of these concerns are so general that they are handled by the Department of Educational Foundations and Inquiry, and some are more appropriately handled in the Department of Industrial Education and Technology.

All professional courses in the department are clinically based and project oriented. As appropriate to the course content, students either go directly to the schools or engage in active laboratory work in class. These courses are further enhanced by their location on the time continuum in relation to other professional courses as noted in the model, and by the two field experiences which are extremely important to the success of the entire sequence.

An articulated set of field experiences is designed to help students in industrial education programs answer the following types of questions for themselves. Is teaching for me? What's it like? Is teaching in industrial education for me? At what level would I like to teach? What component area of industrial education is for me? Where can I do the most good and be the most satisfied? In the city, the "inner city," the suburbs, or in a consolidated rural area? What are the several related missions of the various component areas of industrial education?

Responses to such questions are obtained in the equivalent of two full weeks of field experience which is distributed over three years. These involve individual observation and participation as an aide at various levels and in representative programs of industrial arts, vocational-industrial education, technical-industrial education, and special education (as well as a glimpse at industry-oriented training programs for persons who may be interested in teaching in industry). Remember, this is in addition to field work required in the professional courses.

In the first experience, students visit five different environments associated with industrial education from a selection of fourteen environments. The fourteen are listed under appropriate headings below:

<u>Industrial Arts</u> 1) Elementary school, 2) Middle or junior high school, 3) Senior high school 4) Adult and continuing education

<u>Vocational-Industrial Education</u> 5) Comprehensive high school, 6) Area vocational school.

<u>Technical-Industrial Education</u> 7) Community or junior college, 8) Technical institute or technical college.

<u>Special Education and Vocational Rehabilitation</u> 9) Vocational rehabilitation centers, 10) School district special services, 11) Special projects

<u>Cooperative Work Experience Programs (CWE)</u> 12) Occupational Work Adjustment or Experience, 13) Diversified Occupations.

<u>Industrial Training</u> 14) Training programs in industry.

The student spends at least a half day at each of five educational environments chosen from the types listed above and the equivalent of the remaining two and one-half days in areas of his choice from the list. This brings the total observation and participation time to five full days. Return to two of the more interesting or promising environments previously visited, or perhaps an environment of the same type but with a different teacher, is encouraged.

In the second experience, students focus more directly on one or two programs closely related to their technical competence objectives. They will spend two continuous days in one context and three continuous days in another. If students are trying to decide whether they want to be a junior high industrial arts teacher, time should be divided between two different junior high industrial arts situations, perhaps one in a large city and one elsewhere. Or perhaps the choice will be between Mr. X who is known to have a highly structured program and Mr. Y who is known to have an effective, but more experimental, program.

We find the field experiences combined with a clinical approach in methods classes to produce students, if they choose to remain with the program, who are committed to teaching, who feel secure in their choice of level, and who seem to be able to relate the professional demands of teaching to their concepts of their own competencies and potentialities.

ENRICHING EXPERIENCES

There are a number of benefits which accrue to faculty and students as a result of the environment which has been created. These are enumerated in the following:

Research

Much enthusiasm for meaningful individual research has been generated because of what we have done in the building (the Research Modules) and our overt behavior. The following is a list of projects for which research modules were assigned. Approximately ten times as many student research projects have been undertaken in the same period for which research modules were not assigned.

Research projects conducted for which research rooms and funds were awarded, 1972-73:

Undergraduate Student Projects

Design and Construction of an Automatic Silk Screen Machine
Quality Assurance Computer and Data Processing Application for the Ready Mix Concrete Industry
Improve, Redesign, and Construct a "Pedal Car."
Process Control Simulation
Television Typewriter (Character Generator)
Detection and Measurement of Heat Loss of Buildings by Using Infrared Photography
Self-Educational Game Table

Graduate Student Projects

The Effects of a Manual Dexterity Training Program Upon the Manual Dexterity of the Trainable M.R.
Producing a Film, "How to Make a Slide Show."
Undergraduate Program Evaluation
Th Effects of a Linear Measurement Instructional Unit on the Learning Abilities of EMR Students at "x" School
Development and Evaluation of a Rotary Fluid Control Valve
Development of Set Instructional Module Film Development
The Effect of Video Tape Replay of Psychomotor Skill Development
The Design and Development of a Device for Moving Equipment in a Mobile Industrial Laboratory
Low-Cost Housing Development

Cooperative Internship

Curriculum enrichment for industrial arts majors is available also in the department's cooperative internship program. This program was really developed to serve non-teaching majors, but anyone can opt for the experience. The cooperative internship program provides industrial arts majors the chance to observe, participate, and work in an industrial environment. They can obtain job experience, current technical information, and exposure to various people and organizational styles. Industry has an opportunity to utilize the talents of capable students and to evaluate and influence the university curriculum. Students are provided with names of cooperating companies, automatic placement is not implied. It is expected that the student will be interviewed and meet employer's standards before a position is filled. Prior to accepting a position, the student must demonstrate that it is related to his career goal (his technical concentration) and is of an appropriate level of challenge and responsibility.

Another bit of evidence of the results of conscious efforts to create a total environment to accomplish missions and goals may be meaningful to those who like to compare things quantitatively. What follows does that for the department and compares the years 1967-68 to 1973-74.

	1967-68	1973-74
Job Placement	100%	100%
Total No. of Undergraduates	170	381
No. of Teacher Ed. Majors (Total)	170	381
Industrial arts	170	195
Voc-industrial	0	18
Tech. College Teaching	0	7
No. of Technology Majors (Total)	0	161
Construction	0	23
Design	0	37
Electronics	0	11 (new in 1974)
Environment	0	5 (new in 1974)
Instrumentation and Power	0	15
Manufacturing	0	32
Visual Communication	0	38
No. of non-major students served	98	740
No. of funded research projects (professors)	0	4
No. of non-funded research projects (professors)	0	4

No. of student (undergraduate) research projects		Approx. 60 + 6 research rooms assigned
No. of student (graduate) research projects		Approx. 80 + 8 research rooms assigned
No. of consultations to education	1	12
No. of consultations to industry	0	3
No. of summer workshops or funded institutes	0	8

Besides the many positive values implied in the foregoing, we see these added but important values accruing to students. From the student's point of view, the essence of the environment is options, options in what to study, options in career choice, as well as some freedom to delay binding decisions for a career. Early participation in research and working on projects with graduate students and professors, which is fostered in the environment, is invaluable and indeed immeasurable as they contribute to the personal and professional growth and development of the student.

Location of offices, of student and faculty lounges, and like physical arrangements have provided privacy when desired and have promoted desirable interaction among staff and faculty and students.

CONCLUSION

We have grown, but growth was not a primary objective. Rather, we set out to strengthen an existing industrial arts teacher education program. As we speculated on the job before us, we purposefully tried to achieve an environment for people—one which would stimulate those activities that we judged valuable in education and in industrial technology. Size certainly seems to be a factor in achieving some minimum elements, but desire, attitude, commitment to excellence, hard work, and enthusiasm are attributes out of which the environment grew and which the environment continues to foster.

Dr. Streichler is Professor and Chairman, Department of Industrial Education and Technology, Bowling Green State University, Bowling Green, Ohio.

The Large Department Environment and Quality Industrial Arts Teacher Education

Terence Trudeau

The most challenging task facing educators today is that of providing contemporaneous and quality education for students. Properly executing this task is most compelling in the field of teacher education, since each product of a teacher education program will eventually have a profound and lengthy influence upon hundreds of elementary, middle, and high school students throughout his or her teaching career. In support of an up-to-date educational program, Shane and Shane (1971) state, "Our present knowledge depreciates rapidly, has very short validity, and must be corrected by careful and continuing speculation about our role in an emergent world (p. 348)." Speaking of this need on a college level, Martin (1968) suggests, "The prime need now in higher education is for men and institutions who have the courage to investigate possibilities for alternative futures, to shape them into actual models, and to put those plans to the test of practice (p. 22)."

Our task in industrial arts teacher education is further compounded by the fast-evolving technology of industry. In the book, Educational Futurism 1985 (Hack, Briner, Knezevich, Lonsdale, Ohm, Sroufe, 1971), it is stated, "In the late 1960s, many segments of our society reflected concern with the sequential but interactive phenomena of the knowledge explosion and technological revolution, the thrust for innovation and change, and most recently the ability to cope with and adapt to rapidly accelerating rates of change (p. v.)."

Thus, the quality teacher-education schema is dependent upon the interfacing of adequate financial resources, appropriately prepared professors, an empathetic and knowledgeable management, support personnel such as technicians and secretaries, an appropriate array of hardware-software, and a ready reserve of students who are available to learn. Obviously, this matrix of people and things involves a complex environment that is readily influenced by a multitude of both internal and external forces.

Relative to this, it has been suggested that one of the major forces influencing a quality educational environment is institutional size (Hodgkinson, 1970; Reichard, 1971; Astin, 1968). This size influence has many dimensions, such as economic, sociological, professional, etc. The ability to perceive, control and utilize, or professionally manipulate when possible and desirable the components within the constraints of the system size is necessary to achieve any marked degree of quality education.

RETRENCHMENT AND DEPARTMENT SIZE

This country is in the midst of an economic decline which has generated a demand for accountability in education. That is, the public is more resistive to the economic support of higher education without documentation showing its degree of efficiency. This could lead to serious loss of resources and subsequent sharp decline in program quality. To counteract this, a move to increase FTE's generated by faculty as well as a move toward utilization of a Competency Based Teacher Education (CBTE) have emerged. In the face of this external force, does the large department have an advantage over a small one in maintaining a viable educational environment of acceptable quality? Consider the following:

1. Larger physical facility and larger student body can lead to increased class sizes and thus higher FTE generation. This notion pleases educational supporters and budget monies continue to flow.
2. Larger programs can lead to the "division of labor concept," with each faculty member a specialist in a discrete subdivision of the IA curriculum. This can lead to more efficient teaching, and a subsequent learning environment within the context of a traditional time-based format or the emerging competency-based notion. Documentation in this regard provides increased public empathy.
3. Capital investment in software-hardware to support the instructional strategy (delivery system) is reduced in a large program when calculated on a per-student cost basis. Thus, supporters of higher education are more inclined to support such budgeting requirements.
4. Larger departments can justify more administrative, supervisory, and support personnel to more adequately and efficiently direct and support the educational program.

The larger program can operate more efficiently in terms of "input dollars" and "competency output" and will be less adversely affected by economic retrenchment. That is, they can more adequately justify obtaining, and more efficiently utilize, the resources available to achieve a high-quality program.

THE PROFESSIONAL COMPONENT

When one observes the professional IA courses and the accompanying student teaching segment, the advantages of the larger department become evident. The following advantages are worthy of consideration:

1. Larger enrollment justifies larger faculty which can be diversified in such areas as Philosophy of Technology, IA Theory, Student Teacher Supervision. This provides in-depth as well as breadth of professional content for quality student growth.
2. "Teaching centers" may be set up that provide correlated professional courses simultaneously with student teaching in the field. This requires a college faculty specialist to manage and conduct the "off-campus" center on a full-time basis. To justify this, large numbers of participating students, as found in larger departments, are necessary.

   The close correlation between theory and practice, both taking place in the field, lead to a more efficient and higher quality student teaching-professional experience. The student is functioning in the "real world" that cannot be replicated on campus. As stated by Pitkin and Beecher, "Colleges and universities have come to look upon planned off-campus experience as a valid and important part of the educational process (pp. 174, 175)."
3. The utilization of contemporary educational technology in the form of closed-circuit TV for monitoring and critiquing student presentations is possible in a larger department because the initial cost-per-student is less than in a smaller

department. This immediate feedback of student performance leads to rapid and efficient student growth as negative aspects are eliminated and positive aspects reinforced.

Sekerak and McDonald (1969) define this emergent technology as employment of "personnel, space, equipment, and process, each for its most efficient intended purpose, but all in close interrelationship and in tune with society and environment (p. 48)." The larger department, with its more diversified faculty and facility (both on and off campus) can provide a broader and more relevant professional sequence due to the advanced educational technology that is possible.

THE TECHNOLOGICAL COMPONENT

The technological aspect of the industrial arts teacher education curriculum is most important. This was mentioned previously. Does the larger department have an advantage? Consider these:

1. Larger enrollment allows faculty specialization in the discrete laboratory areas of industrial arts. This allows students to select professors, as opposed to taking "who's available." This motivating factor, coupled with individual faculty expertise, leads to quality student growth.
2. Specialized and diversified laboratories and their accompanying hardware provide in-depth and variable student experiences. This would also include such diverse aspects as R and D work, along with conventional laboratory experiences. As in the professional component, the technological dimension has the advantage of advanced educational technology due to faculty and facility diversification.

THE HUMAN COMPONENT

The larger faculty, with its accompanying specialization, is able to provide general as well as specialized student advisement. By equitable division of student advisement load, the student-advisor ratio is not unwieldy.

Since faculty can specialize, total commitment to his or her specific area is possible, as opposed to split commitment to several areas.

SUMMARY

The larger departments appear to have advantages in the following categories:

1. Ability to meet the economic retrenchment through more efficient use of resources while providing a quality program.
2. Diversified faculty who individually provide in-depth exposure and collectively provide breadth of offerings in all phases of IA education.
3. Diversified laboratories and classrooms that individually provide in-depth student experience and collectively afford breadth of experiences.
4. The advanced educational technology afforded by appropriate combining of varied faculty specialization and diversification of hardware available within the context of a large program.
5. Identification with a specific area of IA leads to a stronger commitment than is found by splitting allegiance to two or more areas.

BIBLIOGRAPHY

Astin, Alexander W. The College Environment. Washington, D.C.: American Council on Education, 1968.

Hack, W. G., Briner, C., Knezevich, S. J., Lonsdale, R. C., Ohm, R. E., & Sroufe, G. Educational futurism 1985. Berkeley: McCutchan Publishing Corp., 1971.

Hodgkinson, H. "Ideal governance structure would be larger and smaller simultaneously." College and University Business, 1970, 48(4), 65-68.

Martin, W. B. Alternative to irrelevance. New York: Abingdon Press, 1968.

Pitkin, R. S., & Beecher, G. Extending the educational environment. The community as a resource for learning. In S. Baskin (Ed.) Higher education. Some newer developments. New York: McGraw-Hill, 1965.

Reichard, Donald J. Campus size. A selective review. Southern Regional Education Board, Atlanta, Georgia. 1971. ERIC #ED 052-686.

Sekerak, R., & McDonald, B. A. Two views of educational technology. Educational Technology, 1969, 9(8), 47-49.

Shane, J. G., & Shane, H. G. Cultural change and the curriculum. 1970-2000 A.D. In W. VanTil (Ed.) Curriculum, Quest for relevance. New York. Houghton Mifflin Co., 1971.

Dr. Trudeau is a professor of Industrial Arts Education at the State University College, Buffalo, New York.

Preparing Industrial Arts Teachers: A Faculty Perspective

D. Wayne Becker

The purpose of this presentation is to approach the subject Excellence and the Departmental Environment. Preparing Industrial Arts Teachers from the perspective of a relatively small department. I am currently one of five full-time faculty comprising an industrial education department. Formal educational programs listed in my vita are. high school diploma from a graduating class of twenty-eight students, BA in Industrial Education from a department containing two full-time faculty, an MS in Industrial Arts from large departmental faculty of over twenty members, and an Ed.D. from a big ten school. I have come to realize that size of the student body or the number of persons comprising the departmental faculty per se does not directly affect the educational program to any great extent. Factors other than size of department are more directly associated with the quality of the educational program. A department, small or large, can take no pride because of its size alone. Furthermore, large departments do not clearly have an edge on educational quality, as might be commonly assumed.

Research interest in college environment consists of exploring new ways of viewing and measuring the style of life and atmosphere within the institutional context that affect learning and growth of its students. Dressel and Mayhew (1954), Eddy (1959), and Jacob (1956) speculate that there is something about the total atmosphere of the college and its programs, and particularly about its peer-group associations, that is significantly important.

The diversity of abilities, backgrounds, and aspirations of students, as shown by Darley (1962) and McConnell and Heist (1962), express more about the environmental traits of a college than do differences in faculty and departmental organization. Astin (1962) concurs that output of a college may simply be a function of input in the main. Prestigious schools such as Harvard may be great because they accept only great students. Therefore, before one can assess the output of a department, the input variables must be controlled. When many college campuses are seeking greater numbers of students for economic reasons, schools, and particularly small ones, cannot afford the luxury of screening its students, either at the enrollment or process stage.

In studies by Pace (1964) and Kirk (1965), substantial differences in environmental press traits within different departments were found, but the traits exhibited by students were more attributable to the environment of the whole college than to a particular department. This begs the question, "Who is responsible for the training of the industrial arts teacher, the department or the university?" The answer seems to be the university. These findings suggest a mass-action concept of educational impact, the more massive, cumulative, and congruent the stimuli are among the various departments of the university, the greater is the impact upon changing the behavior of students. That is, when all functions of the university work toward a common goal, the end product, an industrial arts teacher, will possess greater potential than is possible with the industrial arts department operating in isolation from other university departments.

Work by Becker (1963), based on directly observed events and behavior, attributes the quality of student response to be largely a function of how that student perceives the institutional environment. If the student senses he or she is a member of a meaningful and demanding department, the response will correspond favorably, irrespective of departmental size.

Coyne (1970), in his assessment of the directions to be taken in training qualified teachers, followed-up the job performance of control and experimental groups. He concluded that any well-planned purposeful program in teacher education will produce skilled and competent teachers, secondly, all students benefited greatly from the student teaching experiences, thirdly, early exposure to public school programs assisted the student to determine whether he or she wanted to continue in teacher education and if so at what level, and lastly, courses associated with in-school involvement help students perceive and analyze classroom situations. An outstanding trait of this study was that it had a built-in capability for screening candidates, perhaps the screening aspect accounted for most of the improved performances of the experimental group.

From the perspective of one faculty member among a total of five comprising the department, the role played by faculty members differs markedly among large and small departments. Pritchard (1973) found role specialization can be and often is much narrower among faculty members on large campuses. Specialization, while often allowing for greater efficiency and greater depth of educational experience, may not be as important to the training of an industrial arts teacher as is professed by some of my colleagues. The very nature of industrial arts curricula includes a study of the "wholeness" of industry as an institution, considering both its beneficial and detrimental effects on the societal culture. To achieve the "wholeness" objective, a broad and integrative input is required on the part of the faculty. This objective is achieved not by the number of faculty members on hand but by the breadth and integrative ability of each individual faculty member. Each faculty member must have breadth to satisfy the educational objectives of industrial arts.

Issues pertaining to group dynamics, interaction process, and teamwork among industrial arts teacher training faculty are important considerations when determining faculty effectiveness. The very small and the very large departments may both suffer as a result of sheer size when an assessment of the quality of group processes is tabulated. But for the range between the very small and very large, factors other than size control the group dynamics of departmental faculty.

Numerous studies on size of student body and class size offer some ideas that provide insight pertaining to the excellence of industrial arts education by inference. Astin and Holland (1961) suggest that larger student bodies are characterized by more aggressive behavior, exhibitionism, pragmatism, heterosexual activity, and more deference shown toward faculty, while in the smaller student bodies there is more academic competition, more striving for intellectual achievement, and greater involvement in campus activities. The smaller student bodies exhibited a greater degree of fantasied achievement and were more enterprising.

The enterprising trait has been noted by the presenter over a period of some fifteen years. It appears that the products of small departments, often of sub-standard facilities, somehow function surprisingly well when they accept teaching positions that represent sub-standard facilities and below-par educational programs. The achievement motivation, while not objectively investigated, appears to be higher than for those having been trained in well-equipped facilities.

Teacher education quality was assessed by Olsen (1971) by using the criterion measure Indicators of Quality. In the study, seven internal classroom variables explained significant proportions of the criterion score variance at the secondary school level. The variables, listed in order of importance, are: 1) the style of educational activity, 2) the subject taught, 3) class size, 4) grade level, 5) type of teacher, 6) number of teachers in the room, and 7) day of the week. Particularly high-scoring teaching styles were small-group work, individual work, discussions, laboratory work, pupil reports, and demonstrations, while the lower-scoring teaching styles were lecture, question and answer sessions, seat work, tests, and movies, notwithstanding that teachers generally spend the greatest percentage of their time on the lower-scoring teaching styles.

The relationship between class size and criterion scores was well defined and consistently favored the smaller classes, even when the class size dipped below five students. The study also showed that secondary student achievement decreased when more than one teacher operated simultaneously in the room. The implication of this finding appears not to favor placing more than one teacher in a room to off-set the disadvantages of very large classes.

Proponents of small classes have consistently maintained that the advantage lies in the methods that may be employed by the teacher. Little (1951) asserts that the small class allows for greater varieties of experience, exploration, personal attention, teacher knowledge of individuals, and interpersonal relations. However, Roberson (1959) found the most consistently-used teaching method was the lecture in both small and large groups, and McKenna and Pugh (1964) state that not all teachers, given a small group, will adopt a method of optimum compatibility with the small group.

Vincent (1960) states that researchers of class size investigate five general types of criteria: economic efficiency, working conditions or teaching load, opinion of teachers (generally favor small classes), effect on pupils as measured by achievement or adjustment, and class activities made possible or prohibited by group size. While class size and departmental size are not synonymous, some interesting inferences surely provide some food for thought.

From my perspective, the task of bringing about a significant curriculum change within short periods of time is more within the realm of possibility in a small department. The lag between the birth of educational design and implementation can be much less in a small department.

Many public school districts do not look to the very small teacher training institutions for teaching candidates at the outset. Credentials of persons who graduate from a very small department, housed within a very small college, located in an isolated geographical area, often do not present sufficient sophistication for the public school personnel seekers. Care, however, must be taken by public school employment agencies that they don't generalize to the point that they hire only from the large teacher training institutions without first investigating the quality of educational experience the candidate brings to bear on the available teaching position.

In assessing excellence of educational environment pertaining to the preparation of industrial arts teachers, the following factors must be analyzed: First, the size of the educational environment is represented by the total amount of services made available to students, including number of teachers, library services, number of administrators, graduate assistants, student teaching program, industrial influence, community service, and uniqueness of opportunity, i.e., special research projects and input of student body; secondly, the quality rather than the quantity of faculty is most important. Teachers do differ in effectiveness, so the issue is not of faculty size but faculty adequacy, thirdly, the adequacy of materials and equipment relate to excellence of educational experience, especially in the field of industrial education, and fourthly, the method of instruction must be chosen that is deemed to be effective for the group size and educational task at hand.

BIBLIOGRAPHY

Astin, Alexander W. "Influences on Student's Motivation to Seek Advanced Training. Another Look." J Ed Psychol 53:303-9; 1962.

Astin, Alexander W., and Holland, John L. "The Environmental Assessment Technique: A Way to Measure College Environments." J Ed Psychol 52:308-16; 1961.

Becker, Howard S. "Student Culture." In The Study of Campus Cultures. Western Interstate Compact for Higher Education, 1963. p. 11-25.

Coyne, Charles E. "Comparative Analysis of Teacher Education—Final Report" Missouri Western College, December 30, 1970.

Darley, John G. Promise and Performance. A Study of Ability and Achievement in Higher Education. U California Press, 1962. 191p.

Dressel, Paul L., and Mayhew, Lewis B. General Education: Explorations in Evaluation. ACE, 1954. 302p.

Eddy, Edward D., Jr. The College Influence on Student Character. ACE, 1959. 185p.

Jacob, Phillip E. Changing Values in College. Edward W. Hazen, 1956. 178p.

Kirk, Jerome. Cultural Diversity and Character Change at Carnegie Tech. Carnegie Press, Carnegie Institute of Technology, 1965. 150p.

Little, Ruth C. "Effect of Class Size on Learning." Nation's Sch 39:215-6. 1951.

McConnell, Thomas R., and Heist, Paul. "The Diverse College Student Population." In The American College. Wiley, 1962. p.225-52.

McKenna, Bernard H., and Pugh, James B., Jr. 'Performance of Pupils and Teachers in Small Classes Compared to Large." IAR Res B, 4(2):1-4; 1964.

Olsen, Martin N. "Ways to Achieve Quality in School Classrooms. Some Definitive Answers." Phi Delta Kappan, September, 1971.

Pace, C. Robert. The Influence of Academic and Student Subcultures in College and University Environments. USOE Cooperative Research Project 1083, U California, Los Angeles, 1964. 255 p.

Pritchard, Keith. Role Specialization of College Teachers of Education. ERIC, 34p.

Roberson, John A. "Teaching Efficiency and Class Size." J Engineering Ed 50.37-40, 1959.

Vincent, William S., and others. "The Question of Class Size." IAR Res B 1(1):1-4, 1960.

Dr. Becker is a member of the faculty of Industrial Education at Wichita State University, Wichita, Kansas.

Preparing Industrial Arts Teachers: A Student's Perspective

Steven F. Schmit

The purpose of this presentation is to give you an idea of what a student feels with respect to excellence and the departmental environment. I was recently a student at Valley City State College, which has an enrollment of 927 students. I also attended the University of North Dakota at Ellendale. At the time I was there, the total enrollment was 156. At no time during my college career have I attended a school that had more than three full-time industrial education instructors.

First, with respect to departmental environment, recognize that only a student knows how a student feels. In turn, a student cannot see things as an instructor. No matter how close a relationship develops between the students and departmental faculty, it is impossible for them to totally understand each other's views. For this reason, it becomes important to obtain student input to this discussion of environment and its effects.

There are many environmental factors which effect the students' education. Cooperation and a unified thrust among departmental faculty is important. Do the teachers in your department get along? Isn't it true that three or four or even five people have a better chance of getting along than say fifteen or sixteen?

Smaller numbers of people seem to relate better to one another. There seems to be less chance for a personality conflict with smaller numbers of people than in large groups. Of course, in a small department, if they do conflict the damage is consequently greater. Students tend to "side" with instructors.

Respect for faculty is another variable. If the student feels that one instructor is not liked very well by his peers, the students might also grow to dislike him. This most certainly has an effect on what is learned in the classroom.

Students generally do not feel that academic formality contributes to program quality. Formal titles, such as Mr., Dr., Professor, etc., have a tendency to make the classroom atmosphere "tight." Are these formal titles necessary in today's colleges and universities? Many students feel more relaxed when they can refer to their instructors by their first or last names. I believe that formal titles are a carry-over from an earlier age. Aren't we supposed, as future teachers, to try to bring our students into a new and industrial society?

In a similar way, class size plays an important role. Where the class size and total student enrollment is small, the students and instructors know each other. If and when a student has a problem, it can be shared by all. Interaction of instructors and students is seen by students as being helpful to their preparation.

Another advantage, from the students' viewpoint, is that when all the instructors know all the students, they are more willing to have an "open door" policy with their labs. Instructors seem to be willing to go "out on a limb" to give their students an opportunity to help develop their skills in an unsupervised lab. Since we are the professionals of the future, why shouldn't we be given the chance to demonstrate our abilities?

When instructors have a chance to get to know and trust their students, their trust and respect are felt by the student, no good student is going to "kick a gift horse in the mouth" and endanger this respect. Students want respect and certainly need it to develop self-confidence and initiative necessary for their future professional roles.

Just as a small number of instructors are able to get along with each other, small numbers of students will do the same. No matter how good a relationship the students have with their instructor, no one quite identifies as well as do two students. On the small college campus, everybody knows everyone else and is consequently more apt to ask for help. Students probably learn more from their peers than anyone else. Instructors may lecture on a subject for hours, but the students will sometimes get more out of his lecture by talking it over with a few friends.

At a small college, the student has an opportunity to be an individual. After a couple of years, you can be known by many of the faculty. These faculty members—the men who care—have many good ideas they are willing to share with you. Their ideas are about a wide range of topics, all of which help you along in your education.

It is a fact that many small colleges cannot afford, or do not have the space for, larger, more technically advanced equipment. Now, before we consider this tremendous disadvantage, let us ask. Do many of thousands of smaller or even larger schools have this type of equipment or space. It is true that the idea of industrial education is advancing by leaps and bounds, but school districts and government funds fall far short of meeting the needs of all the schools. Consequently, do potential teachers need exposure to very sophisticated equipment?

I don't feel as though I have been cheated, education-wise, by attending a small college; in many ways, I think I am better off. I am not used to all of the advanced equipment, and when I get out into the world of reality I will not miss it. What about those who are not used to being without it? How are they going to cope with the situation?

At the small college level, you have a great opportunity to get out and mingle with many people. People naturally seem to be more friendly in smaller groups. I believe this factor helps the students when they are out teaching. They have the ability and know how to get along with many types of people. It is simply a carryover from their college.

In conclusion, may I encourage you as industrial arts teacher educators to involve your students in all of your activities. Give them an equal vote in your staff meetings, have them help plan and develop your facilities, and give them the opportunity to be the professionals you wish to develop. Help them learn, but you also must let them teach you. We have new and sometimes better ideas which can be a great help in future plans.

Mr. Schmit is an instructor at Linton High School, Linton, North Dakota.

Cultural—Societal—Technical Aspects of Futurism

Marshall S. Hahn

No doubt some of you are expecting me to list many of the technological activities that are going to be happening in the near future. I could list literally a thousand and one different things that are being worked on and designed and will happen or be put into production in a few years. But then, most of you have read and heard about these things too, and no doubt the various guest speakers and even the members of this team will be extolling some of the things that are products of futurism. Most of these fall in the hardware variety. I happen to consider these important, but I want to go in a slightly different direction. So if you will bear with me, I hope I can make sense out of my ideas so that you can understand what I as one of a group think. It will be increasingly difficult for the members of the panel who follow me to do their job unless make sense.

Let me begin by asking you a question. What do you see in society that irks you? What do you see in society that you deplore, that you wish could be helped, improved and maybe solved? Now I have no idea of what you are thinking of, but I have several, and they will come out as I proceed. Now that you have some things in mind—can you tell me how they are going to be helped, improved, or solved? You look deep into your mind and say that in the future 25 years we will have all small cars on the road, an honest president, and very little pollution. Well, let me assure you, it is not going to happen unless we have some changes made someplace. Look at society and ask yourself, "Is society getting better?" Of course you say, look at the improvements and the standard of living today. This is because of technology. Let me request you to look at it from another aspect. The issue isn't how much better life is now compared to what it used to be, but how bad society is today compared to what it could be.

The evidence exists that too many people are rotten to the core. The impending scandal discussed in the recent series of articles by the New York Times shows the moral tone of the athletic departments in our colleges and universities around the country. The streaking that is being done and encouraged by mass communications is a disgrace. The patterns of our national and local politicians have let the flood pour through the gate. If you want to go farther, examine as closely as you can what happens in industry with oil, milk production, grain sales, and about as many items as you would care to examine; each will be found wanting.

I asked you if society was getting better. If it isn't getting better, then you realize that society doesn't improve itself unless something causes it to be improved. The adults in society are beyond our general range of influence. What we can help to change in society can only be changed through the influence you and I bring upon the youth of society.

Immediately you say, it is hard for schools to change society. I would be the first to agree, but there is no other effective way than through the young with education. New knowledge or insight is the only basis for change. The young must be educated to the ills of society, and they must possess a will and a desire to improve.

In the March issue of M S T, our colleague from Western Washington, Fred Olson, stated that philosophy should receive immediate recognition and attention, and with an appropriate philosophy in mind we should keep a watchful eye on technology. I strongly urge each of you to go back and read what he said in that article. However, our passion with humanism must not be blinding. Humanism for humanism's sake is just as irrational as change for change's sake. Students must begin to develop a life determinism philosophy at a very early age so that humanism will become determinism for HUMANITY rather than for individualism. I recommend that as educators we begin to press for comparative philosophy to be included in the junior high school.

Can our government improve our society by legislation? You don't legislate improvements in society. You don't legislate improvements in schools. Schools as we know them will change considerably in the near future, therefore, I look to education to make the difference for improvement in society. If we in the schools can't make a better showing in the future as cultural problem solvers and cultural interpreters, we should give up.

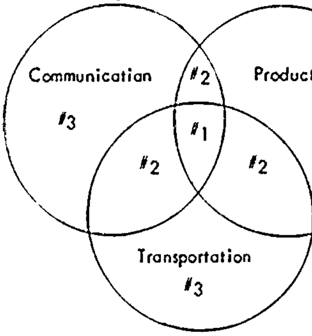
As an industrial educator, I am not ready to do this. But there are some around the country who feel that time is closing in and that we had better begin to change our dated curriculum to the object of a definition that is adapted from Maley of a few years ago. It is a philosophical point on which I preface my remarks and hope that they will not bore you but help you to see justification for change in most industrial arts programs.

THE DEFINITION. Industrial arts is an area of study that explores the ramifications of Technology in and, or the solution of major social, environmental, and operational problems facing mankind.

If you recall, another definition of many years ago that had a similar ring when it was given used the phrase "...and the social implications the man-made changes have upon man." There is a similarity in the two, and both are surely applicable to today's society and to tomorrow's IA.

With that bit of philosophical orientation as a base, let me anticipate a question. What has all this to do with IA? It stems from the philosophical point that in the definition we speak of societal problems. Industrial arts should have as part of its base societal problems rather than industrial problems. How would that work? If IA were to be developed with Technology (Capital T) as its technical base and societal problems caused by technology as its working base, we would see IA as a different subject in our schools. Let me explain this a little bit, because you no doubt are thinking that technology is much too large an area to try to cover and develop technological understanding or technological literacy in a great many of our pupils. We really cannot say this for sure, since we have never accepted DeVore's challenge to complete the taxonomy that would make it more intelligible. But we know and admit that it is a very large and complex subject. To try to make it understandable, I use the following illustration.

TRILOGY OF TECHNOLOGY



DeVore called his three areas of study that made up technology the cultural universals of production, communication, and transportation. I call these the trilogy of technology. Now if you look carefully, you see that the universals overlap with each other, and the most important overlaps are those where all three make up one area labeled #1. This is the most important area to be concerned with in teaching. This area is basic to all three. One of the subjects that I feel must be considered in the study of IA is energy. Man is another area of study that falls into all three areas, and therefore would fall into the basic #1 area. Computers would be another area of study that should be very important for IA to study in the near future. Right now, I see it falling into area #2. Energy is so basic to the study of Technology that none of the other areas can function without it. Man cannot function without energy. Now I don't mean energy as it is related to the one-cylinder gasoline engine that we find on lawn mowers and go-carts, as is usually the case in most studies of energy in industrial arts. I mean a thorough study of energy and how it is related to Man and his society and all the trilogy of Technology. This study includes the reasons why Japan found itself short in the face of the oil embargoes, why the American public is finding out that its ways of wasteful and indulgent consumption are coming to an end. We have to change, and we have to do it now. The schools should be leading the crusade. If they aren't, why aren't they? What are we in IA doing? (Speaking of go-carts, have you noticed the sophisticated knowledge base that go-carts have evolved through? They are almost too sophisticated for most industrial arts programs of today.)

This proposal doesn't sound like IA to some of you, I am sure. Remember, it is based upon the philosophical statement that IA is a study of Technology, and that capital "T" indicates that it is broader than hardware. Technology has to do with the kind of thinking that takes place in man. Indeed, thinking, planning, looking to the future are among the highest forms of activity in which man can participate. Technological forecasting is a method of projected thinking. It should be a technique that is learned through industrial arts. Technological forecasting and technological assessment are tools the thinking man uses to solve problems. The industrial arts definition that I used earlier is one that includes teachers of industrial arts as being cultural problem solvers and cultural interpreters. To me it is more important that we gear our programs to look at the effects of past and future technologies upon man and society than upon individual skills and problem-solving capabilities dealing with individual materials like plastics or woods or with individual tools used in these areas. Indeed, individual subject areas like woods, plastics, metals, and graphics have no place in the curriculum of the future. That just isn't the way it is in the environment or society. Everyone and everything has multiple interfaces. A much more broadly based curriculum is envisioned.

In my classes, I describe these individualistic courses as colored balls on a Christmas tree. They are directed toward separate entities, and the whole area of interaction on the ecological system is overlooked. The interface of one to all is ignored, and if we don't put them together, how can we expect the future generations to understand the dynamics of the environment and the impact of technology on man? We live in a highly complicated closed system which our students must come to know and understand. Industrial arts, as well as all of education, must aid Man in understanding the systems of which he is a part. Man is not just man for man alone. The knowledge and understanding of concepts must be understood and involved to such an extent that they are internalized to the point that natural reactions and responses by habit are made to various stimuli that are not contrary to the environment and Man's purpose. The buying of compactors for garbage disposal does not engage the real question. Your unconscious response to the chemicalized additives in food should be not to eat them and therefore not to buy them. In this case the real behavioral objective of education becomes considerably different. I have yet to see a competency-based teacher education program that devotes equal time to both positive and negative sides of industry. You noted, I said equal time. Are you doing it? If not, why not? What questions are you engaging? Are you engaging the career education program or the Man survival concept program?

In my studies these past several years, I have come to the conclusion that one of the societal problems with which IA should be concerned is energy, as you have already heard and seen. How long would that problem last? Let me assure you that it is going to be more lasting than career education. It won't last only as long as the last office holder in HEW, it will out-last several presidents. Please let me come back to this later. There are some who go so far as to say that until we reach fusion power, if indeed it can be achieved, we will have energy problems. They think that this may be the ultimate solution to man's energy needs.

This past semester I asked one of my classes to accept the challenge of studying nuclear fusion as I described it in the March issue of Man/Society/Technology. The very few that even attempted it tentatively reached the conclusion that it would not be the panacea that so many anticipate. Indeed, Seaborg and Corliss argue in Man and Atom that the future of the human race may very well depend on how man uses atomic energy. This may just well be another half truth. As we so desperately throw out any gains environmentalists have helped us to achieve, we rush pell mell hither and yon without thinking through the decisions we make. We may just find ourselves half destroyed by the eventual slip of not just 346 dead DC-10 riders, but thousands to millions who could be decimated because of that first atomic energy accident.

No one can disagree with the Seaborg and Corliss stetement. If man uses atomic energy in the future as he has fished for the whale or plundered his valleys with spoil and tailings, he may not be around to ask the question, "Is there another way?"

The quality of education of the citizen which we provide in IA is directly proportional to his internalization of the concept of working with nature rather than against nature. The whole business works together. You cannot escape it.

Earlier I mentioned career education and suggested that I would come back to it. Much of the career education system is founded on a false base. Work as we know it is changing and will change even more in the near future. Could it be that career education is 40-plus years behind time? Today and in the near future, we should be trying to get our students to understand the natural systems of which man is a part. A new awareness of the natural environment and a sensitiveness about others will be in constant demand in the years to come. We should be working with our students to help them gain that general understanding that may lead them to say "technology be damned." Technology with a large T must be studied from a perspective to evaluate and to help them understand the whole system, so that individual technologies may or may not be appropriate to study or even consider to use in education, because that just isn't the way it is in the enviroament.

Recently I heard a recording of a talk that Don Lux gave to a conference in NY State a year ago in which he said, "People Power—Hell! What we need is brain power." The statement is knowledge-based. It is based on information that would lead us to question not whether we worry about a job, but whether the job should exist at all. On what knowledge do you base a decision to phase out jobs at an asbestos plant or a plant producing DDT, or on what knowledge base will we continue to dump garbage, industrial waste, and human waste into the oceans or rivers? The jobs are there, but the question that should be asked is, "Should they be?" Should we mine coal from a deep mine or strip mine other coal to be able to generate electricity to operate heating wires in the freezing tubes of the deep freeze to melt off the ice so the unit can operate and use more energy to recool the food which is triple processed and has little food value?

A HUMANE TECHNOLOGY

This panel, as well as parts of the conference, points to the future and a more humane technology. It may sound inconsistent, but could it be that the most humane technology would be a more human technology? A human technology that has more human time, energy, ingenuity, and understanding being put to many of the technological innovations we have acquired over the past 5000 years? Perhaps we should have an equation that would allow us to think more about the quality of life. Can we measure the quality of life with some of these ingredients?

$$\frac{\text{Beauty, durability, economy}}{\text{Time of Man}} = \text{quality of life?}$$

Could it be that we are and have been thinking too much in terms of "Macro" instead of "Micro" for answers to many of the societal problems that confront us? The issues of pollution will be overcome when we as individuals begin to ignore the false benefits of bigness and macro structure in our utilities, our corporations, and our governments, and begin to ask how we can help nature. Man is human when he is at one with nature and at peace with the world. We need a school system that treats the foundations for the quality of life. There is more to life than jobs. Industry will never have a conscience until we have students in public and private schools who are personally making decisions based on a sound philosophy and not economics and carry these decisions to completion not for themselves but for the sake of humanity. What we need are students who will take it upon themselves to analyze societal problems, learn what is being done in their communities, study the effect on the small scale, project the results to the macro, and say STOP or GO.

The question is not whether we should curtail the use of energy, but how can it be used without significant harm to the environment, the quality of life, and without wasting our natural resources.

There is real need for integrated action on the part of the people of the U.S. in the way of energy utilization and development. Our programs should be the integrator of concepts and actions from every field and discipline presented in the public schools. It should be more the center of the whole school system, for there is nothing in our society that affects us more than the thing we call Technology.

What are we doing? What are we waiting for?

"Cooperation and fellowship in the future" is a name given to a challenge or request for one or all, some or many of you to join me in a program of energy self-sufficiency in 10 years. President Nixon has begun to re-orient our priorities in national energy direction. I have begun a program of energy self-sufficiency that I hope will make me and my family energy self-sufficient to perhaps 90% within 10 years.

I would urge any one of you to do the same. I urge you to join me in a cooperative knowledge-based expansion experimental program that will take us through a series of technical experiences based on our understanding of energy and ourselves.

I envision experimental technical work in the areas of wind generation of electricity with storage through batteries, compressed air, flywheels, and hydrogen. I envision conversion through a series of events depending on the need of the moment in the way of production, transportation, or communication for food, heat, light, or air. Further, methane gas conversion of many of our problems in the way of garbage, effluent, and other solid wastes is a must. The individual man will probably not find much solace in fusion power, but there is a great feeling of independence and being at one with nature when we utilize the sun to do the micro rather than polluting the environment with the macro. Madison Avenue has us believing that we always need "bigger and better" or "whiter than white" to the point where we are very deeply dependent on others for almost everything. Perhaps a humane technology is one that lets us utilize the micro human man a bit more. That is you. Remember — the study of the future does not necessarily insure the future nor the direction we go, but it at least gets you started to think.

Come — let us think together.

BIBLIOGRAPHY

Kahn, Loyd. Shelters, P.O. Box 279, Shelter Publications, 1973.

Gass, "Education, Work and the Quality of Life," the OECD Observer (Organization for Economic Cooperation and Development), No. 67, December 1973.

Thomas, Wes. Synergy Access, Nos. 3 & 4, December and February 1973-4.

Browne, Harry, Interview, Pacific Coast Coin Exchange Gold and Silver Newsletter, March 1974.

Train, Russel. The Long-Term Value of the Energy Crisis, the Futurist, Feb. 1974.

Savino, Joseph, Wind Energy Conversion Systems. NASA-Lewis Research Center, Washington, D.C., June 11-13, 1973.

Miller, David C., and Ronald L. Hunt. Advent Futures Studies and Research Learning and Resources Guide, DCM Associates, 908 Fox Plaza, San Francisco, California 94102, 1973.

Lambert, Richard D. The Annals of the American Academy of Political and Social Science, The Future Society Aspects of America in the Year 2000, Lancaster, Pennsylvania, 1973.

Hall, Robert F. "EQ News", The Conservationist, April-May 1974.

Shavin, Norman, Editor. Atlanta 2000, The Atlanta Magazine, August 1973.

Dr. Hahn teaches at New York University, Washington Square, New York, N.Y.

Teaching Strategies in Futurism

Donald P. Lauda

Reference is made to the writing of Dr. Marshall Hahn and Dr. John Fecik in these proceedings. The three manuscripts were presented in succession and represent a composite theme.

For the past few years, futurists have addressed themselves to countless issues, including education. The market has been deluged with new books, periodicals, and conferences, all of which have resulted in an increased awareness of the future. At the same time, it has resulted in an increased need for new content, teaching strategies, and practices in our field. This presentation will address itself to this theme.

EDUCATION 1974

It is no secret that the world-shaping citizens of the year 2000 are sitting in our classrooms today. It is these youngsters who will be making decisions about their society, utilizing data and systems unknown today. Of approximately forty million children who will be twelve years of age, or younger, in 1975, all will be 37 or younger in 2000. The 21st century will belong to them (Shane, in Learning for Tomorrow by Toffler, p. 182).

Our educational system has not responded to the challenge of the changing technology and its inevitable consequences. Morriseau (p. 11) states:

> We make linear assumptions that the world is going to be basically the same, but in larger outline. It leads to a curriculum that conditions children, that sets them up for future shock. . . Basically, what today's system does is to say to youngsters that the world of the future is going to be more of the same, only bigger and more bureaucratized.

One thing we can be assured of is that the world will not be the same. The knowledge explosion is an indication of the changes that we can expect. Currently, enough information to fill a 24-volume set of encyclopedias is added to the world's libraries every 40 minutes. The United States government alone generates 100,000 reports and publishes 450,000 articles, books, and papers annu lly. It is also estimated that our technical knowledge doubles every eight to ten years. Although these statistics are overwhelmingly interesting, they also are overwhelmingly indicative of the changes we can expect in lifestyles.

In spite of the changes occurring in our society, we continue to work with outmoded systems of thinking. We merely perpetuate schools which look like museums as they transmit inherited and verified facts. Learning has become a mechanical process rather than a human process. Basically we, like politicians, remain precedent-oriented. We cling to what worked in the past. We find it difficult to keep pace with the changing technology (technically or philosophically). We remain crisis-oriented and respond only in times of dire need, with federal funding serving as our barometer of change. All of this occurs in spite of our expressed concern for the educational systems to reflect society.

If we cannot keep pace with the technology of today, how can we introduce the future? One means is to offer courses or experiences in futurism in which simulations and other means fulfill our goals. The number of such courses at the teacher education or public education level is very small. Rojas and Eldredge (Learning for Tomorrow by Toffler, p. 345) report that currently there are 350 to 400 futures courses in North America. It is unknown how many of these are available to the future teachers of industrial arts. It is undoubtedly a safe assumption to say that the number is miniscule.

EDUCATION FOR THE FUTURE – CONTENT FOR I.A.

Even a cursory review of current textbooks and journals in the field of industrial arts reveals that the content is outdated in many cases. Since the lead time of book production is one year or more after submission by the author, this is inevitable. However, even if these books could be generated instantly, they would be behind because they would not introduce the students to the world in which they will live. Another reason, and even more important, is that as a discipline we have not collectively studied our global culture to identify the content which can do the most good for children. Please allow me to be specific and relate some concepts which will be very relevant for those 40 million students who will be in their prime years in 2000.

Multi-national-Corporations (MNC)

Lester Brown (p. 210) has stated that the internationalization of production may be the most significant economic phenomenon of the late twentieth century, one which will eventually affect not only the structure of the world economy, but the global mode of political organization as well. Today production resulting from indirect U.S. investment abroad will exceed $210 billion. On the domestic side, it is estimated that one-tenth of the U.S. gross national product is associated with investment from abroad. International production world-wide now totals an estimated $450 billion of a Gross Global Product (GGP) of nearly $3 trillion. The future consequence of this 8 to 10% growth factor is the eventual emergence of a global economy.

If we rank the top 100 countries and corporations according to size of GNP or annual sales, we find that the first 22 are countries. The 23rd is General Motors, the 27th is Standard Oil, and the 29th is Ford Motor Co. As a matter of fact, of the list of 100 we find that 41 are corporations rather than countries (Brown, pp. 214-215). Some analysts estimate that by 1980 some 300 large corporations will control 75% of all the world's manufacturing assets.

Currently the main thrust of industrial arts is to interpret American industry. This restricted view will not introduce students to the production enterprise of their lives, consequently, our model is hypocritical and somewhat irrelevant.

Computer

In spite of the fact that the principle of the computer has been with us for centuries, we still continue to disregard this concept. This evolutionary process which is mechanical and electronic in nature seems to frighten us. We realize that other technological elements are extensions of our physical extremities, limbs, and sensory organs. It is ironic that when we have the opportunity to extend our mind, we retreat. We are quick to turn to the "high cost" excuse.

The computer will be one of the dominant universals that all of our students will deal with. It was just 24 years ago that Univac wheezed into operation with its vacuum tubes and phenomenal space requirements. Today and tomorrow is reserved for the 4th generation of computers. What once took 10 miles of magnetic tape for storage can now be encoded on a one-inch square of photographic film. RCA predicts that by 2000 there will be one computer in existence for every 1,200 persons (Shavin, p. 106).

A recent United Nations report on the computer, which was prepared for the Human Rights Commission, warned that our human rights may be in jeopardy due to the computer. Reference was made to a new process that would enable a 20-page dossier to be compiled on each of the 200 million citizens of the U.S. Such information could be stored on a single plastic reel. By the year 2000, we may see artificial intelligence, computers in the home, and access to computers from almost every library, school, office, and vest pocket. The $6 Million Dollar Man is not far from reality as the developments with cyborgs progress into the actuality stage. It is no accident that the second International Conference on Robotology was held this spring.

If industrial arts is to maintain any integrity in the area of curriculum, the computer must become a dominant element in every program.

Diminishing Resources

Technology Forecasts (Wilks, p. 6) estimates that while the United States gains 40 to 50 million more Americans and the economy doubles by 1990, our consumption of iron, copper, lead, zinc, lumber, and petroleum will probably double. At the same time, our consumption of aluminum, electricity, and natural gas will increase approximately two and one-half times. It would be redundant for me, in this time of environmental awareness, to mention the potential we have for ecodisaster.

What students need to understand is that their future resources depend upon decisions of today and tomorrow. They need to understand the network of events that lead to such transitions. Industrial arts teachers seldom, if ever, discuss one element of the chain of events, let alone discuss the concept of cross-impact. To discuss a diminishing resource without discussing population, values, and economics is ludicrous. Students must realize that their survival depends upon the new technologies, skillful management, and an alteration of values. Trade-offs will have to be made while business and private sectors work together to find solutions. As we work in our I.A. laboratories, we need to develop social consciousness in our students, but first we must develop this in ourselves.

Others

It would be easy to list a vast array of other concepts we totally disregard in our classes but yet which represent the world of today and tomorrow. Reference is made to synthetics, miniaturization, cryogenics, global communication systems, global transportation systems, automation, changing concepts of work, etc. As we move into the 3rd and 4th world, the list becomes endless. However, the remainder of this paper will discuss teaching strategies for the future since this is an area that has been avoided. Teachers in our public schools are busy people, they teach, they have families, and rightly so, they rely on the teacher education institutions for direction. They need direction with methodology. As the writer sees it, the futurism movement has dealt with the rationale for teaching about the future, but has avoided the "how-to" portion.

Support for the ideas presented thus far can be found in a report to Sydney P. Marland, Jr., which was done by Harold G. Shane. This report, The Educational Significance of the Future, addresses many of these same issues. Your attention is directed to pages 58-59 for the major educational emphases as identified by futurists in this country.

EDUCATION FOR THE FUTURE – TEACHING STRATEGIES FOR I.A.

Recommendation Number 1. The American Industrial Arts Association should immediately establish a formal study of the future to determine the direction of our discipline.

Recommendation Number 2. Every teacher education program should include at least one course in futurism.

Recommendation Number 3. Every experience the student has in industrial arts should include a reference to the future.

Recommendation Number 4. Teacher education programs must provide summer courses and/or in-service training in futurism for teachers in the field.

The implications of these recommendations for our discipline are literally mind-boggling. At the same time, they present one of the greatest challenges our field has had and probably will make one of the greatest contributions to the citizens of the 21st century. Now, how do we accomplish these goals?

The novice in the futurology movement will soon realize that he is forced to work primarily in the cognitive and affective domain. Industrial arts teachers have been working primarily in the psychomotor domain for so long that this may be a frustrating experience. Once you step into the future movement, you no longer have tangibles to work with. You must rely on predictions, ideas, intuitive thinking, and other new modes of problem solving.

A course in futurism can be designed around central themes. Several are presented here for your consideration. If a new course cannot be added, these same concepts can be presented as part of current courses. Any futurism course should confront students with root questions about the future and provide an environment in which they can come to grips with the mandates of a technological society. At the same time, they need to make value choices which will demonstrate that the future is predictable and predestined to man's will. This approach will:

Identify future needs (technical and social)
Present alternatives for the future
Help determine logical approaches to solving problems
Clarify our value choices
Clarify our expectations about the future
Reduce future shock

1. Technology: Curse or Blessing

It is possible to look at the future in several ways: optimistically, pessimistically, apathetically, or from a fatalistic viewpoint. Students today are quick to point out the inadequacies of our technological culture and raise questions about its future. They need to realize that technology is inherently neutral, and it will be themselves that will shape the 21st century. They have the opportunity to press technology to its ultimate conclusion. This "ultimate conclusion" will be of their choosing and will rely on their value system. Therefore, they must acquire an optimistic, realistic view of the future.

Activities. Allow the students to discuss their views toward a technological society. Their conversation will inevitably lead to a discussion of values. Take advantage of this moment to work with value clarification. Isolate the inconsistencies in current value structures and project these into the future. For example you might present such situations as:

What will happen if life expectancy is increased to 100 years?

What will happen if 2 of the work force produces all goods and services?

The film Technology, Catastrophe or Commitment (Document Associates) is recommended for this theme.

2. Futurism as an area of study

Activities. Immerse the students into a discussion about the future. One technique that works successfully is to follow the steps below:

a. Have each student write five to seven major issues of humankind.
b. Make a composite list of these, avoiding duplication, and discuss them as a group.
c. Using the composite list, have the students write five to seven implications for society.
d. Repeat item b.
e. Using the composite list, have the students write five to seven implications for education.
f. Repeat item b.
g. Have the students re-write their implications, utilizing data from their discussions.
h. Have the students write future predictions about education, including date of occurrence for each, with an indication of confidence stated in percent.
   Ex. All industrial arts programs will have computer terminals in the laboratories by 2010 (95 sure of this occurring).
i. Repeat item b.
j. Revise all predictions, utilizing data from discussions.
k. Repeat item b.
l. Revise and discuss until consensus is reached.

This activity will develop an awareness of what the future has in store for the field of education and society. Chances are the students will identify severe weaknesses in industrial arts programs. For example, if they identify the computer as being a universal for the year 1980, they will immediately make judgments about its inclusion in I.A. This technique can be modified to include discussions about any of our basic institutions. Save these predictions for revision at the end of the course. This will serve as a pre-test/post-test instrument for your group. Other tests are available from the author of this article. Several films are available which serve as fine introductory material. Reference is made to the films Future Shock by McGraw-Hill and The World of Future Shock by Contemporary Films.

3. Rapid change: its cause and its consequences

Activities. Trace the history of technology from the beginning of time through the future. Do not expect to develop historians, but strive to gain an understanding of rapid growth since the 1970's and the continuation of exponential growth expected in the future. Include such concepts as:

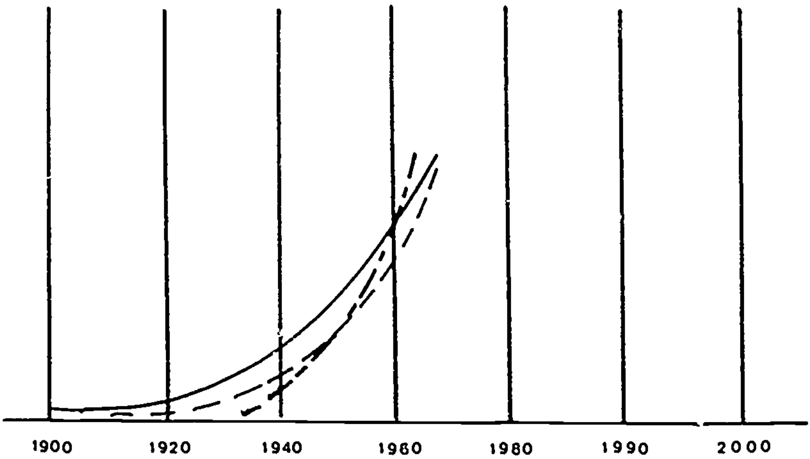
a. Decreasing time between discovery of scientific principles and application for the consumer. Reference is made to the World Resources Inventory (McHale, p.38) for a discussion.
b. Explosion of knowledge in the world.
c. Adaptation to rapid change. Reference is made to Toffler's Future Shock.
d. Have your students complete the graph in Diagram 1 up to the year 2000. Have them justify their response.
e. Ad hocracy. Generate assignments that reflect this mode. Discuss new work modes which utilize the ad hocracy principle and give assignments which are very short-term in nature.
f. Trace the development of a recent development, including its speed of development.

4. Technological assessment and forecasting

Activities. Discuss the movement in the world, including information about the recently-formed International Society for Technology Assessment, The Office of Technology Assessment U.S., and the Office of Technology Assessment and Forecast in the Dept. of

DIAGRAM 1

GROWTH CURVE ACTIVITY



Commerce. Study recent assessments such as that done for the SST, Ocala Canal in Florida, and the Alaska Pipeline. Include assessments done in your own community. These may be very informal studies on highway development, location of parks, etc., but will serve as a base for discussion. Explore new techniques in assessment such as computer models, simulations, scenarios, cross-impact studies, etc. Reference is made to a manuscript by this author which appears in these proceedings called, "Technology Assessment: Implications for I.A."

5. Cross-impact studies

Activities. This goal ties in directly with number 3. Futures research relies on a gestalt view of impacts. To study diminishing resources, for example, without studying population, economics, politics, human needs, etc., is short-sighted. Diagram 2 represents an out-moded model for solving man's problems, since it looks at alternatives without concern for other areas. Diagram 3, on the other hand, represents logical futures-thinking, since it considers cross-impact studies. This will help students to understand that alternate futures are possible. They can generate a society which is cohesive and will avoid the tragic errors that are possible with the high technology. Have your students do a cross-impact study.

6. Technical developments

Activities. Time and space do not allow the writer to offer suggestions for more than two primary technological universals of the 21st century. These are the computer and the laser.

Computer. Trace the history of the computer and project its technical and social impact into the 21st century. Allow all students to have a hands-on experience with programming and decision making with the computer. Currently students are not given a chance to work with the equipment, and consequently we are generating students who

DIAGRAM 2

ALTERNATE FUTURES

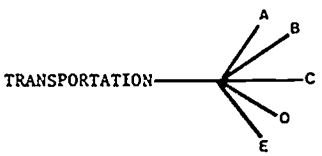
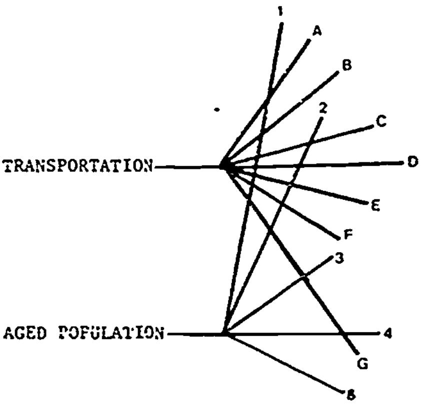


DIAGRAM 3

CROSS IMPACT ANALYSIS



will be susceptible to control in the future. An introduction to the computer via test scoring, examinations, and grade reports will not assist in the technological awareness process.

Laser. Trace the history of the laser and project its technical and social impact into the 21st century. Allow all students to utilize the laser in a laboratory situation.

NOTE. Currently industrial arts programs are outfitted with out-dated equipment, and those in charge are reluctant to turn to the new technologies. The computer on campus can be utilized and computer games, such as the Comput-a-Tutor, will make a contribution. Lasers can be purchased for about $100 for laboratory use. These innovations of today will be basic tools in the future and are justified in any budget and much more so than bigger and better lathes, radial arm saws, etc.

7. **Future of education, including industrial arts**

   Activities:
   a. Predict the new content areas, with a rationale for each.
   b. Predict the new teaching strategies with a rationale.
   c. Visit area schools which are using new techniques, especially those with an ad hoc arrangement (e.g., open schools).

8. **Project the probable futures of current areas of industrial arts (e.g., production, manufacturing, transportation)**

   Activities:
   a. Study the current status of diminishing resources, and predict their future along with replacements.
   b. Visit research laboratories in your area.
   c. Design an industrial arts program, assuming that our basic products no longer exist (e.g., wood, metal).

These ideas are presented to assist the reader in pursuing topics rarely touched in industrial arts programs. The reader undoubtedly has noted that the bulk of these activities involve a transition in the affective domain. This might be frightening for many teachers, since in many cases the student will have as much or more data than the teacher. Who is to say what the future will be like? Who is to contradict the statement by each student?

Basically what we are trying to do in the futurism movement is:

Clarify expectations about the future
Identify needs of the future

Help determine approaches to a viable future
Develop optimism based upon knowledge about the potential future
Reduce future shock
Present alternative futures
Generate early warning systems

The key question is not "What Is," nor is it "What Can Be," but it is "What Should Be." If we can address ourselves to this theme and generate citizens who know how to look for solutions because they have already visited the future via your class, we just might have a chance for a viable future.

TEACHER STRATEGIES

RE-DESIGN "HOMETOWN" FOR YEAR 2000
GENERATE A NEW BOOKLIST DEALING WITH FUTURE
HAVE STUDENTS MAKE A FILM ABOUT THE FUTURE
STUDY AND DEVELOP COMPUTER ART
STUDY AND DEVELOP COMPUTER DESIGN
RE-WRITE THE BILL OF RIGHTS TO MEET THE DEMANDS OF THE FUTURE
WRITE HEADLINES AS THEY MAY APPEAR IN THE FUTURE
DESIGN A MUSEUM OF THE FUTURE
UTILIZE SCIENCE FICTION
(Reference is made to the work of Dick Allen; see bibliography)
RE-WRITE A SECTION OF THE YELLOW PAGES TO REPRESENT THE 21st CENTURY
DEVELOP A POSSIBLE AND PROBABLE LIST OF EVENTS FOR THE FUTURE
GENERATE A CHRONOLOGY FOR A TECHNICAL OR SOCIO-CULTURAL EVENT
(past, present, and future)
DESCRIBE THE JOBS OF THE FUTURE
DEMAND IN-SERVICE WORKSHOPS DEALING WITH FUTURES RESEARCH
UTILIZE THE COMPUTER WITHIN YOUR SYSTEM
ADMINISTER A PRE-TEST AND POST-TEST WHEN STUDYING THE FUTURE
IDENTIFY PEOPLE IN THE COMMUNITY WHO MUST MAKE FORECASTS
STUDY FORECASTING TECHNIQUES USED IN THE COMMUNITY
DISCUSS THE MANAGEMENT OF ANTICIPATED FUTURES IN THE COMMUNITY, STATE, COUNTRY, AND WORLD
WRITE SCENARIOS (Suggested topics might be)
Earth runs out of a resource/s
The computer evolves beyond the human
Guaranteed income becomes a reality
The world becomes united
Earth is at the point of collapse environmentally
UTILIZE FUTURISTIC MATERIALS ON THE BULLETIN BOARD
DEVELOP A TIME CAPSULE TO BE OPENED IN THE YEAR 2000
DEVELOP A COLLECTION OF MYTHS ABOUT THE WORLD
FORM A FUTURIST CLUB IN YOUR SCHOOL
DESCRIBE A TREND AND ALLOW STUDENTS TO PROJECT IT INTO THE FUTURE
(e.g., speed of transportation)
CONSTRUCT TANGIBLE OBJECTS SOLELY OUT OF SYNTHETICS
MOVE TO THE METRIC SYSTEM (100%)
PERUSE THE NEWSPAPERS AND MAGAZINES FOR FUTURE PREDICTIONS
UTILIZE THE DELPHI TECHNIQUE
(e.g., consider utilizing experts within school system or community)
WORK ON CROSS-IMPACT STUDIES
(e.g., Study the cross-impact of the forestry industry and the environment)
GENERATE NEW VOCABULARY FOR I.A. OF THE FUTURE
(e.g. cybernetics
ergonomics
cryogenics
holography
laser
fiberoptics
geodesic)

BIBLIOGRAPHY

Agel, Jerome. "Futuring," Learning, February 1974.
Allen, Dick. Science Fiction. The Future. New York. Harcourt Brace Jovanovich, Inc., 1971.
Baier, Kurt, and Rescher, Nicholas. Values and the Future. New York. The Free Press, 1969.
Brown, Lester. World Without Borders. New York. Random House, 1972.
Cappon, Daniel. Technology and Perception. Springfield. Charles C. Thomas, 1971.
Case, Charles W., and Larson, Robert L. "Preparing Educators for the Future," The Futurist, December 1972.
Clarke, Arthur C. Profiles of the Future. New York. Harper and Row, 1958.
Dunn, Kenneth, and Rita. "60 Activities That Develop Student Independence," Learning, February 1974.
Dunstan, Maryjane, and Garlan, Patricia W. Worlds in the Making. Englewood Cliffs: Prentice-Hall, Inc., 1970.
Eldredge, H. Wentworth. "Education in Futurism," The Futurist, December 1970.
Goodman, Frederick L. "Speculations Concerning Some Uses of Gaming," Theory Into Practice, December 1973.
Hellman, Hal. Biology in the World of the Future. New York: M. Evans and Co., 1971.
Hellman, Hal. The City in the World of the Future. New York: M. Evans and Co., 1970.
Hellman, Hal. Communications in the World of the Future. New York: M. Evans and Co., 1969.
Hellman, Hal. Transportation in the World of the Future. New York: M. Evans and Co., 1968.
Hellman, Hal. Energy in the World of the Future. M. Evans and Co., 1974.
Henson, Kenneth T. "Future Education. A Systematic Approach," Educational Leadership.
Hull, Ronald W. Intelligence and the Machine. Monograph in the Social/Cultural Series, Program for the Study of Technology, West Virginia University, 1973.
Illich, Ivan. Deschooling Society. New York: Harrow Books, 1971.
Johnson, Beverly B. "Practical Preparation for the 21st Century," Phi Delta Kappan, April 1973.
Koerner, James. "Educational Technology: Does It Have A Future in the Classroom," Saturday Review of Education, May 1973.
Leonard, George B. Education and Ecstasy. New York: Delta Books, 1968.
Livingston, Dennis. "Schooling Up For a Future With the Futurists," Media and Methods, March 1973.
Livingston, Dennis. "Science Fiction Taught as Futurology," 14 Extrapolation, May 1973.
Marien, Michael. "Higher Learning in the Ignorant Society," The Futurist, April 1972.
McClure, Robert M. The Curriculum. Retrospect and Prospect (The 70th Yearbook of the Society for the Study of Education). Chicago, University of Chicago Press, 1971.
McHale, John. World Facts and Trends. Binghampton, New York. School of Advanced Technology, 1970.
Miller, David C., and Hunt, Ronald L. Futures Studies and Research Curriculum Guide. San Francisco: DCM Associates, 1973.
Miller, David C., and Hunt, Ronald L. Future Studies and Research Learning Resources Guide. San Francisco: DCM Associates, 1973.
Morrisseau, James J. "A Conversation With Alvin Toffler," National Elementary Principal, January 1973.
Pierce, Chester M. "The Pre-schooler and the Future," The Futurist, February 1972.
Saturday Review of Education. "Child Rearing 2000 AD," March 1973.
Scobey, Mary-Margaret, and Graham, Grace (Editors). To Nurture Humaneness. Commitment for the 70's. Washington, D.C.: ASCD Yearbook, 1970.
Shane, Harold G. The Educational Significance of the Future. USOE: A Report prepared for Sidney P. Marland, Jr., October 1972.
Shane, Harold G. "Education for Tomorrow's World," The Futurist, April 1973.
Shane, Harold G. "Looking to the Future. Reassessment of Educational Issues of the 1970's," Phi Delta Kappan, January 1973.
Shavin, Norman. Atlanta 2000. August 1973. Available through the Atlanta Chamber of Commerce.
Theobald, Robert. Futures Conditional. New York. Bobbs-Merrill Co., 1972.
Toffler, Alvin. Future Shock. New York: Random House, 1970.

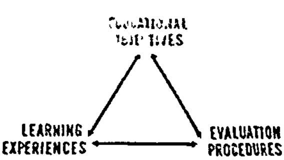
Toffler, Alvin. The Futurists. New York: Random House, 1972.
Toffler, Alvin. Learning for Tomorrow. New York. Vintage Books, 1974.
Van Haden, Herbert I., and King, Jean M. Innovations in Their Pros and Cons. Worthington, Ohio: Charles A. Jones, 1971.
Vonk, H. C. "Education and the 27 Year Countdown," Phi Delta Kappan, April 1973.
Wilks, Willard. "Technology and Resources 1990," Technology Forecasts and Technology Surveys, September 1972.

Dr. Lauda is Coordinator of Technology Education at West Virginia University, Morgantown, West Virginia.

Evaluation Aspects for Future Programs

John T. Fecik

The impact of futurism, change, futurists, critics, technology, and new ideas on education has been a reconsideration of values, individual, social, and universal. These values require the most concern in the future. Is it possible that future development of values will be as phenomenal as the technological changes we already observe? Wendell Bell (Learning for Tomorrow by Toffler, p. 102) concludes that choosing which values are to be served as economies, politics, cultures, and society are deliberately shaped has enormous implications for, and need of, human responsibility. Thus we arrive at the questions. Who makes decisions? Who controls the educational enterprise? Who chooses a specific value or its alternative? In terms of evaluating or validating educational programs, systems, curricula, teaching strategies, and instructional technology, our goals, purposes, and or objectives are to be considered. The part evaluation plays in the determination of the soundness or unsoundness of our values also indicates magnitude and may compromise our goals or how they were attained. In this presentation, my concern was to provide a measuring stick to the writings of Dr. Marshall Hahn and Dr. Don Lauda and their educational concerns of the future.



EVALUATION DEFINED

The purpose of this presentation is not to provide a technical manual on how to evaluate but how to use evaluation as a positive force in educational efforts of the future. We tend to see evaluation as a measurement, a rating, or a degree of magnitude. Educational evaluation is defined as the process which determines the effectiveness of teaching and/or the value of a learning experience which assists students to attain the goals of education (Phillips, p. 2). Elaborating upon evaluation, Wilhelms (Evaluation as Feedback and Guide, p. 9) reports:

> ...when we view evaluation and feedback, we instantly see how it resonates back through every stage of the educational process. Good evaluation has a way of stimulating deliberate thought about basic purposes and values and goals. One cannot measure progress toward a goal without knowing what that goal is.

The purposes of evaluating programs, instruction, strategies, or content are to make judgments and decisions. At times the terms assessment and appraisal are used interchangeably with evaluation. In this case, we are to evaluate the suggested strategies for teaching industrial arts, as well as the new directions and changes in teacher education with significance for the future.

THE IMPORTANCE OF VALUES

It is generally accepted that education has been eroded as a societal institution in transmitting values, attitudes, continuity of standards, and order within change to the young of society. Critics of education such as Toffler (1970, p. 400) concluded that the curriculum of the past was based on a stagnant society repeating the past as present. But who made this decision? Who emphasized the value of education? Shane (PDK, p.331) reported that one of education's diseases is that sometimes no one knows who is in control or who speaks for whom on what authority. Other critics such as Charles Silberman (Crisis in the Classroom), Alvin Eurich (Reforming American Education), and the NEA Center for the Study of Instruction identify the most pressing educational problem as making the schools reflect a humane technology. Who can accomplish this value-oriented task? Teachers, students, parents, school administrators, or the business elite individually are not capable. Participating collectively, they can do it. Turner (p. 59) suggested community control and decentralization. Shane (PDK, p. 331) advocated employing an outstanding feature of participatory democracy, cooperative social action. Eurich (1969, p. 148) identified the ideal mix, an informed school board guiding its school system in self-evaluation and a superintendent as interested in teaching and instruction as in organization.

Once the business tycoon sat on the school board to keep the academic-oriented educator from becoming a fool in the world of affairs while watching for heresy. Now he attends to keep contact with his supply of labor and talent. Each of these examples reflects community or societal values in the educational systems. Such values are imposed either as cooperative social action or as those of the wishy-washy organization man subordinating his convictions in order to conform. At this point, educational systems are wondering who does exercise leadership. Is it determined in terms of the values of society, of the school board, of the teachers union, of the student council, or possibly of some trade or civic association? The values of a school system have in the past been bound to political divisions such as wards and the industrial bureaucratic model, the corporations. Thus it becomes easy to see what values the school system has reflected. Today, as we look at education in a future tense, we also must realize that our values are strained and challenged.

The concept of value varies, but when a person values something such as a work of art, a state of affairs, or a social practice, there is an identifiable property or characteristic, according to Baier (pp. 38-39). Behavior-wise values are dispositions to behave or interact in accordance with observed criteria. Then value appraisal or evaluation is conducted to decide if the behavior observed complies with the criteria of that value. Both positive and negative aspects of a value must be considered when a specific goal or objective is to be adopted in order to make progress in realizing or attaining that goal or value at issue.

A community should have its values reflected in the goals of its school system. This is accomplished by participation, since schools reflect the community, the culture, or the society. Hornbake (Improving Industrial Arts Teaching by Schmitt, p. 2) has written that such a development evolves from the attributes and creative efforts of that group. This concern about values is of consequence now because the clearly defined and stable but traditional set of values once familiar to all is in disarray and some new values have appeared on the horizon. Students label some current modes of education as not relevant. It becomes worse since our students are seldom encouraged to analyze their own values as well as those of their peers and teachers. Such a mentality is a carryover from the industry or factory model.

> ...our problem of how to survive and grow into a humane community is not so much the result of lack of available knowledge as it is first of all a crisis in values. The priorities essential to survival demand a new ordering, based upon the valuing of human progress rather than material progress. (Vonk, p. 51)

We must look, analyze, project, or assume, but we must deduce in some fashion the nature of values that the people of tomorrow will need in order to survive. As Eurich (1969, p. 164) points out, looking to the future of education inevitably means looking to the future of society.

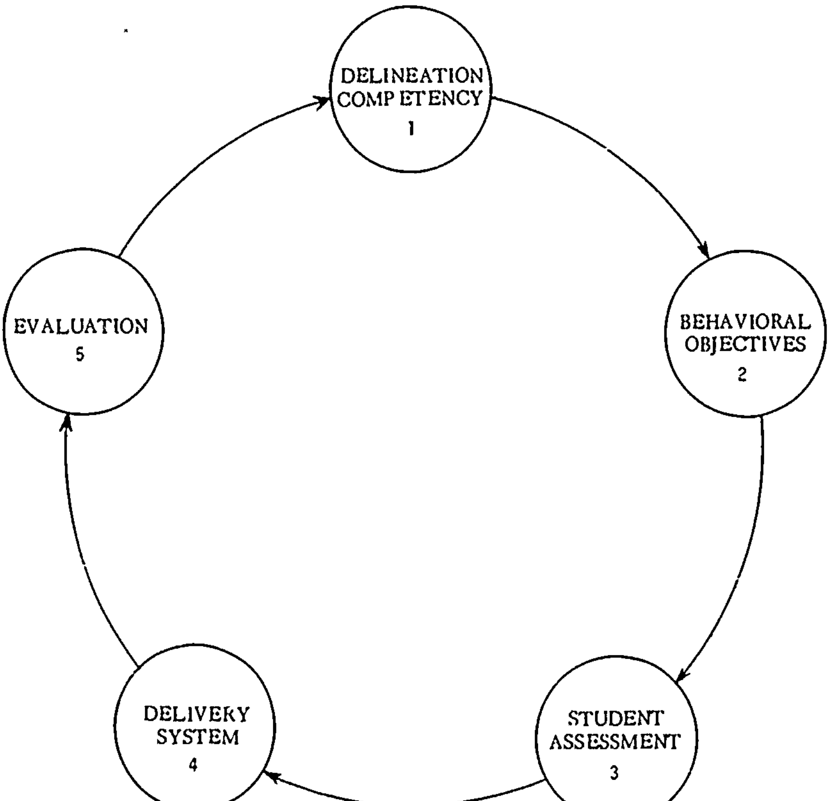
GOALS OF EDUCATION

Since it is from the values of society that the goals of education are derived, the process of evaluation is underway. When the values become outlined for scrutiny and given priorities, and prior to the decision to annex values to a specific goal, the process of evaluation has been functioning. The context of evaluation, as it will be employed here, was viewed as the aggregation and analysis of evidence, or even data, prior to decision-making. The nature of the evaluation will depend on the kind of decision then required (MacKenzie, p. 116). In order to reach a decision, then, the consideration of values which occurs is an example of evaluation.

Another phase of evaluation begins to prevail which Wilhelms (pp. 2-3) has identified as feedback, the return of data either before or after a decision for reconsideration, reflection, or action. Regardless of whether the data or the decision is good or adequate, the next step or procedure is under control. In this fashion goals are attained, they may be controlled, and change is restrained.

Control over the goals of education has slipped from the auspices of society or community. Students feel that education has become irrelevant, lacking in direction, or even possibly devoid of usefulness. Toffler in Future Shock (p. 58) has labeled us as a "throw-away society." Our technology has had an impact on our values by creating new opportunities, more choices, and the potential of value change or alteration (Mesthene, p. 50). The stress and disorientation induced by such volumes of change has produced the term "future shock" which is also the title of a best-selling novel.

The development of goals for education to apply to the future is a demanding task (Shane, PDK, p. 328). It means very little to state that the primary purpose of education is to prepare young people for their future lives. This description of the task is not so demanding. Considering the rates of social and technological change, we must perceive



far enough into the future so that our design of education will be adequately attuned to the adult world of those we will attempt to educate. Therefore, an important step to shift education into a future tense is to clarify our goals. Education must become a futurist enterprise. The theme of this conference illustrates our concern.

The literature is plentiful in recommending the qualities or capabilities that future-oriented education must develop in our students. Shane (in Learning for Tomorrow, p. 188) states, "An education for effective living in possible alternative futures should emphasize how to use what is learned in immediate learning situations." Other summary statements follow. Students should be prepared to live a life which is creative, humane, and sensitive, rather than just to earn a living. This means that a person must think for himself, dependent neither on the opinions nor the facts of others. Such a capacity must be used to think about the meaning of life and of knowledge and of their relationships. As described by a psychologist:

> The new education must teach the individual how to classify and reclassify information, how to evaluate its veracity, how to change categories when necessary, how to move from the concrete to the abstract and back, how to look at problems for a new direction—how to teach himself. Tomorrow's illiterate will not be the man who can't read, he will be the man who has not learned how to learn. (Toffler, 1970, p. 158)

Improvements must surface in our educational program, and the progress of education must be commensurate with other aspects of our society. The craggy and unshaped outlines of the education enterprise seems to be emerging from the mists, myths, and biases. While education is under attack, we must characterize industrial arts education as a program prepared for tomorrow. Our philosophy tends in this direction, but we need recognition from other segments of education and society that our program is a model for others to emulate.

We have programs that are developing students to make critical judgments, to navigate through novel and uncharted environments, to recognize new relationships in rapidly changing conditions, and to have inquisitive minds as well as the capacity to cope with the real world because we, in industrial arts, have taught them how to learn. These are the tasks before us; we must now proceed to accomplish them.

THE STRATEGIES OF ATTAINMENT

The listing of methods is not intended here, but a concern for the more important ingredient in the process of learning. the student. A goal in education is determined for the student. What teaching method will prepare that student to attain that goal? The lecture may be selected, but the student has not learned sufficiently to attain the goal. The results or evidence are gathered and analyzed, and an appraisal made. Since the student has not learned and a low appraisal has resulted, the student has failed. But several other aspects of evaluation come to bear. First, feedback has occurred, because we know that the student has not attained the goal. Questions are interjected. Feedback occurs again as it is discovered that the student could not hear the lecture. A decision is now necessary for the teacher to repeat the lecture or show a film. The second aspect of evaluation should be obvious, with continuous feedback or interaction, continuous evaluation becomes the focus of concern. A third aspect is self-assessment, which permits the student to peruse the evaluative data (Phillips, p. 13) in order to diagnose strengths and weaknesses.

Clearly, these assessments are spread across time and possibly may not permit the decision-maker enough time for analysis prior to a decision. These assessments are such an integral part of the teaching-learning process that proper time and planning must be considered. Rather than making decisions during the process of evaluation, it is preferred to plan certain decisions, as well as alternative actions. Such a plan of action is termed a strategy in the current educational jargon. A general plan of action which identifies specific instructions to be used for dealing with contingencies or variations which could deter goal attainment is the description of a strategy (Shubik, pp. 226-227). Preparing a strategy designates a particular teaching method or technique for a particular purpose in a specific situation or condition. Shane (PDK, p. 332) described it as developing "...a talent for knowing what mix works best for whom, when it works, and in what circumstances." Accepting the premise that students are different, strategies should be devised to allow for these variances in individuals.

ASSESSMENT OF STRATEGIES IN FUTURE-ORIENTED EDUCATION

Evaluation is essentially the process of determining the extent to which educational goals are being realized by the program of instruction. Such an evaluation must be a continuous interactive process primarily concerned with assessing teaching methods and strategies. MacKenzie (p. 119) describes it in these words:

> One is always making decisions about what one is doing, and these decisions are usually based on a constant flow of information about what is going on and how one's plans are working. Each decision can be said to be based on an evaluation which compares one's objectives, ...

As our educational programs and goals become more future-oriented, the teaching strategies deployed become more significant in developments for tomorrow. Any strategy or teaching method, to be meaningful and likely to realize its goals, must be appraised carefully. But we still need a better understanding of our current teaching methods. Silberman (p. 48) called for a diagnostic assessment of how we teach. Can we evaluate our present teaching methods in terms of changes in student behavior? Can we evaluate these methods also in terms of costs, resources, or materials? Can we identify the conditions or criteria for selecting teaching methods? Have you analyzed your teaching methods or strategies in terms of goal achievement?

We must know our goals before assessment can measure any progress, but our real need is to appraise our teaching methods and strategies. Sand (in High School 1980, p. 124) suggests a procedure: (1) formulate a statement of objectives, (2) clearly define each objective in terms of behavior and content, (3) find promising evaluation situations, (4) select and try out promising methods of obtaining evidence, (5) determine the aspects of human behavior to be summarized and the units or terms in which each aspect is to be summarized, (6) devise means for interpreting and using the results to improve the program.

It is no easy matter to determine how effective a method or strategy will be in the classroom. Criteria are needed which will assist teachers to reach sounder decisions with respect to allocating resources in developing their strategies. Suggested criteria could consist of the following items: (1) a description of the strategy or method, (2) characteristics or components, (3) advantages, (4) disadvantages, (5) preferable situations, (6) conditions to avoid, (7) facilities needed, (8) materials needed, (9) what preparation does the teacher need, and (10) a means of appraising or evaluating the progress of the student. A model for such criteria is developed in the book Innovations in Education. Another version was developed by Turner (p. 254). Regardless of the model employed, continuous feedback must be a constant factor in order to avoid "a funny thing happened on the way to the future."

Such criteria will assist in a better understanding of the educational experiences so that industrial arts education will help learners to cope with real-life crises, opportunities, and perils. It must strengthen the student's practical ability to anticipate and adapt to change.

Good evaluation depends on objectives, teaching strategies, and a means of assessing whether the strategy has permitted the achievement of the objective by the student. This must be our plan, our strategy to make industrial arts the subject of tomorrow. Lurich (1969, p. 173) reported that:

> ...if educators do not plan for the changes that are inevitable in the near future, the changes will take place at random, in response to specific crises and to pressure from special interest groups. Instead of a tapestry, we will find ourselves with a badly made patchwork quilt.

So we must bear in mind that other challenges await us. An important challenge is evident today, that industrial arts educators must accept the responsibility to shift into a future tense. What needs to be relevant in education is the responsibility that education must bear. One of our vital tasks as educators is joining with other citizens to define both the emerging potentialities of education and the emerging responsibility for societal healing. One last reminder to the industrial arts educator: if you do not think about the future, you cannot have a future!

BIBLIOGRAPHY

Baier, Kurt, and N. Rescher (Ed.). Values and the Future. New York: The Free Press, 1969.

Clarke, Leonard H. (Ed.). Strategies and Tactics in Secondary School Teaching. New York: The Macmillan Company, 1968.
Eurich, Alvin (Ed.). High School 1980. New York: Pitman Publishing Corporation, 1970.
Eurich, Alvin. Reforming American Education. New York. Harper & Row, Publishers, 1969.
Hornbake, R. Lee. "What is the Place of Industrial Arts in the American Culture?" Improving Industrial Arts Teaching. Conference Report. Edited by Marshall L. Schmitt. Washington, D.C.: Government Printing Office, 1962.
Mesthene, Emmanuel G. Technological Change. New York. New American Library, 1970.
Morphet, Edgar L., and C. O. Ryan (Ed.). Planning and Effecting Needed Changes in Education. Designing Education for the Future No. 3. New York: Citation Press, 1967.
Shane, Harold G. "Education for Tomorrow's World." The Futurist, June 1973. pp. 103-106.
Shane, Harold C. "Looking to the Future. Reassessment of Education Issues of the 1970's." Phi Delta Kappan, January 1973. pp. 326-337.
Shane, Harold G. The Educational Significance of the Future. Bloomington, Indiana. Phi Delta Kappa, Inc., 1974.
Shubik, Martin. Strategy and Market Structure. New York: John Wiley & Sons, Inc., 1959.
Silberman, Charles E. Crisis in the Classroom. New York: Random House, 1970.
Toffler, Alvin. Future Shock, Bantam Ed. New York: Bantam Books, Inc., 1970.
Toffler, Alvin (Ed.). Learning For Tomorrow. New York: Vintage Books, 1974.
Turner, Joseph. Making New Schools. New York: David McKay Company, Inc., 1971.
Von Haden, Herbert, and Jean King. Innovations in Education: Their Pros and Cons. Worthington, Ohio: Charles A. Jones Publishing Company, 1971.
Vonk, H. G. "Education and the 27-Year Countdown." Phi Delta Kappan, April 1973. pp. 514-517.
Wilhelms, Fred T. (Ed.). Evaluations as Feedback and Guide. Washington, D.C. Association for Supervision and Curriculum Development, 1967.

Dr. Fecik is Professor of Industrial Arts Education at Cheyney State College, Cheyney, Pennsylvania.

AIACSA

American Industrial Arts College Student Association

Communication: The Foundation for Humanism and Professionalism

W. A. Mayfield

Whether you are a two-year-old trying to break into the system or an experienced professional attempting to lead an organization, the major problems relate to communication. There are many obstacles that contribute to poor communication. In education, we are as guilty as other segments in our society of permitting these communication obstacles to clutter the system. Many times we ignore the individual by becoming bogged down with administrative or clerical chores, making it very inconvenient for communication processes to exist. Those who have spent time in the classroom setting know it is easy to discern the difference in attitudes of teachers who practice effective communication procedures and those who do not. The first group are more humane in their approach to communication and are considerably more effective. However, the importance of communication in education is an area that we only give lip service to because it is easier to produce subject-centered students and teachers. Consequently, we promote a system that dehumanizes both students and teachers because they are the necessary evils of a presumably efficient system.

Fabun (1968, p. 15) says that many of our problems in communication arise because we forget that individual experiences are never identical. He also insists that "when you talk or write about something, what you are describing is those interactions that happen inside of you — not just what happened outside of you." Our senses allow us to experience communication in many ways. In education, we practice teaching individuals what to see or what to hear instead of how to employ different carriers to transmit information, attitudes, and skills. Quite often we forget that communication is a two-way process. The two-way process is frustrating to many leaders and educators. Some of us have not learned to listen. Some of us have not learned to share leadership roles or authority.

Communication is transmitted by symbols which represent something we have experienced internally, according to Fabun. These may be audible or visible. Body motion, such as a wink of the eye or pointing of a finger, is also a very humanized communication process.

Cartoonists are usually fantastic communicators, many times using facial expressions or a very descriptive word to transmit a complete message. One of the problems many educators are faced with today in communicating with young adults, particularly with some of the ethnic groups, is that the dictionary has been used as "Law and Gospel" to tell us what common words mean, rather than to accept it as a history of how a word has been used most frequently in some context. When someone says, "Give me some bread, man" or "I've got to split," we have all kinds of circuit jams because the carrier experience is on another wave length. We have all heard that a picture is worth a thousand words, but in education we seem to prefer to hear ourselves use that thousand words to describe an object than to show it. One of Fabun's favorite statements (1968, p. 16) is, "Common words do not have meanings — only people do, and sometimes they don't, either."

If we are given an opportunity to say something about anything, we feel we must gather all the facts. Many times the so-called facts are only inferences, so we have cluttered the communication circuits again. Fabun (1968, p. 147) says "The ability to communicate is not something we are born with, we have to learn it — often the hard way. Whenever we talk or write about anything, what we talk or write about is something that happened inside us — not outside us. If we have difficulty understanding or being understood, it is likely we have ignored some part of the communication process. It is up to us, individually, to find that part and correct it."

As educators we have a unique responsibility, and that is to communicate a way of life. This responsibility not only assists students in focusing upon careers, but provides opportunities for students to participate in national issues. For years we have told young people that they are the leaders of tomorrow instead of communicating to them that learning to live today will help them to lead tomorrow. We only have inferences for the future. However, by involving our youth in the solution of today's problems, we can feel reasonably sure that they will be able to cope with tomorrow's problems.

We are not only faced with communicating with the inner and the outer man, in education we have the internal public and the external public. We must communicate on a professional level with all who are involved in education. Then we must take education at its best to those outside. We must also bring those outside to education to complete the communication cycle. Cullen (1974, p. 35) said, "Community involvement can help students channel that enthusiasm in the right way not only for the good of the student, but for the community as a whole." In a recent issue of the American Vocational Journal dedicated to national youth organizations, one student leader remarked (Nelson, 1974, p. 27) "Somewhere along the line in our automated society we have lost the ability to relate to one another. Perhaps sensitivity is what we are lacking in our society. Although we have such wide and varied means of communication, we don't seem to be able to communicate." This gap has grown so since about 1965 that we tend to live in a society against our fellowman instead of with him.

The frustration of communication reminds one of a freeway across one of our major cities about quitting time each day. Many are trying to get on the freeway into the main stream of traffic. Some are trying to get from one lane to another, and a few may be trying to get off. As long as everyone functions properly, traffic flows. But just as sure as someone malfunctions, the flow of traffic stops, and you hear the frustration of those resenting the malfunction. This kind of atmosphere is not conducive to good communication. Good communication takes place where human warmth and acceptance are present. This again emphasizes the proper carrier. The fragrance of a rose cannot be experienced by reading about it, by looking at a picture of it, or by just handling the rose.

As professionals, our goals have been to improve education through better communication. This can be done only by better communication techniques and a better understanding of the users of the techniques.

In conclusion, I would like to use a definition of communication provided by one of our graduate students, Michael Pierson. I asked Mike what the communication process meant to him, and the following remarks are as inclusive as I have seen.

THE COMMUNICATION PROCESS

Communication is the employment of different carriers to transmit information, attitudes, and skills. Communication is a discriminatory response of an organism to a stimulus. Many of the existing problems that have manifested themselves between people can be traced to a breakdown in the communication process. The lack of competency in communicative skills is caused by an inordinate dependency of the communicative process on verbal behavior. This dependency on verbal behavior facilitates frustrations and misunderstandings, because utilization of verbal behavior predominantly transmits information.

The goal of communication is changing the perception of an individual. Changing perception by transmission of information is psychologically impossible. A communicative message must appeal to the knowing, doing, and feeling side of man by containing information, attitudes, and skills. See Figure I.

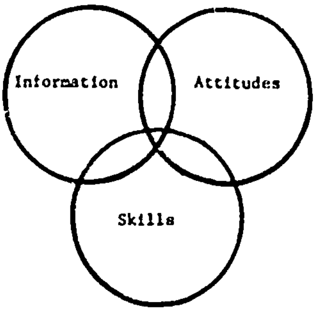


Figure I

ELEMENTS OF A MESSAGE

The communicative process is very technical in nature. To facilitate understanding this process, it is graphically displayed in Figure II. The conceptual-affective side of man conceives and encodes the message. Transmission of the message is accomplished through verbal, somatic, and motor carriers. Unless all three are utilized, one cannot transmit all the elements of a message that are illustrated in Figure I. The message is then received and decoded. The information, attitudes, and skills transmitted then impinge or color the conceptual schemata, which precipitates a discriminatory response.

The basic problems with communication lie in failure to have the necessary competencies to employ communicative things in our environment as carriers that transmit information, and termination of the communicative process before feedback occurs.

(continued on page 134)

THE STUDENT: A PROTEGE OF THE SYSTEM

By W. A. Mayfield

Once there was a group of students in school.
They were quite an enthusiastic group.
This was the usual traditional school.
When the students found out they could have a club
They rushed right in to see their teacher.
They were all happy
And the school did not seem
Quite so traditional or boring.

One morning
After the students had been in school a while
The teacher said:
"Today we are going to start a club."
"Good!" thought the students.
They liked to participate in clubs.
Club activities meant doing all kinds of things.
Fund raising and work nights,
Field trips and service projects,
Local and state meetings —
And they all began to talk at once
And they began to plan.

But the teacher said, "Wait!
It is not time to begin!"
And he waited until every one looked ready.
"Now," said the teacher,
"We are going to write a constitution."
"Good!" thought the students.
They were anxious to write a constitution,
And they began to develop a good one
With laws and by-laws to govern their club.
But the teacher said, "Wait!
And I will show you how."
He gave them a constitution he had prepared.
"There," said the teacher,
"Now you may begin."

The students looked at the teacher's constitution.
Then they looked at their constitution.
They liked their constitution better than the teacher's,
But they did not say this.
They just turned their paper over
And wrote a constitution like the teacher's.
Just exactly like the teacher's.

On another day
When the students had regained their enthusiasm
And were anxious to get their club started,
The teacher said:
"Today we are going to elect our officers."
"Good!" thought the students.
They could do all kinds of things once they had officers.
Work projects and meetings,
Socials and guest speakers,
Regional and state meetings,
And they began to think on who would make good officers
And how they would go about electing them.

But the teacher said:
"Wait! We are not ready."
And the teacher waited until everyone looked ready.
Then they elected officers as the teacher directed.

"Now," said the teacher,
"We are going to plan our activities."
"Good!" thought the students,
They looked forward to planning their activities.
And they began to list their plans
Of the things that they would do.

But the teacher said, "Wait!
I will tell you what we must do"
And he told them what they needed.
One complete year was outlined.
"There," said the teacher.
"Now you may begin to plan."

The students looked at the teacher's plan.
Then they looked at their plan.
They liked their plan the best,
But they did not say this.
They just turned over their paper
And wrote down the teacher's plan.
It was a comprehensive plan.

And pretty soon
The students learned to wait.
And to watch,
And to do things just like the teacher.
And pretty soon
They didn't do things on their own any more.
Then it happened
That the group of students
Graduated and went to college
In another city across the state.
And that group of students
Wanted to belong to a club in college.

College was larger than high school,
And the first day the teacher said,
"Today, we are going to start our club."
"Good!" thought the students,
And they waited for the teacher
To tell them what to do.
But the teacher didn't say anything.
He just sat in the back of the room.

After a while the teacher said,
"Don't you want to have a club?"
"Yes," said the students,
"But what are we going to do?"
"I don't know what you want to do," said the teacher.
"What should we do first?" asked the students.
"Why, whatever you consider most important," said the teacher.
"Whatever we think important," said the students.
"If I told you what your constitution should say,
And who your officers should be,
And what activities you should have,
Would you enjoy your club?" the teacher said.
"We don't know," said the students.
And they opened their note books
And took out the material
That was prepared by the high school teacher
And began to copy their constitution
Because they had learned to wait.

Mayfield's version of Helen E. Buckley's "The Little Boy"

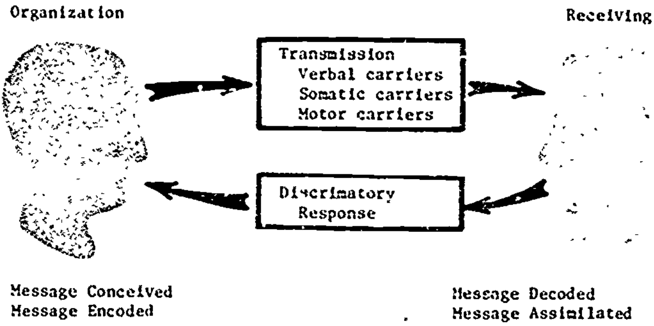


Figure II

THE COMMUNICATIVE PROCESS

BIBLIOGRAPHY

Cullen, J. A. Rapping With the Student Representative. American Vocational Journal. 1974, 49 (3), 34-68.

Labun, Don. Communications: The Transfer of Meaning. 1968, Kaiser Aluminum & Chemical Corporation, p. 1-47.

Nelson, S. A. Vocational Youth, What They are Saying and Doing. American Vocational Journal. 1974, 49 (3), 24-33.

Dr. Mayfield is an Industrial Education Faculty Member, Texas A&M University, College Station, Texas.

Toward a Humane Technology for the Future: A Developmental Perspective

James F. Gamble

I would like to begin by calling attention to the theme of the 1974 conference of the American Industrial Arts Association—"A humane technology for the future." That theme carries with it some important implications. It implies that our present technology is somehow less than humane. It suggests that, in spite of all its accomplishments and its many contributions, technology has much more to offer mankind than it is presently offering. The theme further suggests that there is something we can do, that through our efforts we can help bring about a technology that better serves human goals and purposes.

The idea that technology needs to be more humane, that it can be made more humane, is an idea that has been expressed by some of the most brilliant and outstanding social philosophers of the past century. For you, the members of the American Industrial Arts Association, to have addressed yourselves to the idea of a more humane technology is indicative of your vision and foresight, as well as of the high level of sophistication of your organization.

Technology has had a profound influence on man's way of thinking about the world. The modes of conceptualization shaped by technology have tended to be extremely one-sided. The modern world has been fragmented into sets of dualistic, either-or, mutually exclusive categories. Certain aspects of reality have been given attention, while other equally important aspects have been excluded or denied existence altogether.

One primary example of the one-sided or dualistic thinking fostered by our technological orientation is the way that men in Western industrial societies have come to view their relationship with nature. Man perceives himself to be involved in a struggle against nature. Nature is viewed as an obstacle to overcome, as a tyrant to oppose and conquer. Man has neglected to emphasize his essential relatedness to nature, he has forgotten that together man and nature are a part of the same original totality. Recent forecasts of ecological catastrophe have served to remind man of this inherent complementarity between himself and nature. Thinkers who are not known for their undue pessimism have warned that a continued antagonistic and oppositional attitude toward nature could well be the undoing of the human species (Ferkiss, 1969, p. 211).

Not only has man pitted himself against nature, he has also engendered a context in which he is at odds with other men. Our technological orientation has had a strong tendency to overemphasize the individualistic and competitive side of man's nature. Far too little attention has been given to man's need for a community in which there are opportunities for cooperative, sharing relationships with other men.

Another bit of one-sided thinking which has emerged concomitant with the development of technology is the tendency to focus on those aspects of man's reality external to him. By emphasizing how to manipulate, control, and come to terms with the world outside us, we have neglected man's inner or spiritual nature. It is this latter tendency — the tendency of our technological thinking to ignore the inner or psychological side of man — that I would like to make the focus of this presentation.

Abraham Maslow has told us that man attends to his higher, spiritual needs only after he is secure in his more basic needs. For example, man attends to his intellectual and aesthetic needs only after he has successfully negotiated with the external world to fulfill his more basic needs, that is, after he has a full stomach and is secure from the elements (Maslow, 1954). Thus, from Maslow's perspective, it seems that man's preoccupation with the external is a necessary state of affairs, historically speaking. Using technology to come to terms with and secure himself in the outer world before attending to his inner possibilities seems a natural enough process for man.

But according to Maslow, man's inner and higher needs — the needs for knowledge, aesthetic appreciation, and spiritual understanding — have an opportunity to emerge once he has satisfied his basic or outer needs. One of the most disappointing things about modern man is that once he made himself secure and comfortable through his successful manipulation of the external world, he has not shifted his focus to the development of his own inner potential. In his preoccupation with overcoming obstacles in the world outside himself, he seems to have forgotten what he originally set out to accomplish — to create a better and more complete life for himself.

Erich Fromm believes that modern man has become idolatrous (1955, p. 121). Having lost sight of the balance between the inner and the outer, between the spiritual and the material, too many men today believe that their salvation lies in the further perfection and accumulation of things in the material world external to themselves. Fromm believes that man today has come dangerously close to committing the Biblical error of worshipping the golden calf — this time the golden calf of technology and its rich material benefits — and forgetting to be concerned with his own soul.

Man has turned technology against himself in other ways, too. Our one-sided materialistic thinking has caused us to ask the wrong questions about ourselves, and more particularly, about our relation to work and the process of production. Too often we have asked how we could best utilize human resources for the development of a more efficient technology. Too long we have forgotten to ask how we can best utilize technology for the further development of human potential.

By ignoring or refusing to recognize the human factor in the process of production, we have allowed ourselves to become unconcerned with the welfare of the worker, with the quality of his life either on the job or outside the work situation. In our narrow and compulsive concern for economic efficiency, we have forgotten that no production process is really efficient if it is carried out at the expense of the psychological well-being of the worker (Fromm, 1968, p. 35). Although we have come far from the inhumane and exploitative labor practices at the turn of the century, there remains a tendency to view the worker as a means rather than an end in the production process, to perceive him as one more manipulatable factor among others in a complex mechanized system.

If we are truly concerned about developing a more human technology, we must come to view the activity of work as more than a means of production directed by narrow economic concerns. Work must be viewed as a means of personal fulfillment and self-expression, as an avenue for the actualization of the worker's potential as a mature, fully-developed human being.

I have referred to work as an activity that can potentially facilitate the growth, development, and psychological maturity of the individual person. It is important to realize that I am not using psychological or developmental terminology in any vague, metaphorical, or figurative sense. Due to the meticulous efforts of a number of outstanding psychological researchers in the past two or three decades, the criteria for mature, developmentally higher levels of human functioning are known, and we can speak of these in a very real, empirical sense. The researchers I refer to here are men like Erik Erikson in personality development, Lawrence Kohlberg in moral development, Carl Rogers in psycho-therapy, Jean Piaget in cognitive development—men working largely independent of one another, investigating different areas of psychological functioning, among whom has emerged a general consensus concerning the nature of psychological maturity and emotional health. In other words, we know in a rather specific sense what constitutes a mature, healthy person, and we are able to specify with a relatively high degree of certainty the types of activities that nurture and facilitate as well as inhibit and suppress the growth process.

Perhaps it would be instructive if at this point we move to a discussion of the characteristics of the mature, psychologically healthy individual and attempt to relate them to vocational contexts which would best enhance their development.

Work which is organized around a dull, boring routine and which demands little or no imagination or creative effort cannot meet the needs of the psychologically mature man. The healthy fully-functioning person demands a certain level of complexity in his work (Hampden-Turner, 1971, p. 166). He feels stiffled and unnecessarily restrained by activities that require endless repetition and offer no opportunity for him to think.

The psychologically mature individual is not motivated by fear or insecurity. Since he is operating to fulfill higher needs, threats of economic coercion have little if any influence on him, except perhaps to make him less productive. He is responsible and co-operative, but not submissive and blindly obedient to authority. He responds best to reason, respect, and relationships based on mutual trust. Because he has the capacity for greater involvement, the mature, self-actualized man is more productive. Since his motivations are intrinsic, he has a higher degree of self-discipline and is more responsible and trustworthy. His demands for freedom, autonomy, and individual expression do not make him unruly or unmanageable, but since he needs fewer external restraints, he is often unwilling to accept unnecessary restrictions and controls (Maslow, 1962).

Given a vocational context that allows for imagination, flexibility, freedom from coercion, and opportunity to participate in the decision-making process, the mature psychologically healthy person enjoys his work. He does not experience it as drudgery. Often he finds it difficult to distinguish between work and play, since work has become for him a means of self-expression and self-fulfillment (Maslow, 1965).

Extrinsic rewards alone are never sufficient for the mature self-actualized man. Money, fringe benefits, and other economic concerns, while important, are not enough in themselves. The fully-developed person needs to experience a sense of personal efficacy and self-worth in relation to his work, he needs to feel that he is making a significant contribution, that he is accomplishing something worthwhile. Obviously, a vocational context which relates to the worker in a completely impersonal manner, which views him as another object in the larger mechanical apparatus, can do little or nothing to meet these higher, intrinsic needs.

There are still many employers who are operating on the basis of unwarranted or outmoded psychological theories, who assume human nature to be basically corrupt and evil, and who base their policies and actions on the belief that man, if he is to be productive, must have his basic nature restrained, controlled, and suppressed.

Too many of our current industrial practices are based on erroneous assumptions concerning the nature of man and the course of his development. Whether it be a psychological perspective that views man as a machine or a metaphysical doctrine which assumes his nature to be basically evil, the effects are much the same: a production process designed to make use of immature and psychologically deficient human beings, a production process that cannot help but have a retarding effect on the workers it employs (Herzberg, 1966, p. 209). Underlying much of what has been called technological progress is a mode of production which has depended upon, and thus fostered, an arrested development in man and which has operated to fixate him at a lower, less mature level.

Ultimately, the development of humane technology will entail a rather radical re-orientation of the entire society, a restructuring of our social, economic, and political order (Ferkiss, 1969, p. 202). These changes can take place only when there is a rethinking and a reconsideration of what a human being is and what he can be. These changes will take place when the over-all goal of all of our social activities is the further development of human potential.

What does this mean for you, the industrial arts educator, for the individual instructor who performs daily in the classroom and in the shop? Important and necessary social changes do not just occur, nor are they all-at-one happenings directed from some nebulous authority above. Society progresses because of the activities of individuals like ourselves. As educators, we can be especially influential in contributing to positive and responsible social change. While some would argue that the educator could be most influential through responsible social organizations and political involvement, my position is that we can best effect change through our individual efforts in the classroom. Before we can talk about a humane technology or a humane society, our first concern is a humane classroom with humane instruction — an educational environment which provides the context for optimal growth and development of the individual person. Let me now briefly outline some important areas in which the industrial arts educator can significantly contribute to the implementation of these ideas.

First, I would say that the concerns of the industrial arts educator must go beyond his own area of specialization. It is necessary that he become knowledgeable about what constitutes higher levels of human functioning. He needs to become aware of the types of activities which facilitate (as well as those which retard) mature, responsible behavior in his students. This requires that he be knowledgeable concerning his own personal development, that he become aware of his own strengths, his own weaknesses and shortcomings. He should remember that as a person becomes aware of the weaker elements in his personality, what once were deficiences are transformed into potential areas of growth.

Industrial arts educators need to work to dispel the myth that skilled craftsmanship and technical competence require less intelligence or thinking ability than the academic areas of study. This myth — John Dewey (1958, p. 124) reports that it goes all the way back to the Greeks — seems to be based on the misconception that when people are engaged in activities using their hands, somehow their minds are disengaged. Vocational educators seem only to perpetuate the myth with their one-sided emphasis on "hands-on" activities. They also inadvertently contribute to this myth by taking a somewhat defensive anti-intellectual posture and by becoming hostile toward the humanities and social sciences. This stance is, of course, understandable in light of the supercilious attitude often taken by academicians toward the industrial arts curriculum. Then too, much of the criticism directed toward the social sciences and liberal arts curriculum are valid. Often there is a tendency for teachers in these areas not to relate their subject matter to the real life experiences of their students. And the students, having not been properly guided to see the relevance of these areas of study, reject them as a meaningless waste of their time. This, however, is not an indictment of the social sciences and humanities. It is an indictment of poor teaching.

If we take the point of view with Kohlberg (1972) that development is the over-all aim of education, any educational endeavor — whether it be liberal arts or industrial arts — will be of little value to the student unless they relate to and enrich his experiences, aid him in understanding himself and others, and lead to the development of skills which guide his activities in life. Intellectual activities that end up as mental exercises or the manipulation of useless abstractions accomplish little or nothing educationally. On the other hand, when the outcome of vocational education is a person with a fixed repertoire of manual skills rather than an individual with imagination and flexibility, capable of adapting to new and changing work situations, again we have failed to educate.

Industrial arts educators must continue to make the distinction between education and training. Skills and technical competencies are more than responses programmed into the learner. While the acquisition of these requires repetition and practice, we must remember that these skills and competencies provide a mode of self-expression for the individual. They convey to the student a sense of accomplishment, they serve as indicators that he has the capacity for further achievement and growth.

The industrial arts educator, if he has a sense of the humane, does not perceive himself simply as a programmer of skills. He knows that he is teaching young people how to live successfully. He knows that he himself must be a model for successful living, that he must be a living example of the fully-developed, psychologically healthy human being.

The final point I would like to make concerns your use of the term "art." In referring to your discipline or area of study as industrial arts, the term art should be taken seriously. To the degree that the products of industry are artful, the dualisms have been overcome; man has gotten beyond his narrow, one-sided perspectives. No longer is there a radical separation between the inner and the outer, between means and ends, between the practical and the enjoyable – between what Dewey called the instrumental and the consummatory (1958, p. 361).

Creativity, imagination, self-expression – art implies all of these. If the end products of man's industrial and technological activities are indeed objects of art, the psychologists' criteria of emotional health and developmentally higher levels of human functioning have been met. When a man's work is artistic, it is necessarily humane. Art implies the humane.

REFERENCES

Dewey, John. Experience and Nature. New York: Dover, 1958.

Ferkiss, Victor C. Technological Man. New York: Mentor, 1969.

Fromm, Erich. The Sane Society. New York: Rinehart and Co., 1955.

Fromm, Erich. The Revolution of Hope Toward a Humanized Technology. New York: Bantam Books, 1968.

Hampden-Turner, Charles. Radical Man. New York: Anchor Books, 1971.

Herzberg, Frederick. Work and the Nature of Man. New York: Mentor, 1966.

Kohlberg, Lawrence. Development as the aim of education. Harvard Educational Review, 1972, 42, 449-496.

Maslow, Abraham H. Motivation and Personality. New York: Harper and Row, 1954.

Maslow, Abraham H. Toward a Psychology of Being. New York: Van Nostrand, 1962.

Mr. Gamble teaches Foundations of Education, Auburn University, Auburn, Alabama.

Social and Philosophical Perspectives on a Humane Technology for the Future

Michael S. Littleford

The problems, issues, and controversies suggested by the term, "humane technology," are by no means new. They have haunted us continuously since the late nineteenth century, and are all included within THE question which, according to Arthur Wirth (1972, pp. 142 and 237), still remains unanswered. Can our technological-urban realities be truly integrated with democratic values and ideals? Stated another way, can we reconstruct our social order so that technological-industrial arrangements are subordinate to questions concerning human values and the quality of human life?

The fact that the question remains unanswered testifies to our ineffectiveness in dealing with the concerns implicit in the theme, "A Humane Technology." The reasons for our failure are complex. Basic among them are certain fundamental and historically rooted attitudes and habitual modes of thought, acting as barriers to any effective and widespread concern for even raising the kinds of questions necessary to begin to build a humane social and economic system based upon a complicated technology. These attitudes and ways of thinking are an expression of the dualistic world view which has pervaded Western thought since the emergence of modern science in the seventeenth century, and which is reflected not only in our basic beliefs and habits of thought, but also is expressed concretely in our social and economic arrangements and policies.

As modern science was emerging and developing, its thinkers began to challenge the view of the universe endorsed by the church. The traditional world view in simple terms saw the universe as a perfect sphere in which all of the constituent heavenly bodies traveled in perfect circles with the earth at the center. During the several decades when this world view was being undermined by scientific discoveries, there was much conflict between scientists and churchmen, with many of the former being harassed, branded as heretics, and even executed. In spite of this action, it was the previously all-powerful church which was losing credibility and influence over its followers. To put it bluntly, the church had been put in a very embarrassing position, it was caught in a seemingly unresolvable dilemma. On the one hand, the church dogma had to be infallible because its truths were based upon revelations from God. On the other hand, there was no getting around the fact that the dogma had contained an erroneous view of the physical universe.

At this point, a French philosopher, mathematician, and devout Christian, Rene Descartes, entered the picture and presented a solution to the church's dilemma. Descartes maintained that the universe is fundamentally dualistic, that is, there are two separate worlds, the mental and the physical. Both the world of mind and the world of matter are real, but they are distinctly different domains and are known through different means. The physical world belongs exclusively to science, and is known through the empirical procedures involved in observation and experimentation. In employing such procedures, scientists may make errors which are eventually corrected through further observation and experimentation. The world of mind, which via the dualistic conception belongs to the church, includes all significant moral and mental concerns. This world is known through pure thought and revelations from God, and is not subject to empirical-scientific inquiry. Knowledge derived about the world of mind is not subject to error — it is infallible and absolute. The Cartesian solution thus got the church off the hook by effectively separating questions of morality — what ought to be — from scientific inquiry and technological development.

The Cartesian split is strongly built into contemporary society, with the matter or physical pole of the dualism being dominant. This dominance reflects the progressive increase of scientific-technological influence in all areas of life and the corresponding decrease in the influence of religious institutions. In effect, we have continued to make advances in the physical world which have had profound effects on the moral-human domain, but since the latter has traditionally been considered a separate area and not subject to inquiry, little has been done in the way of seriously raising questions that consciously acknowledge and attempt to deal intelligently with the moral consequences inherent in developing science and technology. Thus, we have scientists and technologists constructing nuclear weapons and other technological devices and claiming no moral responsibility for their creations. The general attitude has been that technological developments are morally neutral. Along the same lines, economic growth, an ever-increasing rate of production of goods and services, has often been taken as the highest good, with moral questions concerning how ought the goods and services to be distributed and used occupying at best a second class, unscientific status, if indeed they are raised at all. At the level of formal schooling, educators using "scientific" measurement devices test people's "abilities," "aptitudes," or levels of "achievement" and on this basis assign them to slots in the educational system — e.g., a vocational or an academic track, a "slow" learners class — without confronting the moral implications of their choices.

The above are only a few of many examples that could be given to illustrate the consequences of the pervasive split between the world of mind, morality, the ought, the possible, and the physical world, the world of matter, the is, the actual. All of the specific examples, however, demonstrate our failure to deal with moral questions and concerns regarding the consequences of scientific-technological and industrial developments for human affairs and the quality of human life. With the increasing importance of science and technology in our society, we have fallen into a kind of technological determinism in which the is, the actual, becomes identical with what ought to be, and the actual is determined by developments in the technological-matter side of the dualism. Within such a deterministic viewpoint, technological developments have come to be viewed as having a reality quite apart from human purposes. Serious inquiry into the basic values and moral questions regarding technology tends to be viewed as romantic and unscientific. Intensive and systematic methods of inquiry are not generally considered applicable to important but precisely unquantifiable questions involving human feelings, purposes, and desires — the need for community, the need to belong and feel worthwhile, the need to exert some control over one's destiny, and the need to grow.

All of this does not mean, however, that moral decisions — decisions as to alternative possibilities which for better or worse affect the human condition — are not being made (Dewey, 1957, p. 257). They are made continuously with respect to technological concerns, but with the separation of morality from the scientific-technological enterprise such decisions are too often made on the basis of routine habit or immediate practicality.

Frequently, there is no genuine reflection in the way of a broad survey of conditions and possible consequences or even any real awareness that important moral decisions are being made. Nonetheless, there is no way to avoid making such decisions, and the only means by which we can begin to develop a humane technology is to become truly reflective about moral concerns.

Like many other educational movements, vocational education has been deeply influenced by the historical dualisms mentioned. The historical development of vocational education for the most part has been clearly tied up with the matter or physical side of the dualism:

> But a mental review of the intellectual presuppositions underlying the opposition in education of labor and leisure, theory and practice, body and mind, mental states and the world, will show that they culminate in the antithesis of vocational and cultural education (Dewey, 1966, p. 306).

The ideology behind the major thrust in the development of vocational education has been appropriately labeled "social efficiency" (Wirth, 1972, p. 143). Such an ideology is the direct antithesis of a humane technology, placing things humane and things technological in separate domains, with technocratic goals being primary and humane concerns tending to be ignored. Thus, the adherents of the social efficiency ideology emphasize the necessity of producing loyal and contented workers possessing the skills and attitudes needed by the present state of industrial and technological development. Whether or not the existing order is humane is not an important question; rather, it is tacitly assumed that we live in the best of all possible worlds and that material prosperity and the efficient functioning of the existing economic regime outweigh all disadvantages for the quality of human life that may accrue from mindless and uncontrolled industrial-technological developments and arrangements (Wirth, 1972, pp. 154-155). It is obvious that here we have a classic example of the primacy of the world of matter in twentieth century American social and educational thought.

With the social efficiency adherents dominating the movement to establish vocational education, it is no surprise that the Cartesian split appeared within our schools both in the form of a narrow conception of vocational education and in the separation of vocational-technical studies and the so-called "liberal" academic studies. Thus, we have vocational education representing the material or physical side of the dualism, concerned primarily with helping people find their slot in the world of work by providing them with the necessary technical skills. Separate from all of this and equally narrow, we have the academic studies representing the mental, theoretical side of the duality.

The dualistic perspective continues to be expressed in our educational programs and elsewhere. The persistence of this perspective obviously precludes dealing seriously and effectively with fundamental questions concerning a humane technology, but the remedy for this unfortunate situation is not easy to accomplish because it involves drastic shifts in our fundamental assumptions concerning the nature of our world and the relationships among the phenomena which comprise it. In essense, what is required is a new set of categories from which to view the world.

Fortunately, there is already some solid ground upon which to build. The dualistic world view has not gone unchallenged. Throughout this century, a new world view with new categories and modes of thought has been emerging. For example, early in the struggle to establish vocational studies in our schools, there were people who were arguing for a much broader conception of vocational education. Such people were able to raise and inquire into questions related to a humane technology because they did not polarize mind and matter, science and morality, the theoretical and the practical, labor and leisure, "cultural" and "vocational" studies.

A foremost spokesman for the broader, antidualistic point of view was John Dewey, one of the major pragmatic philosophers in America. Dewey was a strong supporter of vocational education. This support is illustrated by the fact that the curriculum in his University of Chicago Laboratory School was organized around the concept of occupations (Wirth, 1966, pp. 130-131, 278). However, he strongly opposed limiting the definition of vocation to activities that involve economic rewards and the notion that each person has only one vocation (Dewey, 1966, p. 307). Each person has several vocations, but the dominant and all-encompassing occupation of all human beings at all times is living, which to Dewey is synonymous with a continuous process of moral and intellectual growth (Dewey, 1966, p. 310).

Within such a perspective, there could be no separation of the vocational and the "liberal" or academic. Instead, the goal was an effective integration of the two areas. The appropriate place for vocational studies was as an integral part of general education for all children, rather than a separate domain for those who were not going to pursue a higher education. The conception of a liberal education was redefined to mean a common education for all children which included vocational-technical studies in such a fashion that schooling became relevant to the realities of an emergent industrial, urban society. This redefinition was desperately needed because the idea of a liberal education originally came into being to prepare a leisure class for the pursuit of leisurely activities (Dewey, 1966, p. 251) and was not fitting for education in a supposedly democratic society.

To Dewey, the main reason for including occupations in the school curriculum is not that they can serve as the basis for developing job training programs to serve industry in its present state (such a thrust only perpetuates the Cartesian split and the primacy of the material, physical world). Rather, occupations or vocations are important to educational studies because of their social and moral significance, the way in which they connect with other interests and the social order as a whole, and because of their scientific content (Dewey, 1966, p. 315). For example, metal technology and wood construction need not be carried on as a way of preparing future carpenters or welders or merely as an agreeable way of passing time. They afford an approach to knowledge of the place of wood construction and metal technology in the history of the human race and the place they occupy in the present social order (Dewey, 1966, p. 200).

Much more could be said about Dewey's antidualistic, interdisciplinary stance concerning the place of vocational-technical studies in our public schools. He wrote extensively on this subject in Democracy and Education and in other sources. However, Dewey realized, just as we must, that issues concerning the proper place and function of vocational factors in formal schooling, while of crucial importance, only reflect in microcosm larger societal problems which must be confronted if a humane technology is to be achieved. Our efforts to foster a humane technology for the future must reach far beyond mere school reform. In fact, such a goal is impossible to achieve by so limited a thrust, to so focus our efforts makes us guilty of foolishly tinkering about (perhaps this is where we ought to place Career Education!), for the basic educator is the total pattern of culture, the entire socio-economic system (Wirth, 1972, p. 173).

There will not be, cannot be, a humane technology so long as the historic dualisms continue to be perpetuated and maintained in new forms by our socio-economic system. For instance, a revealing example of the Cartesian split in contemporary society concerns the concentration of power in our major public institutions. Power is frequently concentrated in the hands of a few people who figuratively could be said to represent the "mental world" and who make "moral decisions" — i.e., decide the ends, on matters of gravest importance to society. The rest become helpless pawns, "bodies" operating almost exclusively in the physical domain, used as means to achieve ends which they had no part in formulating. A humane technology is out of the question so long as the majority of the participants in our public institutions are treated as "hired hands," extensions of the material world, and cut off from meaningful processes of participation and communication (Dewey, 1962, pp. 181-182). Even today, this is too frequently the case except for "bread and butter" issues (i.e., confined to the world of matter) such as fringe benefits, wages, and working conditions.

The total rejection of a dualistic polarized world view led Dewey to pose critical moral questions concerning the existing social and economic order. To Dewey, such questions were not merely abstract concerns about which philosophers might debate at their leisure; they were questions that were just as deserving of reflective and systematic inquiry as the movements of the planets or the nature of electricity.

Such a way of thinking was (and is) so contrary to the predominant modes that the questions raised seemed ridiculously romantic and idealistic to many people. For example, Dewey and other like-minded people maintained that a major function of vocational guidance ought to be looking critically and reflectively at available career opportunities to determine whether the various careers were worthy of people in terms of such criteria as opportunities for moral and intellectual growth, the exercise of initiative, control, and responsible freedom, and the quality of educational experience involved in the activities comprising the careers (Wirth, 1972, pp. 113-114). From the Deweyan perspective, it was emphatically denied that the only important question was whether or not the people could fit the requirements of the careers. Dewey refused to subordinate the moral-human domain to the physical-technical. He continued to insist that our first concern should be how to restructure the industrial machine to support human values, and that such restructuring should be accomplished through reflective and intelligent inquiry and activity.

It is evident that as Dewey worked toward the end of a humane technology, he was operating out of a perspective which transcended the academic vocational dualism, which confined itself to neither the ivory tower nor the shop. His antidualistic and interdisciplinary perspective suggests, among other things, important commonalities, both existing and possible, between those of us who are specialists in the Foundations of Education and those of you who are specialists in Industrial Arts Education. The actual and possible commonalities between us present the opportunity for the establishment of meaningful dialogue and cooperative action at various levels toward the end of creating a "Humane Technology for the Future."

Both of our areas are related to and touch upon many disciplines. The issues we are interested in cut across isolated subject matter lines, as is illustrated by our common concern for a humane technology. Furthermore, in order to attend to such concerns, people in both areas must be involved neither with the practical nor the theoretical, the applied nor the academic, the technical nor the liberal, the mental nor the physical in themselves or by themselves, but with an effective union between them. In short, to be truly effective in either field, an educator must be strongly interdisciplinary and constantly concerned with the interplay between theory and practice, knowing and doing, ideals and actuality. This is a big order and in reality demands a type of Renaissance person, but is necessary if we are to resolve the dualisms which have plagued us for so long. And if we are truly concerned with a humane technology, the breaking down of these dualities and the construction of a new perspective from which to operate is our most important function.

At this point, it should be stressed that the precedent for challenging the traditional world view in the interests of a humane technology has been set not only by individuals chiefly indentified as philosophers of education (e.g., Dewey and Wirth), but also by individuals within the field of industrial arts education. The title of the leading journal, Man, Society, and Technology, is an expression of the broad, antidualistic, and interdisciplinary outlook extant among many leading industrial arts educators. Such an outlook is also expressed in the definition of industrial arts published by the Office of Economic Opportunity last November. The definition is clearly compatible with the goal of pursuing a humane technology through resolving and integrating dualisms in thought and activity. It emphatically rejects identifying industrial arts with job training or as preparation for those who will later enroll in job training programs. Industrial arts is defined as general education of value to all students, regardless of their aspirations. Furthermore, the framework provided by the definition encourages the development of an integrated program of studies with an emphasis upon reflective thinking and the development of high levels of cognitive-moral functioning (Federal Register, Nov. 21, 1973, p. 32242-43).

In addition, currently some leading industrial arts educators are forcefully and publicly asking the types of questions and conducting the kind of inquiry necessary to deal with the problems inherent in a humane technology. As an outstanding example, I refer you to Paul DeVore's article on environmental education in the April 1971 issue of School Shop. Dr. DeVore's approach is clearly interdisciplinary; he uses the concept of system, which cuts across all of the academic disciplines. Second, he is concerned not with the schools in isolation, but with the entire social and cultural context. Finally and most importantly, he questions, is critical of, and suggests constructive alternatives to existing attitudes, values, and modes of thought which continue to reflect the Cartesian split (DeVore, 1971, p. 69).

The above indicates that industrial arts educators are in a uniquely favorable position to take the lead in fostering a humane technology. Unlike most other vocational education groups, there is a strong thrust in your field to see your work as general education and as related to many different areas of study (Wirth, 1972, p. 139).

Unfortunately, this is not the only or perhaps even the major thrust in industrial arts. There are those who justify industrial education on the basis that it provides non-college-bound students with a salable skill. There are also those who see industrial arts as an agreeable diversion from the tedium and strains of "regular" school work (Dewey, 1966, p. 194); and those who have fallen hook, line, and sinker for the career education approach. Each of these positions may be valuable for some purposes, but none of them have much to contribute toward the endeavor of creating a humane technology. Each perpetuates the dualistic perspective by encouraging the continued separation of the academic and the vocational, by ignoring the total social setting in which education occurs, or both.

In the final analysis, there is no avoiding the fact that the problem of creating a humane technology is a moral problem. The moral questions which must be confronted are obviously related to the structure and functioning of our public educational system, but they are by no means limited to the realm of formal schooling. Such questions are inextricably tied up with our entire socio-economic system.

If we are serious about developing a civilization which is both technologically advanced and humane, we cannot get caught up in stop-gap measures such as career education which focus only upon superficial reform of the public school or simple-minded technocratic approaches such as "teaching every child a marketable skill." Whatever their merits, these narrow solutions stand as obstacles to the main task that confronts us, and that task is both awesome and urgent, for time is running out on the option of acquiesing to mindless, anti-humane, technocratic solutions (Wirth, 1972, p. 237). In spite of the successful quest for material gain, we have failed to demonstrate that we can create a humane social order, a civilization worthy of allegiance (Wirth, 1972, 222). Our task is to begin to apply the same methods of intelligence which have produced our advanced technology to the social-moral sphere of related human affairs, toward the end of subordinating technical power to humane democratic ends (Wirth, 1972, p. 237). The task involves disciplined, sustained, and systematic investigation of difficult moral questions to which there are no pat answers, as well as a willingness to approach these complex questions with a genuine spirit of inquiry. A commitment to new and daring modes of thought is required. A willingness to reconstruct our belief through the difficult and arduous processes of reflective thought is essential. The courage to act upon the reconstructed beliefs in concert with others who are concerned with a "Humane Technology for the Future" is demanded.

BIBLIOGRAPHY

DeVore, Paul W. "How Can Industrial Education Meet the Challenge of the Environmental Crises?" School Shop (April 1971), pp. 68-70.

Dewey, John. Democracy and Education (New York. The Free Press), 1966; original publication 1916.

Dewey, John. Human Nature and Conduct (New York. Random House), 1957, original publication 1922.

Dewey, John. Individualism Old and New (New York. Capricorn), 1962, original publication 1929.

Federal Register (Washington, D.C.. Office of Education, HEW) Vol. 38, No. 224, November 21, 1973, pp. 32242-32243.

Wirth, Arthur G. John Dewey as Educator. His Design For Work in Education (1894-1904) (New York: John Wiley and Sons, Inc.), 1966.

Wirth, Arthur G. Education in the Technological Society. The Vocational-Liberal Controversy in the Early Twentieth Century (Scranton. Intext Educational Publishers), 1972.

Dr. Littleford is an Assistant Professor in the Foundations of Education program, Auburn University, Auburn, Alabama.

Teacher Education, A Perspective

Wiley G. Hartzog, Jr.

The theme of this conference, "A Humane Technology for the Future," is in reality a theme of understanding. Only those things that can be brought into the frame of human understanding can be truly humane. Industrial arts has long advocated that the education of all students should include a strong emphasis upon understanding the technological society that surrounds us.

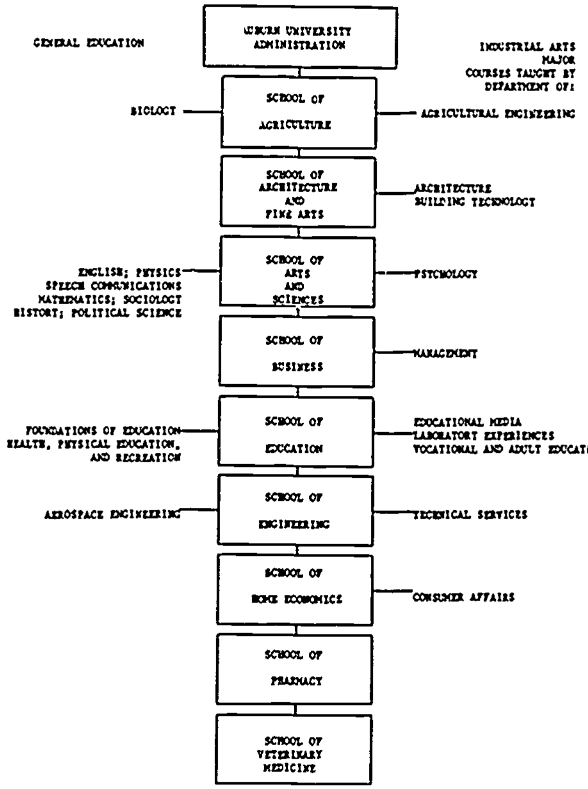
The teacher education perspective that I share with you is one of understanding through interaction. These interactions are many and varied. They include not only technical and traditional disciplines, but interactions within the field of education as well.

It would perhaps be desirable if it could be claimed that this curriculum was the product of extensive curriculum study and research. However, it is the result of curriculum revision influenced by the following constraints:

1. Auburn University does not permit duplication of facilities, courses, or equipment until maximum utilization has been reached with existing resources.
2. At the time of the revision, budgetary consideration dictated that only those revisions could be approved that did not require additional staff members or equipment.

Even with these constraints, we are proud, and we feel justifiably so, of the very positive results we have observed. We feel that the following observations reflect favorable outcomes from our teacher preparation program.

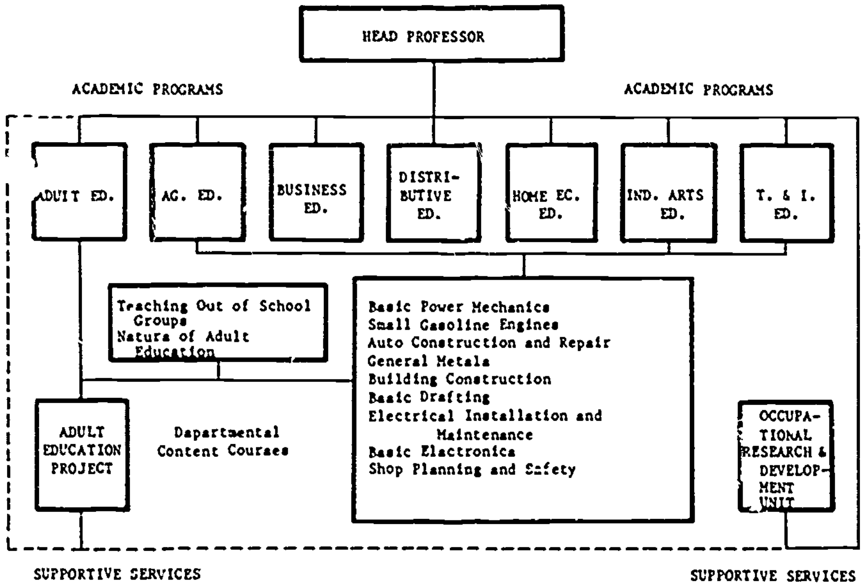
1. Over 90% of our graduates, in the three years since implementation of this curriculum, are presently industrial arts teachers.
2. As a result of interactions within our own department and within the school of education, our graduates, while they have a strong role identification, evidence ability and willingness to cooperate with other teachers in other areas.
3. As a result of interactions with other academic schools and departments within our university, our graduates evidence the understandings necessary to relate industrial arts activities to an understanding of our technological society through their instruction.
4. Departments outside the School of Education frequently employ our students as laboratory aides and assistants, in preference to their own students, citing their ability to communicate and instruct.
5. We frequently receive compliments on the quality and ability of our students from professors in other departments and schools where they are taking courses.
6. Enrollment in the industrial arts curriculum has increased more rapidly than other curricular areas in the School of Education.



DEPARTMENT OF VOCATIONAL AND ADULT EDUCATION

School of Education

Auburn University



Auburn University is a land-grant institution. The undergraduate phase of its instructional program is organized into nine academic schools. The industrial arts education curriculum interacts with seven of these nine schools. At the present, no courses are utilized from the schools of pharmacy or veterinary medicine.

The industrial arts education programs are administered through the industrial arts division of the Department of Vocational and Adult Education within the School of Education. This department offers degrees in seven areas of concentration through its academic programs. It also provides supportive services for several other activities of a research or an extension nature.

The NCATE-approved industrial arts education curriculum consists of 210 quarter hours. An outline of this curriculum is shown in the accompanying chart. The 80 quarter hours in general education (University and School of Education requirements) are distributed over four of Auburn's nine schools.

INDUSTRIAL ARTS CURRICULUM

General Education	80 hrs.
Professional Education	41 hrs.
Major/Minor	75 hrs.
Electives	14 hrs.
TOTAL	210 hrs.

GENERAL

Orientation	2 hrs.
English and Speech Communications	21 hrs.
Biology	10 hrs.
Math	5 hrs.
Social Sciences	24 hrs.
Physical Sciences	10 hrs.
Health, Physical Education and Recreation	3 hrs.
General Elective	5 hrs.

PROFESSIONAL EDUCATION

Human Growth and Development	5 hrs.
Psychological Foundations of Education	5 hrs.
Social Foundations of Education	5 hrs.
Teaching in Industrial Arts Education	3 hrs.
Programs in Industrial Arts Education	3 hrs.
Professional Internship in Industrial Arts	15 hrs.
Philosophical Foundations of Education	5 hrs.

The 41-quarter-hour professional education sequence is shared by the departments of Foundations of Education and Vocational and Adult Education. All of these courses, with the exception of Philosophical Foundations of Education, require student involvement in public school situations. Generally industrial arts majors take Social Foundations of Education, Programs in Industrial Arts Education, and Teaching in Industrial Arts Education in a one-quarter block. This enables them to concentrate on involvement in live classroom participation to an extent not possible if these courses were taken separately.

Industrial arts majors are treated as a separate group only in the teaching and programs courses and during their professional internship. All other phases of their preparation involve interaction with students from other schools or majors.

The 75-quarter-hour major minor in industrial arts education involves seven of Auburn's nine schools. It offers students four options, in terms of specialization within industrial arts.

1. 50-quarter-hour I.A. major plus an approximate 25-quarter-hour minor in a related field, i.e., Educational Media, Economics, Mathematics, Adult Education, etc.
2. Industrial Arts Drafting and Design offering a concentration in Drafting and Design, using courses from the departments of Technical Services, Architecture, Building Technology, Consumer Affairs, and Vocational and Adult Education.
3. Industrial Arts/Power Mechanics offering a concentration in power mechanics, using courses from Agricultural Engineering and the Department of Vocational and Adult Education.
4. Industrial Arts Metals Technology offering a concentration in metals using courses from Technical Services and Vocational and Adult Education.

The first option is the least popular and possibly the least effective in terms of teacher preparation. However, it frequently meets the needs of students transfering into industrial arts from other schools and departments. The other three options are about equal in popularity. In Alabama, the current trend is to offer increased exploratory courses of a general specialized nature at the lower high school level. We feel that our curricular options offer extremely valid preparation for teachers involved in these programs.

The key to success of an interacting teacher preparation program such as ours is in coordination with the other departments and schools involved. To accomplish this coordination, we maintain a master schedule of School of Education and Department of Vocational and Adult Education courses. We also maintain schedule agreement with other schools and departments so that we can effectively advise students in planning their programs.

Some other benefits that have resulted from this approach to teacher preparation are:

1. Increased awareness and knowledge of industrial arts throughout our campus.
2. Attraction of students from other areas to industrial arts through student interaction.
3. A realization by other schools and departments that public school industrial arts can aid their objectives, at the professional level, by providing public school students with awareness, information, and exploratory experiences. In fact, we are currently discussing with the School of Engineering how this might be accomplished and what support they may provide industrial arts.

This program born of necessity has proven to be extremely satisfactory. Based upon our experience, given additional alternatives, it is doubtful that we would make major changes in our program. If you get the opportunity—try it, you'll like it.

Dr. Hartzog teaches in the Industrial Arts Education Department, Auburn University, Auburn, Alabama.

Representative Addresses from the Major Group and Special Interest Sessions

Career Education

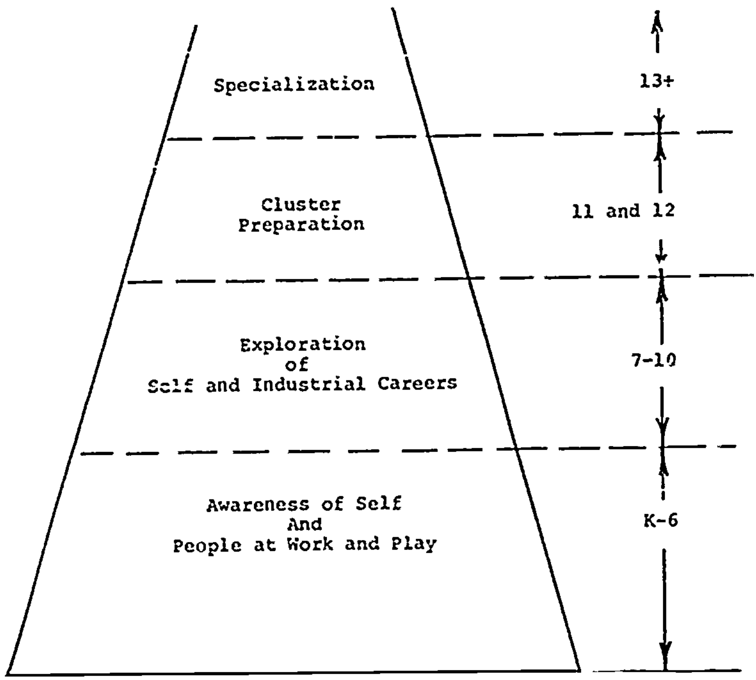
Exploratory Industrial Careers Project

Larry Jon Kenneke

Five Oregon public school districts, the Oregon State Department of Education, and the Department of Industrial Education at Oregon State University are currently engaged in a joint project designed to facilitate career development through exploratory industrial arts programs. Participating districts are Albany, Ashland, Klamath Falls, Philomath, and Salem.

The project, funded primarily through the State Department of Education, calls for a three-year consortium of public school districts whose purpose is to develop outlines for five alternate exploratory industrial career development programs. The program outlines or models will have application to industrial arts students in grades seven through ten, and will provide industrial arts teachers with guidelines and give impetus to exploratory career development activities in the school shop.

Alternate models will reflect individual district needs and desires, along with a unifying theme of career development. For example, District A may elect to develop a model based on the "Occupational Versatility" program, while District B may develop a model resembling the "Function-Base" approach. Care will be taken to avoid the imbalance found in industrial arts models that emphasize technology, materials, and product at the expense of man and his role as worker. Every effort will be made to blend technology with the contemporary needs of real people with real learning characteristics and real career potentialities. Consortium activity will ensure that alternate emerging models will, in fact, possess a definite career development orientation.



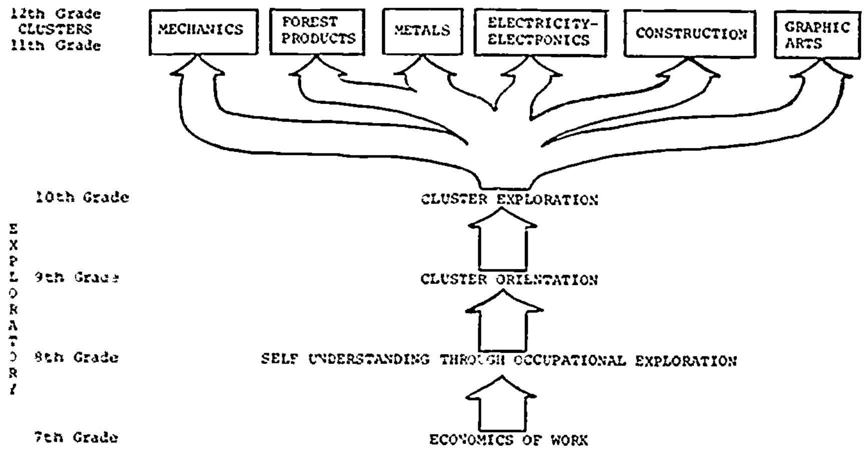
CAREER SELECTION PROCESS

The first year, or phase, will be devoted to devising program models which reflect developmental stages and corresponding characteristic behaviors of youngsters in grades seven through ten. Appropriate occupational content, instructional components, and learning tasks will also be formulated for each stage. These will be drawn from the career development continuum which is characterized by the levels of awareness of self and people at work and play (K-6), exploration of self and industrial careers (7-10); cluster preparation (11 and 12); and specialization (13+).

Since exploratory programs are an integral part of the total career selection process, they will be designed within the framework of a completely articulated career education scheme. The programs will be built upon what occurs within the career awareness level (K-6), as well as that which takes place at the levels of cluster preparation and specialization.

Figure 2

EXPLORATORY INDUSTRIAL CAREERS PROGRAM



Program models seek to facilitate exploration of self and industrial careers. They will promote: a) understanding of the economics of work, b) self-understanding, c) orientation to industrial career clusters, d) exploration of industrial career clusters.

The industrial arts instructional area has been delegated the responsibility for providing exploratory career development experiences in six of Oregon's 14 established occupational clusters. The six clusters are industrial-mechanical, construction, electrical, graphic arts, metals, and forest products.

Specific occupational and technical content for program models will be derived from key occupations found within each cluster. For example, occupational content and learning activities representing the construction cluster will be derived from analyzing the jobs of cabinet maker, carpenter, construction worker, cement mason, and structural steel worker. Key occupations will be examined in terms of both manpower and technological aspects and will serve as a minimal listing around which exploratory career development activities can be formulated.

Self-understanding will be developed through experiences which require that students test their individual abilities, interests, and limitations against real and simulated hands-on experiences with the tools, materials, processes, and products found in industrial career clusters. Laboratory activities will be designed to help students assess personal goals, interests, aptitudes, attitudes, temperament, educational background, work experience, and family background.

The economics of work will also be taught through hands-on activities in the many job areas comprising the six industrial career clusters. Content and instructional components will serve to identify and clarify economic activity, production, distribution, consumption, and employment.

KEY OCCUPATIONS
EXPLORATORY INDUSTRIAL CAREERS PROJECT

ELECTRICAL	MECHANICS	METALS	CONSTRUCTION	GRAPHIC ARTS	FOREST PRODUCTS
Electronic Technician	Construction Mechanic	Foundry Worker	Cabinet Maker	Draftsman	Forester Aide
Electrician	Auto Mechanic	Welder Combination	Carpenter	Printer	Logger
Electrical Repairman	Garage Foreman	Machinist	Construction Worker	Illustrator	Veneer and Plywood Mill Worker
Electrical Appliance Repair	Office Machine Service	Sheet Metal Worker	Cement Mason	Photographer	Composition Board Mill Worker
Electronic Assembler	Diesel Mechanic	Production Machine Operator	Structural Steel Worker	Bookbinder	Woodworking Machine Operato
					Woodworking Mill Hand
					Pulp and Paper Mill Worker
					Sawmill Worker
					Grader-Tester

The second year will be spent in converting content and instructional components into usable teaching-learning materials. Such materials will be designed to clarify employment trends and opportunities, employment location, pre- and post-employment requisites, working conditions, and earning. Student activities and experiences will also clarify work roles in terms of what gets done, how it gets done, and why it gets done.

A typical activity would result in the student being able to write out, recite, or in some manner indicate a mastery of the characteristics which describe selected industrial occupations.

Materials will blend industrial processes and procedures with career development activities. Instructional materials will take numerous forms, including learning packages, audio and video tapes, operation, information, and activity sheets, film loops, slide-tapes, instruction manuals, films, laboratory exercises, checklists, and programmed booklets.

The exact nature of instructional materials will depend on the unique and specific characteristics of each developmental center. Each center's capabilities will be examined in view of available human, material, and economic resources. A benefit analysis will aid decision-makers in ascertaining kinds of materials best suited for each center.

IMPLEMENTATION AND AFTERMATH

The third year will be spent in implementation, evaluation, revision, and dissemination of program outlines and materials. Each participating school will demonstrate the effectiveness of its own exploratory industrial career development model and will apply its own learning materials to industrial arts classes in selected district schools. Each program will be evaluated by a team of external monitoring consultants representing business, industry, the state employment service, and education. Their purpose will be to ensure that the objectives of the models are being met, and if not, that adjustments will attempt to answer questions such as: Do career development models facilitate expected performance? Are sufficient alternatives in content, learning experience, and motivation available? At the same time, it will ascertain whether provisions have been made for the career development of youth with academic, socio-economic, and other handicaps. A revision of models and accompanying materials will take place prior to final printing and dissemination.

Upon completion of the three year effort, five alternate, exploratory, industrial career development models will emerge — complete with teaching-learning materials which effectively blend career development tasks with industrial arts hands-on activities. It is expected that these models will be adapted by other districts in Oregon and elsewhere.

Dr. Kenneke is director of the Exploratory Industrial Careers Project and assistant professor in the Department of Industrial Education at Oregon State University, Corvallis, Oregon.

Implications of Career Education Objectives for Elementary School Industrial Arts

Vito R. Paco

Contemporary curriculum builders are continually refining rationale and content for programs. Educational technology is continually adding to the banks of knowledge and methodology, and these, in turn, are rapidly increasing the potential for excellence in modern educational systems.

Curriculum development in the area of career education has been propelled prematurely into implementation. School systems all over the country are developing delivery systems for programs in career education, but there is little or no evidence in these exemplary programs or in the literature that objectives have been identified through responsible research. The question then arises, how reliable are programs whose objectives have been established without reference to a systematic development of priorities? When objectives for a comprehensive program such as those encompassed in career education are developed solely by educators, we must certainly be prone to public criticism for not involving input from those who are most affected by the results of educational programs.

A study conducted in Niagara Falls, New York, was designed to identify a priority of objectives in career education for the elementary school so that they might be used as a sound basis for curriculum recommendations. Central to the identification of objectives was the notion that objectives have value only when they are selected by a population in relation to its perception of needs, particularly when that population is likely to be affected by its own choices. The study was thus designed to establish the priority ranking of career education objectives for the elementary school by parents and teachers of elementary school children.

The primary source of objectives chosen for the study was 40 current exemplary career education programs, specifically those containing goals and activities for elementary school children. A final list of 16 objectives was identified after a process of synthesizing and rewording in behavioral terms.

The rankings of career education objectives were obtained from parents and educators by means of a Career Education Opinionnaire which employed a Q-sort technique of forced-choice ranking. Respondents were asked to order 16 objectives on a scale ranging from "Most Important" to "Least Important." The instrument also included demographic survey questions, data elicited therefrom were used to analyze rankings in terms of nine conditional variables.

The next logical step in program development is to translate the ranked career education objectives for the elementary school into an infusion model which will reflect the potential input by each of the major curriculum areas. Therefore, if career education at the elementary school level is to provide awareness through stated objectives, industrial arts personnel must be cognizant of their potential role in the infusion process.

The following ranked listing of 16 career education objectives is matched with possible industrial arts correlated activities.

Objective Upon completion of the sixth grade, children will be expected to . . .	I.A. Correlation
1. ...identify relationships between school learning and the world of work.	Demonstrate concepts in technology through activities—relate concepts to operations and occupations—provide experiences correlating concepts taught within the curriculum as utilized by man through technology.
2. ...explain how their abilities and interests relate to various occupations.	Provide opportunities to explore and become aware of self-concepts in relation to likes and dislikes in working with a wide variety of tools and materials.
3. ...identify the values of work for the individual and society.	Provide opportunities for individuals to become contributors through involvement in simulated work activities.
4. ...describe the value of all workers, regardless of occupation.	Opportunity to experience team or group experiences in working with tools and materials—group dependency on individual and individual dependency on the group.
5. ...describe how workers depend on each other (cooperation).	Study of mass production techniques.
6. ...describe the purposes of work to the individual and society.	Explore the value of work in relation to societal goals—technology as a contributor to environmental conditions.
7. ...explain how attitude toward work affects the employee and the employer.	Explore the effects of attitude on degree of success of technological endeavors—quality control, customer satisfaction, etc.
8. ...develop elementary mental and body skills in a number of career-related tasks.	Provide opportunities for children to experience actual contact with planning and executing activities in a variety of media in industrial arts.
9. ...know how to obtain information about a variety of occupations.	Provide resources pertaining to occupations as they relate to areas in technology.
10. ...describe how hobby and recreational activities may relate to future careers.	Provide opportunities to explore hobbies related to industrial arts, correlating concepts with possible employment application.
11. ...explain the idea of reward (pay and others) for satisfactory work performance.	Develop concepts of economics in relation to industry, noting the system of finance related to commercial endeavors.
12. ...explain how various occupations relate to wide ranges of social and economic benefits.	Relate through research and observation various occupations in technology requiring a wide range of skills and ability that are often related to income and social status.
13. ...describe how different occupations take place in different settings such as factories, offices, hospitals, etc.	Through concrete experiences and on-site visits, provide an awareness of the environment and working conditions and expectations for a variety of industrially-related occupations.
14. ...explain the difference between workers who produce goods and those who produce services.	Through activities, provide experiences which define the roles of man the producer and man the servicer of technological equipment.
15. ...express general likes and dislikes about different occupations.	Through actual or simulated activities, provide children with the opportunities to evaluate their likes and dislikes in relation to a variety of industrially-related occupations.
16. ...identify the most common occupations in the community.	Utilize community resources such as people and facilities to explore occupations being performed in the local community.

The abbreviated suggestions presented in this abstract are merely a beginning for a wide variety of potential methods for incorporating technology in industrial arts to achieve established goals in career education.

Dr. Pace is Associate Professor of Industrial Arts Education at State University College at Buffalo, New York, and also serves as Consultant in Career Education for Western New York Public Schools.

Getting a Start in Career Education: Steps 1 through 7

Charles C. Brady

The following are suggestions as to how an industrial educator can become involved in career education, with or without district, state, or federal financial assistance.

STEP NO. 1 – ORIENTATION

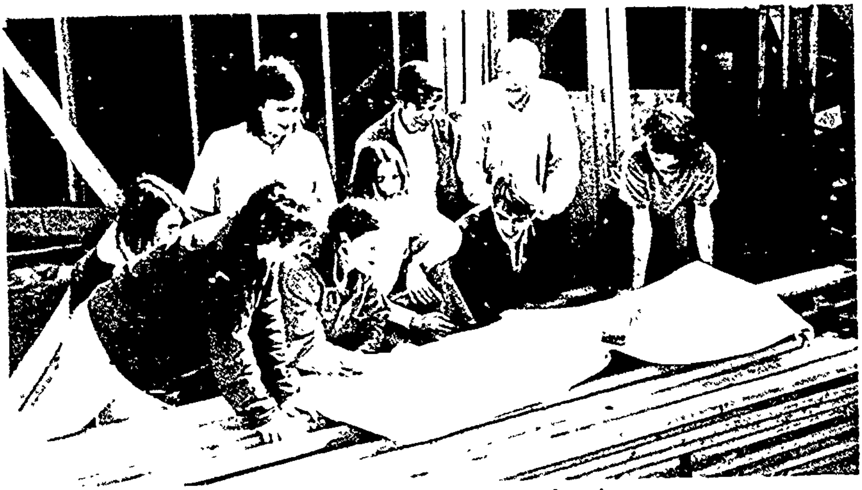
Obtain a true understanding as to what career education is all about. Dr. Sidney P. Marland, former U.S. Commissioner of Education, says about career education, that:

> Career education . . . provides for every student to acquire the skills which will allow him or her to make a livelihood, no matter at what level he or she leaves the educational system. . . . Makes public education more relevant to today's needs and the needs of the future. . . . Provides for a comprehensive educational program focused on careers, which begins in Grade 1 or earlier and continues through the adult years. . . . Provides for elementary school students to be informed about the wide range of jobs in our society and the roles and requirements involved. . . . In junior high school, students may explore several specific clusters of occupations through hands-on experiences and field observation, as well as classroom instruction. . . . Provides assistance for students in selecting an occupational area for specialization at the senior high school level. . . . Ensures that students at the senior high school level pursue studies in their selected occupational area either for intensive job preparation for an entry-level job immediately upon leaving high school, or preparation for post-secondary occupational education, or preparation for four years or more of college. . . . Assists students in developing attitudes about the personal, psychological, social, and economic significance of work. . . . Provides for extensive guidance and counseling activities in order to assist the student in developing self-awareness and in matching his or her interests and abilities with potential careers. . . . Provides for each student's placement into an entry-level job or further education. . . . Provides for avocational pursuits.

(NOTE: Industrial education activities from K through higher education overview in appendix.)

STEP NO. 2 – USE OF ADVISORY COMMITTEE

Get into the swing of career education with or without budgeting dollars, for all that is really needed is your time to develop and use an advisory committee – a group of people who will work with you in relating subject matter to career development, in terms of organizing career information seminars and field trips for your students. Most communities are rich in resources which can and must be employed in career education if that education is to be relevant to contemporary society. Industrial education programs should utilize the industrial, technological, and human resources available for both program planning and industrial enrichment.



Trades math at Santa Barbara High School.

STEP NO. 3 – ASSISTING IN THE GUIDANCE PROCESS

Relate career information to classroom, laboratory, or shop experiences. Contribute to the students' career guidance process by assisting in the identification of individual interests, performance, and capabilities. Try working with a counselor in the development of student profile information.
(NOTE: "Use of Occupational Preparation Sheets" in appendix.)

STEP NO. 4 – A CAREER DEVELOPMENT PROGRAM FOR EACH STUDENT

Your instruction should provide for a variety of teaching methods and media, an opportunity for learning that takes into consideration varying student learning styles, and a reflection of industrial activities.

STEP NO. 5 – USE OF COMMUNITY RESOURCES

Relate and organize learning opportunities beyond the school environment: youth clubs, field trips, exploratory and cooperative work experience, and satellite off-campus instruction. Learning activities in many school subjects require students to avail themselves of varied community resources that enrich and expand the outcomes which might otherwise be expected in formal school settings.
(NOTE: Internship Program in appendix.)

STEP NO. 6 – SELL YOUR PROGRAM

With the help of your advisory committee, design a brochure to describe to students, parents, teachers, and counselors how your program of instruction can fit into a program of career development.

Be sure your research provides for the placing of students in the next step of their career development or into an occupation for which they have been trained. If funds are available, perhaps a Placement Technician can be employed.
(NOTE: See Placement Technician Services described in appendix.)

Provide for related instruction (math, English, science). You will need to work with teachers of varied subject areas to gain input for brochure information.

STEP NO. 7 – START A SCHOOL CAREER INFORMATION CENTER

Ask a community service club, Chamber of Commerce, or your P.T.A. (after conferring with administrators), to assist in the establishment of a school Career Information

Center. If funds can be obtained for the employment of career information technicians, then interest and possibly aptitude tests can be given to students in the Center, as well as career information dissemination.
(NOTE: Career Information Center description in appendix.)

FURTHER EXPLANATION

A little bit of knowledge is dangerous. The above steps indicate a sense of direction only. Read about career education. For example, read Richard E. Holloway's article entitled "Career Education Competencies for Elementary and Junior High Teachers" which appears in the December 1973 edition of "Man/Society/Technology." Read about what other people are doing. Be careful that you don't let yourself believe that career education is the same as vocational education. See how you can develop lessons or units around the following career education concepts:

- All jobs are important.
- People can be successful at a number of different jobs.
- Different jobs have many things in common.
- Childhood experiences affect our career choices.
- How we feel about ourselves affects our career choices.
- People can retrain for a new occupation; often they are adults.
- Our successes and failures contribute to our career decision-making.
- The occupational market is always changing.
- How well you do in school will affect your occupational choice.
- Occupations can be classified into clusters due to their similarities.
- Your hobbies can have an effect on your occupational choice.
- Knowing how different occupations are interrelated gives you a wide range of occupational choice.
- Being a girl is becoming less a factor in job selection than ever before.
- Ethnic background is less of a factor in job selection than ever before.
- As a worker or consumer, we have to play a specific role in our economic system.
- Each individual is unique in his abilities, interests, values, temperament, and attitudes.
- Life styles and social roles vary with different occupations.

The materials in the appendix are used with this presentation to illustrate career education at grade level K - 14 in the public schools of Santa Barbara, California. Visitors who wish to see career education in action Pre-K through grade 12 are invited to contact Charles C. Brady, Santa Barbara School Districts, 720 Santa Barbara Street, Santa Barbara, California 93101. Phone: (805) 963-4331, ext. 223.

BIBLIOGRAPHY

Career Education: A Model For Implementation. Washington, D.C.. U.S. Office of Education, Division of Vocational and Technical Education, Bureau of Adult, Vocational, and Technical Education. May 10, 1971.

Guidelines for Industrial Arts in Career Education, Implications for Curriculum Development and Program Implementation. Prepared by. A U.S. Office of Education Appointed Task Force on Guidelines for Industrial Arts Curriculum in Career Education. Pittsburgh, Pa. 15213. Department of Vocational Education, 2604 Cathedral of Learning, University of Pittsburgh, Pittsburgh, Pennsylvania, 15213.

APPENDIX

Industrial Education Activities from K Through Higher Education

Elementary Grades

Self and Career Awareness. Programs designed to familiarize students with the many kinds of work people do and the interrelationship of such work in the production and use of goods and services. In addition, students develop self-awareness in relation to various industrial-technical occupations. Industrial arts experiences infused in the total elementary instructional program emphasize positive attitudes toward work and the relationship of manipulative activities.

Middle Grades

Career Orientation and Exploration. Programs consisting of laboratory instruction to give students experience with the kinds and levels of activities performed by persons in a broad range of industrial pursuits and all levels of occupations for which special skills are required, to inform them of prerequisites for careers, to acquaint them with the significance of changing and evolving technologies, to instill in them an understanding and appreciation of work, and to assist them individually in making informed and meaningful career selections.

Intermediate Grades

Career Exploration. Programs designed to provide transitional experiences that bridge the gap between the awareness/orientation focus and specialized in-depth offerings. Experiences provide students with opportunities to select and explore individual occupations and technical concepts, thereby assessing their own performance, aptitudes, and interests.

Upper Grades

Career Development and Beginning Specialization. Programs designed to prepare individuals for enrollment in vocational and technical education or institutions of higher education. Provision is made for experiences which might assist students in continuing to assess their interests, abilities, limitations, and potentials in respect to industrial-technical occupations and provide them with competencies that contribute to occupational success. Instruction will also be provided for those who do not specialize in a technical area at this level and who wish to acquire broad skills and knowledge for personal and avocational reasons.

Post-Secondary Grades

Adult, Continuing and Higher Education. Awareness and exploratory programs of laboratory experiences designed for adults and out-of-school youth who may benefit from broad basic instruction related to industrial and technical occupations to obtain a better understanding of the industrial world and the profitable use of recreational and leisure time. Programs also provide for the preparation of professionals required to develop and maintain the efforts cited above.

Use of Profile Card

A profile card has been developed for use in the high schools participating in Santa Barbara's Career Education Project.

The profile is based on information gained from the Priority Counseling Survey, the school records, and the students. It includes such items as:

- Credits earned
- Plans after graduation
- Work experience
- Interests, both measured and stated
- Aptitudes, both measured and stated
- Career choice
- Interests (school subject areas)
- Stated strengths and weaknesses
- Test result data
- Counselor notes and conference, with recommendations
- Current program

The profile serves as a tool in the career counseling effort. When all the above types of data are recorded on the card, the counselor can work with the student to help him arrive at a career development plan which may include course selection, further education or training plans, and a career goal.

Use of Occupational Preparation Sheets

Early in January 1973, a career planning research technician was employed to work with the Santa Barbara High School District Director of Career Education. The technician was assigned the task of providing for the career counselors at Santa Barbara High School and at La Cumbre Junior High School program-planning sheets for specific occupations. The request for this information came as a result of more and more students seeking to find descriptive information regarding what courses and work experience activities are needed in order to reach an entry-level occupational objective.

A variety of sources were investigated by the technician in order to gain information to produce the Occupational Preparation sheets. Some of the sources used are listed as follows:

- U.S. Department of Labor
  "Dictionary of Occupational Titles"
- U.S. Department of Health Education & Welfare
  "Vocational Education and Occupations"
- State of California Department of Human Resources Development
  "Occupational Guides"
- General descriptive information on specific occupations found in numerous books, pamphlets, and brochures.
- Other information was provided by professional and trades associations, colleges, and trade school catalogs, and via interviews with local school personnel.

After obtaining general course suggestions from these various sources, the technician converted them into specific suggestions for the secondary schools of our district.

Skill Training Internship Program

In order to assist students with their career development goals, local community resources must be made available for skill training purposes.

The typical world of salable skill development found in the average high school consists of business education laboratories, industrial education shop facilities, and home economics laboratories. The "school campus world" does not make available all the clusters of occupations for students to investigate and explore.

Work experience student in a U.S. National Forest Service drafting office.

In an effort to expand career planning activities for students to include off-campus educational experiences, many school districts offer one or more types of work experience programs (exploratory, general, or vocational). The Skill Training Internship Program is actually a form of off-campus work experience.

In an internship program, the off-campus employer/consultant agrees to teach the participating student a mutually agreed set of skills that will make the student employable in a stated occupation. After an initial training period, the student is paid for his time and service to the employer as a part-time employee.

One other aspect of the Skill Training Internship Program includes the on-campus related instruction taught by a member of the school's regular teaching staff.

Placement Service

Many students graduating from Santa Barbara High School leave with no definite plans for further education or training and have no specific job entry-level saleable skills. It was a major goal of the Career Education Project for 1972-73 to achieve 100% placement of Santa Barbara High School graduates.

Placement has been defined, for project purposes, as a full-time job for those seeking employment, enrollment in the next link of education or training leading to a career goal, or entry into the military service. To achieve this goal, a placement technician was assigned to the Work Experience/Career Development Office at Santa Barbara High School. During the final months of the spring semester, a placement consultant was employed to find jobs and assist students in finding employment.

Seminars conducted by representatives of the California Human Resources Development officers, and the National Alliance of Businessmen on interviewing and job techniques were also held for graduating seniors.

Placement Technician

During the year 1972-73, the placement technician interviewed 655 senior students, and particular emphasis was placed on helping 74 students who had no definite career choice. Of the original 655 students, many were interviewed more than once, and received additional assistance through their counselor, the Work Experience Department or the Career Development Center. Of the 74 students to receive special help, some were special education students, some had language or reading problems, and some had changes of plans because of moving, inability to locate jobs, etc.

Job Placement Consultant

The placement consultant contacted a wide range of employers during the period of one month (May 15 through June 15, 1973) and located 95 jobs which were made available to the students at Santa Barbara High School. Seventy-three students were interviewed, and by using the background information concerning the saleable skill training of each student, a large percentage were placed in jobs which corresponded with their abilities and interests.

Career Information Centers

The showplaces of career education are the Career Information Centers located at Dos Pueblos, San Marcos, and Santa Barbara High Schools and on the La Cumbre Junior High School campus. These career centers contain a wealth of information that the students may utilize to aid in planning and reaching their career objectives. The types of information available to the students include:

Information about Self

Many students at the high school level have not given any thought toward choosing a career objective. For these students, there are interest and aptitude tests available to help them find the occupational areas that offer the greatest degree of future success and satisfaction.

Information on Occupational Choices Available

There are over 30,000 job titles in the United States. The Career Information Centers have, or can obtain, current information on all of them. This includes information on the duties, requirements, wages, advantages, and disadvantages of each occupation. The students who use the centers will also discover which of these occupations will be most in demand in the future, as well as which occupations are now over-supplied.

Information on Occupational Preparation

After making a tentative career choice, the students are provided with information on how to achieve their career objectives. Included in this information are descriptions of the courses and programs to be completed in high school, as well as the further training requirements — if any — that will have to be fulfilled after graduation. The Career Information Centers also contain catalogs and brochures on all trade schools, technical schools, junior colleges, colleges, and military vocational training programs to be found in the United States. By utilizing these information sources, the students are able to learn about the admission requirements, cost, length of study, and financial aid available for these various institutions.

Career Information Center at Dos Pueblos High School.

This information comes in many forms. Students using the career centers are reading occupational pamphlets, books, and brochures, watching occupational filmstrips and videotape productions, listening to tape recorded interviews and guest speakers from various occupations; and taking part in visits to actual job sites.

A description of the career centers would not be complete without mention of the individuals who staff them, the career information technicians. These capable people gather, organize, and keep all information up-to-date. They also perform all the duties necessary to keep the centers running smoothly and effectively. The La Cumbre Junior High and Santa Barbara High School Career Information Centers provide an additional service to the students in the form of full-time career counselors. These career counselors serve as liaison agents with counselors, teachers, and parents while providing vocational guidance to the individual students.

Mr. Brady is the Director of Career Education at Santa Barbara School District (Elementary) and Santa Barbara High School District, Santa Barbara, California, and the State President of the California Industrial Educational Association, Inc.

Career Education—The Evaluation by the National Assessment of Educational Progress

Ralph C. Bohn

The effort to evaluate career education as part of the program of the National Assessment of Educational Progress (NAEP) began in 1965, as an effort to assess vocational education. During a series of national advisory meetings, the concept was changed from vocational education to Career and Occupational Development (COD). The assessment package is now complete, with testing underway. Data analysis and report preparation will occur during the 1974-75 school year, with reports released at the end of the school year.

The program has received strong support during the past few years due to the national emphasis on career education. Fortunately, the assessment is sufficiently broad to fit the variety of definitions and concepts of career education.

The assessment will be conducted in two parts, which reflect the development of the assessment. Part I will assess universal abilities (abilities which should be possessed by all people). The normal sampling procedures with national coverage will be followed. Emphasis will be on guidance, general occupational and professional skills, and attitudes.

Part II represents a radical departure from past precedence in national assessment. This part is designed for 17-18 year olds only and assesses job entry skills. Only students who indicate they possess job entry skills in the assessment areas will actually be given the examinations. For the initial assessment, six occupational areas were selected to provide an initial reading in this difficult area of assessment. These areas are: Service Station Attendant, Waiters Waitresses, Typist/Stenographer, Carpenter, Sales Person, and Farm Tractor Operator.

While there are hundreds of others, the various review committees felt that these represented a good cross section of occupations available to 17-18 year olds. Many considerations went into the selection, including level of difficulty — need for specific skills, urban rural plus national availability of job, male female, strong union vs. minimum union control, potential student population for assessment, and ability to assess occupation — within time and resource limitations.

This part of the assessment was developed during the past two years and does not appear in early materials on the assessment of COD. At the present time, Part II, Job Skills, is being delayed due to limited funds. Only Part I is being assessed.

Part I is the primary assessment program and is being administered to a sample of 9, 13, 17, and adults. The 17-year-old sample includes students both in and out of school.

The following are the objectives being assessed by Part I.

SUMMARY OF CAREER AND OCCUPATIONAL DEVELOPMENT OBJECTIVES

I. Prepare for making career decisions

This objective covers knowledge and activities necessary for making informed career decisions. One generally thinks of career planning primarily in terms of high school or college students, however, career planning is a life-long task of exploring and weighing reasonable alternatives. Even among 9 year olds, there are behaviors that will bear fruit later in intelligent career decisions. For 9 year olds, such behaviors include a beginning awareness of abilities and interests, of common occupations, and of the fact that some day they will need to accept adult roles. At the other extreme of adulthood, career planning means weighing current occupational status against capabilities and interests, and planning to improve within the context of present employment or through retraining and change of occupation.

A. Know own characteristics relevant to career decisions
   1. Be aware of own current abilities and limitations
   2. Be aware of own current interests and values
   3. Seek knowledge of themselves
B. Know the characteristics and requirements of different careers and occupations
   1. Know the major duties and required abilities of different careers and occupational families
   2. Know differences in work conditions among and within occupational families
   3. Know entry requirements for occupations
   4. Be aware of the impact of social and technological changes on occupations
   5. Know important factors that affect job success and satisfaction
   6. Seek information about occupations in general and about specific jobs
C. Relate own personal characteristics to occupational requirements
   1. Associate own abilities and limitations with possible success in present or future occupational pursuits
   2. Relate personal interests and values to job characteristics and occupations
D. Plan for career development or change
   1. Consider relevant factors in planning toward an occupation or career

2. Be aware of alternative career choices or occupations and consider the consequences of career changes

II. Improve career and occupational capabilities

Along with planning for a career goes the actual doing of things that further those plans or that widen one's knowledge and skills. This objective is concerned with the implementation of career plans and with active participation in both in-school studies and out-of-school activities that enhance one's career and occupational capabilities.

III. Possess skills that are generally useful in the world of work

The six main categories of generally useful skills are numerical, communications, manual-perceptual, information-processing and decision-making, interpersonal, and employment-seeking. Some of these skill categories apply to other subject areas in the national assessment besides career and occupational development. For example, communication skills are related to both the reading and writing areas, numerical skills are included in the mathematics area, information-processing and problem-solving skills include many social studies behaviors, and some work habits and interpersonal relations are also found in citizenship. To minimize overlaps, practical or on-the-job behaviors, rather than academic skills, have been selected to illustrate the COD sub-objectives whenever possible. Second, measures common to other subject areas will not be used in the assessment of generally useful skills but will be referenced in reporting of results.

Although not strictly a generally useful skill, employment-seeking skill has been included under this objective. It is useful not only for initial job entry but also for improvement of occupational status and is a necessary complement to the other generally useful skills.

A. Have generally useful numerical skills
   1. Perform calculations and transactions involving money
   2. Understand numerical values in graphs, charts, and tables
   3. Use measurement equivalents, ratios, and proportions
   4. Estimate numerical quantities
   5. Compare numerical values
   6. Calculate amounts needed to do practical jobs
   7. Make graphic representations of numerical quantities
   8. Interpret statistical data
B. Have generally useful communication skills
   1. Communicate understandably (speak, write, demonstrate, and use non-verbal means)
   2. Understand communications
   3. Interact verbally with others
C. Have generally useful manual-perceptual skills
   1. Use common tools and equipment
   2. Make and assemble, using appropriate materials
   3. Adjust, repair, and maintain
   4. Read displays and scales
   5. Make visual representations
D. Have generally useful information-processing and decision-making skills
   1. Learn efficiently and remember specifics, procedures, and principles which are basic to further learning or which are frequently needed in their work
   2. Apply concepts, principles, and procedures in circumstances different from those in which learned
   3. Analyze information and define problems
   4. Collect and organize data
   5. Develop and evaluate alternatives
   6. Make decisions or choose alternatives in terms of relevant criteria
   7. Devise plans, new ideas, and better ways of doing things
   8. Implement and modify plans on the basis of feedback
E. Have generally useful interpersonal skills
   1. Interact constructively with supervisors
   2. Provide effective leadership
   3. Work effectively with peers, co-workers, and others
F. Have employment-seeking skills

IV. Practice effective work habits

Effective work habits are essential to satisfactory job performance, no matter what one's career or occupation. Until a worker has developed good work habits in applying his generally useful and occupational specific skills, his career and occupational development is not complete.

By the age of nine, children should be exhibiting behaviors in their school work, home chores, and play activities that are the roots of effective work habits. These habits should be more obvious in 13-year-olds, who have had increased opportunities to learn and practice them. The behaviors should have become habitual in the actions of 17-year-olds in school and at work.

A. Assume responsibility for own behavior
B. Plan work
C. Use initiative and ingenuity to fulfill responsibilities
   1. Use initiative but seek assistance when needed
   2. Are resourceful in accomplishing work
D. Adapt to varied conditions
E. Maintaining good health and grooming

V. Have positive attitudes toward work

Today more than ever there is a great diversity of life styles. An occupation or career is only one way of achieving personal self-fulfillment in life. Nevertheless, it is possible within the context of career and occupational development to identify desirable attitudinal goals that should result from the educational process. Thus, national assessment seeks to assess attitudes toward work not only in terms of societal goals but also as acceptance and understanding of the diversity of life styles, regard for competence and excellence in endeavors of many different kinds, and pride in one's own achievements.

A. Recognize the basis of various attitudes toward work
B. Hold competence and excellence in high regard
C. Seek personal fulfillment through own achievements
D. Value work in terms of societal goals

A complete analysis and description of Part I objectives is available from NAEP at a cost of $1.00. Ask for Career and Occupational Development Objectives from National Assessment of Educational Progress, 300 Lincoln Tower, 1860 Lincoln Street, Denver, Colorado 80203. This analysis does not include Part II, since job specific skills were added after publication.

Dr. Bohn is Dean of Continuing Education and Professor of Industrial Studies, San Jose State University, San Jose, California.

Communications

Holography and Education

Don Mugan
Clem Gruen

Holography, three-dimensional laser photography, exhibits potential for tomorrow's education in many unrelated ways. The following are among the many areas identified through which education may receive benefit from holography or holographic research.

Insight may be gained into mechanisms involved in learning through research with holographic memory systems. Optical computers, with random access and capacities in the trillions of bits, may contribute to the rapid dissemination of knowledge and may make computer-assisted instruction commonplace. Three-dimensional displays and instructional aids will provide realism never before possible.

Holography is part of the body of knowledge of physics for its theory and experimental aspects, and is part of the body of industrial education as an industrial process, both from the standpoint of communication and materials testing. Holography has been explored as a medium of expression so unique that artists have not yet learned to use it effectively. Holographic movies and television will undoubtedly have great impact as a medium. Panoramic holography is the ultimate in realism, including movement, sounds, and smells enabling a student to relive an historic event such as the discovery of America or scenes from the industrial revolution.

A hologram is a photographic recording of the entire content of light waves, much the same as a phonograph record records sound waves. These waves are frozen in time and can be played back at any time.

How are holograms produced? How do they differ from photographs?

If we are to record all the information about a scene, we must record light intensity, color or frequency, and phase, which is the property on which depth perception is based.

Black and white photography records only the intensity of the light focused on the film by a lens. Color photography operates on the same principle, except that the emulsion is sensitive to color. However, phase or depth information is lost.

While ordinary photography relies on lenses to refract or bend the light waves to a focus, holography relies on the wave nature of light and its associated properties. These properties of light are coherence, diffraction, and interference.

Thermal light, known as incoherent light, consists of many colors or frequencies leaving the source in different directions and at different times. Coherent light, on the other hand, the type of light emitted by a laser, consists of light waves with the same frequency, amplitude, and direction. they are in step, or we may say they are in phase.

Diffraction describes the tendency of light waves to bend around an object. Diffraction of water waves can be observed by dropping a stone in a pond. Once past an obstacle, the waves tend to spread out again as they proceed.

Interference is a property of light waves or any wave to exhibit enhancement or cancellation, depending on their phase relationships. For example, if water waves meet crest to crest, their amplitudes add to produce a much higher crest. If they meet crest to trough, their amplitudes subtract to form a wave of lower amplitude. This interference is visible only with coherent or partially coherent waves. In holography, this enhancement and cancellation appears as unexposed area on the film and highly exposed areas called fringes.

The simplest type of hologram that can be formed is that of a small point of light. Visualize a small disk with a pinhole in the center. If laser light is incident upon it, some light will pass through the pinhole and be diffracted or bent outward to cover the plate, where it will interfere constructively or destructively with light that passed around the disk, depending on the distance travelled. If at any point on the plate the waves have travelled the same distance or multiples of the wavelength, a bright circular fringe will form and expose the plate.

When the plate is removed and developed, the exposed areas become opaque. Replaced in the path of the beam, with the object removed, the circular fringes will diffract or bend light inward to form a real image of the object, which is a bright point of light. This image appears to hang in space in front of the observer. At the same time, the fringes will diffract light outward, causing the observer to see a virtual image behind the plate. This image appears to be behind the plate because the diverging waves appear to have their origin there.

In theory, recording a three-dimensional object is much the same as for a simple point, because every point on an object reflects, transmits, or scatters light as if it were a single point. The recording geometry of course must be different, and the resultant fringe pattern is more complex.

Viewing the hologram is accomplished by allowing the laser beam to play upon the plate. Both a real and virtual image are formed, but usually only one is visible at any one time.

Holograms are classified many ways. Among the most important types for communications purposes are:

TRANSMISSION HOLOGRAMS

The term transmission refers to the method of viewing or reconstruction. A transmission hologram requires that the illumination beam be incident from the back side of the plate. This type is constructed by allowing both the light from the object and the direct beam or reference beam to interfere at the back side of the plate.

REFLECTION HOLOGRAMS

The term reflection also refers to the method of viewing. The light source is placed on the observer side of the plate and reflected light forms the image. Reflection holograms are constructed by placing the object behind the plate and allowing the reference beam to impinge on the front side. The greatest advantage of the reflection type is that a laser is not required for viewing.

VIRTUAL IMAGE HOLOGRAMS

A virtual image hologram is one in which the behind-the-plate image is most easily reconstructed.

REAL IMAGE HOLOGRAMS

A real image hologram is one in which the image in front of the plate is most easily reconstructed.

FOCUSED IMAGE OR PROJECTED IMAGE HOLOGRAMS

Focused image holograms are ones in which the image is centered about the plate, part in front and part behind the plate.

HOLOGRAPHIC MOVIES

The first holographic movie was produced in 1965. Because of the fact that if the image is projected on a flat screen it becomes two-dimensional, little progress was made for some time. However Dr. Dennis Gabor, inventor of holography, has devised a method of projecting the image on a large curved screen without losing the third dimension. This method, now called panoramic holography, will eventually allow one to experience and participate rather than be a bystander.

HOLOGRAPHIC TELEVISION

The concept of holographic television, though very exciting, will require a great deal of development before it will become even feasible. One of the great problems is the fact that a terrific amount of information is contained in a hologram. A small hologram, for example, contains 360,000 times as much information as a large television picture. The only method that could possibly transmit this volume of information is the laser, and laser beam transmission is not yet here.

HOLOGRAPHIC NON-DESTRUCTIVE TESTING

Holography has been at work in industry for several years testing materials. It is particularly useful in detecting small deformations in parts under stress, separations in laminates, and detection of any flaws in materials which result in a weakness at the surface. For example, tires can be tested for tread separation in the following manner. First a hologram is made of a partially-inflated tire. The tire is inflated slightly more and a second exposure is made on the same plate. The plate is then removed and developed. Two images are seen perfectly superimposed, except where the tire moved between exposures. The portion of the tire that moved the greatest amount obviously is the weakest part, directly above a tread separation. Because the images are no longer perfectly superimposed, large-scale secondary interference fringes form on or about the separation, giving an outline. A few of the many hundreds of items that have been tested by this method are cylinder bores, lathe beds, welds, turbine blades, and spacecraft components.

Equipment necessary to produce holograms in the industrial education laboratory includes a small laser, isolation table, and various optical components. Costs range from $500 to $1000, plus a considerable investment in time and effort. More ambitious experiments require equipment in the price range of $7,000 and up.

Implications: Investigation in the industrial education laboratory is justified on the basis of materials testing, as well as the more futuristic aspects involved in communication.

Mr. Mugan is an Instructor, Dept. of Industrial Education, Valley City State College, Valley City, North Dakota.
Dr. Gruen is a member of the faculty of Lindburgh High School, St. Louis, Missouri.

Curriculum

Programming for Students with Special Needs

Ronald J. Lutz

The third and final year of the Vocational Education Special Education Project is nearing completion. This project at Central Michigan University has focused upon the development, evaluation, and dissemination of curriculum resource materials for vocational practical arts teachers and special education teachers to work cooperatively in the occupational preparation of handicapped persons.

Concerning the background of the project, in August of 1971, M. LeRoy Reynolds wrote the initial proposal and became the 1/4-time director. Soon after, Ronald J. Lutz, Cleo B. Johnson, and L. Allen Phelps were assembled as a project team as Project Coordinator, Special Education Consultant, and Vocational Education Consultant, respectively.

The three-year sequence of events could be briefly described as follows. Initially, an analysis of Michigan manpower and a review of previous curriculum development provided the foundation from which the clusters were formulated. The development of task listings within each cluster and detailed task analysis information was originated. Also during the first year it was found that matching occupations with various handicaps was not possible, since each person is unique and needs to be treated as an individual. Toward the latter part of the first year, several hundred task modules were developed to be evaluated by vocational education and special education teachers with handicapped youngsters during the entire second year. Thirteen schools were selected to do this evaluation by members of the project staff every two weeks. Approximately 250 youngsters having mental, emotional, vision, hearing, and physical impairments made up the target population, and with the cooperation of their 63 vocational and supportive teachers, the project staff collected a wealth of information related to how these youngsters most effectively learned the tasks. With the help of consultants, the project staff analyzed, redeveloped, and rewrote the 729 task modules during the summer and first half of the third year. This process attempted to utilize updated information from employers related to the knowledge and skill that was expected, various methods of teaching and supportive instructional materials supplied by teachers, and the development of the back of each task sheet to include a "Language of the Task," "Quantitative Concepts," and "Suggestions" for a supportive teacher.

The final 3 1/2 months have been spent disseminating and providing an in-service program for vocational and special education teachers and administrators in Michigan. Well over 1000 people have been involved in the network of in-service programs throughout the state, with several hundred yet scheduled before the close of the school year.

The 2-3-hour in-service presentations provide an overview of the need for vocational/practical arts and special education teachers to share in the development and implementation of common units of instruction. This cooperative relationship creates the essential supportive instruction which special students often need to be successful in vocational education practical arts programs, and eventually in occupations of their choice.

Another in-service tool was a 26-minute audio-visual presentation entitled "... In Their Own Way" which can be described as a multi-media sound slide program depicting the extensive planning required by counselors, special educators, vocational educators, and other supportive personnel.

This planning sequence is followed by an extensive review of various job tasks being performed by students within the clusters covered by the project. One of the most dramatic pictures was a series of a young girl, Paula, as she became employable in hospital housekeeping. The next group of slides oriented the viewer to the actual planning process by following the development of a task sheet.

The final portion of the in-service programs focused upon the dissemination and discussion of the educational products developed. Eleven publications represent the educational products generated through the efforts of the project staff and several hundred public school teachers, administrators, employers, and students. Ten of these are Cluster Guides representing ten occupational areas that reflect present and projected manpower needs in Michigan. These clusters include: Agriculture/Natural Resources, Automotive and Power Service, Clothing and Textile Services, Construction, Distribution, Food Preparation and Service, Graphics and Communications Media, Health Occupations, Manufacturing, and Office and Business Occupations. The eleventh publication, the

Program Guide, is a verbal description of what vocational/practical arts teachers should know about students with special needs and what special education/supportive teachers should know about vocational education, as well as reacquainting each teacher with his or her instructional area. An additional portion of the Program Guide includes various "Employment Task Modules" dealing with knowing how to complete job application forms, preparing for a job interview, etc.

Each of the 10 Cluster Guides contains five sections. First is the introduction and acknowledgement section, the second section includes the task analysis information. The third contains the bulk of the Cluster Guide, since it contains the specific task modules for several subclusters within the cluster. The fourth section contains a bibliography of the instructional materials for the entire cluster, and the last section includes the instructional media and task-related competency codes.

The organizational breakdown is described graphically in Figure 1, which illustrates the 10 clusters and the accompanying 34 subclusters. Each subcluster contains a given number of task modules.

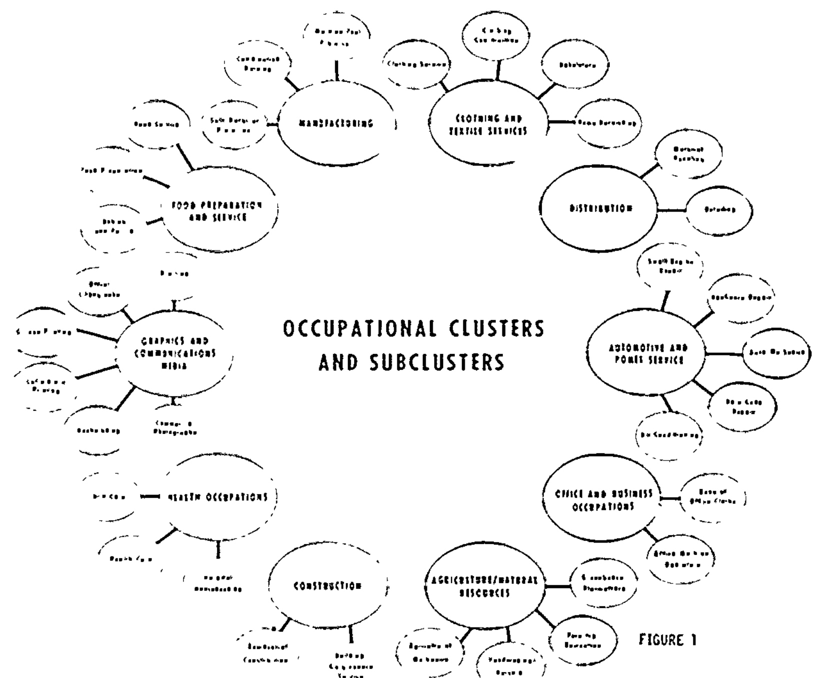


FIGURE 1

The front side of the task sheet is composed of four sections. The Behavioral Task Knowledges Task Skills identify the specific mental understandings or associations needed in the performance of the task, as well as the physical, manipulative activities associated with performing the task. The Instructional Methods and Materials portion is designed to suggest specific teaching techniques, strategies, and materials which have been used effectively with handicapped students. The Task-Related Competencies section identifies some specific learning readiness skills associated with the task.

The reverse or "flip side" of the task sheet is designed to help the special education teacher teach more effectively. The Language of the Task and the Quantitative Concepts provide a common ground for communication between the cooperating teacher and vocational teachers. Suggestions and Supportive Instructional Materials include a variety of suggested teaching activities, ideas, games, or materials that may be used in providing an effective and supportive link to the vocational instruction. After having initiated this link, it is hopeful that educational sequences for handicapped youngsters will be more successful and efficient.

SUBCLUSTER SOFT MATERIAL PROCESSES

Sheet 1 of 1

TASK Use measurement and layout tools

Code MFG. .M02

Student Name ______________

Student Progress	Behavioral Task Knowledges/Task Skills	Instructional Methods
Introduced / Involved / Productive / Employable	Given the necessary tools, materials, equipment, and requisite knowledge, the learner will	• Students view film as an introduction and review of concept
	1. identify by name specific layout/measuring tools a. level b. tape or rule c. framing square d. T bevel e. scratch awl f. steel long tape g. chalk line h. line level i. combination square j. marking gauge k. plumb bob l. dividers m. butt gauge	• Students view film loops and illustrative charts • Teacher demonstrates the use of the identified tools with individual students on specific jobs. Students return the demonstration. Note: This task will be performed as a part of several succeeding tasks.
	2. recognize and observe safety precautions in using layout and measuring tools. 3. interpret measuring tools accurately. 4. properly store specific layout and measuring tools. 5. demonstrate the different applications or uses of each tool.	

Task-Related Competencies	Instructional Materials: Title	Media	Bib
KNOWLEDGE A 1,9	Modern Carpentry, pp 8-22	13	4
NUMBERS B 2a,4a,1,5	"Carpentry Part I - Measuring, Marking, and Leveling Tools"	8	23
	"Layout Using Marking Gauge"	9	11
APPLICATION C 5,7	"How to Use Measuring Tools"	9	24
PHYSICAL D 1a-d, 2a/b, 3	Stanley charts	16	25

SUBCLUSTER: SOFT MATERIAL PROCESSES

Code MFG. .M02 TASK Use measurement and layout tools

Basic Information for Cooperative Teaching

Language of the Task

Level	Inches
Tape or rule	Scale (1/4" = 1')
Framing square	
T bevel	
Scratch awl	
Steel long tape	
Chalk line	
Line bevel	
Combination square	
Marking gauge	
Plumb bob	
Dividers	
Butt gauge	
Feet	

Quantitative Concepts

Measure boards for thickness, width and length. Lengths is in feet, width is in feet or inches, thickness is in inches.

The concept of rounding may be applied by rounding the actual measurement up to even numbers of feet in length, i.e. 6', 8', 10', even numbers of inches in width i.e. 4", 6", 8", full numbers of inches in thickness i.e. 1", 2", 3".

Prepare a shopping list for tools. Find these items in a catalogue, identify and price, figure total cost.

Suggestions

- Teacher picks up a tool - student identify.
- Student picks up tools one at a time and identify.
- Student identify which tool another student is using in pantomine.
  - by description of tool.
  - by name.
- Student match name and tool by
  - printed label
  - verbal identification
- Teacher and deaf student should cooperatively develop some simple signs related to language of the task.
- Informally encourage voluntary buddy system for assisting deaf students (individualize without calling attention to the individual).
- Be careful in using words with multiple meanings when talking to lip reading deaf students (plumb, scale).

Supportive Instructional Materials:

Assortment of measuring tools supplied by the vocational teacher.

Since teachers in the classroom were the major source of input throughout the three years, it is assumed that both a graduate and undergraduate program will be one of the major spin-offs from the project. Although in-service workshops will continue to be made available from Central, the pre-service (undergraduate) emphasis will be developed.

In summary, the three-year research project, conducted by Central Michigan University with funding from the Michigan Department of Education, focused directly upon a philosophy of cooperative teaching.

Initially, this cooperative teaching involvement is fostered by teachers sharing in the development and implementation of common units of instruction. The experience from this involvement suggests that when pairs of concerned teachers work closely, reinforcing each other's instruction, significant changes are observed. In numerous instances, these changes have led the student to a meaningful and productive occupational role in society. Cooperative, inter-departmental teacher preparation programs are viewed as an essential part of the philosophy for enhancement of cooperative teaching attitudes among present, as well as prospective, teachers.

Dr. Lutz is a member of the Department of Industrial Education and Technology, Central Michigan University, Mt. Pleasant, Michigan. The Vocational Education/Special Education Staff includes: M. LeRoy Reynolds, Director, Ronald J. Lutz, Coordinator, L. Allen Phelps, Vocational Consultant, Cleo B. Johnson, Special Education Consultant.

The Secondary Exploration of Technology Curriculum Project

Harvey Dean

The SET curriculum is a teacher-designed industrial education program which

(A) Provides seventh and eighth grade students with a conceptual understanding of industry.
(B) Provides ninth or tenth grade students with understanding of industrial communications systems, material, processing systems, and power systems.
(C) Provides eleventh and twelfth grade students with in-depth work in selected areas.

WHY NEW CURRICULUM?

Utilization by industry of highly developed materials, processing procedures, reproduction methods and techniques, coupled with the fact that industrial education curriculum provided few options for students to learn about recent industrial advancements, magnified the need for a curriculum change. By late 1970, the need for an industrial education program which provided learning options for students and continuity between seventh through twelfth grade classes had become a top priority of Kansas teachers and the Vocational Division of the Kansas State Department of Education. So, in March 1971, the Kansas Model for Industrial Education (see Figure I) was approved by the State Board of Education as presented by the Industrial Education section of the Vocational Division.

However, the model did not specify the details of the curriculum content. Therefore, research funds became an immediate concern for schools interested in implementing programs shown in the Kansas Model.

WHO DEVELOPED THE S.E.T. CURRICULUM?

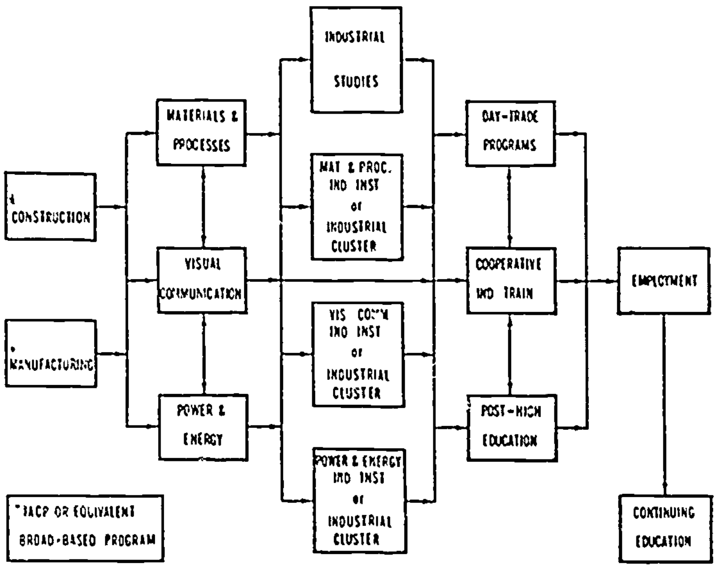
A proposal was approved for the S.E.T. Project, and funds were provided for curriculum development by the State Department of Education's ESEA, Title III office. Vocational funds were provided for parallel research and development in a project known as CBIE.

FIGURE I

KANSAS MODEL

for

INDUSTRIAL EDUCATION



In the summer of 1971, eighteen S.E.T. teachers from three Kansas school districts met to identify learner needs and to formulate a set of goals and objectives for grades seven through twelve industrial education programs. A rationale was delineated by the teachers and presented in the form of a position paper. The position paper described a psychologically-sound approach for grades seven through twelve curriculum guides.

The eighteen S.E.T. teachers proceeded to write, revise, and evaluate curricula designed to fulfill learner needs. After almost three years of research, development, and evaluation, the S.E.T. curriculum evolved. Recommended methods, programs, guides, and other supporting data were completed.

WHAT DOES THE S.E.T. CURRICULUM LOOK LIKE?

Since various size school districts, each with different scheduling systems, were involved in the research and development effort, only broad summaries of curricular offerings can be provided herein.

First, seventh and eighth grade programs are designed to provide students with multiple activities, structured around major sectors of industry. Programs are designed to provide conceptual learning through hands-on activities. Curriculum materials developed by the I.A.C.P. are used extensively in most programs. Length of programs within schools vary greatly, ranging from one-semester-per-year programs to full-year concept-based programs.

Ninth and/or tenth grade programs aim at providing students with many activities built around a study of systems of industry. The Industrial Communications Systems course allows students to experience such hands-on activities as platemaking, printing, T.V. use, technical report writing, drafting, and photography. All activities are designed to relate to communications systems used by industry.

The Material Analysis and Processing Systems course provides hands-on activities in woods, metals, synthetics, and earth products. Processing methods are emphasized in each activity.

In the Power Conversion and Transmission Systems course, students are provided with insights into how man converts and transmits basic forms of energy into power to work for him.

A segment of each systems course includes a contractural arrangement in which the student must complete a selected task.

In eleventh and twelfth grade industrial education programs, students do many of the things that have been done for years in industrial education — they make individual projects. However, the teacher's objectives and evaluation of the project differ from objectives and evaluation methods of previous years.

Performance instruction modules are being utilized to help the teachers more adequately meet the individual needs of each eleventh or twelfth grade student. The 'Module Method' provides self-paced instruction for each student while allowing the teacher to assist students in problem areas. Cooperative training programs have also been encouraged for twelfth grade students interested in specific careers. Students interested in skill training are encouraged to enter vocational programs.

The answer to the question "what does the S.E.T. curriculum look like" may be: It looks like a program designed to allow students to experience many options in order that each may better select a field of study or a vocation. The S.E.T. curriculum is a partnership for learners — by and between industrial arts and vocational education.

Mr. Dean is Director of the Secondary Exploration of Technology Project housed at Kansas State College of Pittsburg, Pittsburg, Kansas.

Texas Industrial Arts Curriculum Study

John R. Ballard
M. D. Williamson

This curriculum study originated on the premise that industrial arts in Texas was in need of improvement because twelve years had lapsed since any organized effort had been made to evaluate the program. In a dynamic culture, this suggests the probability of obsolescence. Immediately we were confronted with the decision to ascertain whether, and to what extent, obsolescence was present in the industrial arts program.

A perusal of the developments in our schools over the past twelve years indicates the following characteristics. Physical plants are modern, attractive, landscaped, carpeted, air-conditioned, and well-lighted. The classrooms and laboratories are spacious, quiet, colorful, and well equipped. Teachers are better educated than in the past, and they exhibit increasingly more professionalism. Instructional media such as textbooks and curriculum guides are increasingly more plentiful, colorful, and well-designed. Teaching supervision has increased significantly in both quality and quantity.

Research and innovation have especially been in evidence through the expenditure of huge sums of money for buildings, team teaching, closed circuit television, modular scheduling, programmed instruction, open schools, individualized instruction, non-graded schools, etc. The curriculum gives primary emphasis to college preparation consisting of a study of the sciences and humanities.

From these characteristics, one could infer that citizens (taxpayers) are interested in having good schools. Educators are continually probing for answers to unresolved educational issues. Teachers are willing to prepare themselves for a lifetime of work helping learners.

In contrast to these commendable efforts in providing a good education, the fact remains that too many kids are bored with schools, hence we continue to have the motivational problem. Low achievers, thus the achievement problem, remain with us, not finding meaningfulness in their school experiences. This, of course, we recognize as a transfer or relevance problem. Learners too often find it difficult to relate their in-school experiences to their outside-school experiences.

Educational leadership is to be commended for these advances in the school program, yet it should be apparent that the achievement, the motivational, and the relevance problems continue to exist. Uninteresting and irrelevant subject matter, no matter how it is organized, will continue to be uninteresting and irrelevant. There must be a reason. We firmly believe that we have good teachers and good facilities, but the nature of the curriculum and how it relates to the learner appear to be open to question. Therefore, a primary concern of this curriculum study is to make industrial arts more relevant to learners.

In order to produce a relevant curriculum, it appears logical for us as curriculum developers to have some criteria to guide us in the pursuit of this worthy goal. The industrial arts teachers who attended the 1971 Phase II statewide regional workshops made several pertinent statements which have implications for our guidelines. The following statements, which are recorded on pages 18-20 of the industrial arts rationale, indicate the feelings of many teachers in the field.

Ninety-three percent of the industrial arts teachers were in agreement that industrial arts must assume a greater responsibility in developing the student's ability to adjust to his environment.

Competencies in the methods of problem analysis and problem solving need to be built.

Industrial arts must build flexibility into its program, thereby eliminating major revisions of our discipline in order to maintain balance as society changes.

Industrial arts must include a more comprehensive coverage of technology.

Industrial arts must become more concerned with attitudes, leisure time activities, career awareness, consumer knowledge, broad concepts of a mobile society, industrial resources, community development, continuing education, and preparing students to learn and participate in a society as responsible citizens.

Industrial arts should relate to environmental problems, service occupations, home maintenance activities, problems of labor, management and government, conservation and recycling processes, not for boys only, but for all students.

More attention should be given to forming concepts about industry and less emphasis should be placed on the development of a high degree of manipulative skills. These concepts need to include safety, quality control, management, labor, cost analysis, ecology, etc.

Industrial arts should provide career information as an integrated area in the elementary grades to help the learner form acceptable attitudes concerning the world of work. The concepts and ideas the learner forms in the early years will help him in decision-making responsibilities in later years.

The learner is the recipient of the industrial arts curriculum. The curriculum and the teacher should be directed to fill the in-life needs and capabilities of the learner. The present industrial arts curriculum tends to fall short of meeting these needs.

Technology should play an important role in the industrial arts curriculum. Since industrial arts is not the only curriculum area teaching industrial technology, a close working relationship should be established within the entire educational community to facilitate a higher degree of efficiency in providing meaningful experiences to more students.

In addition to this teacher input, the rationale committee also provided useful ideas for the formulation of our curriculum development guidelines. Some pertinent statements of the rationale committee as recorded in the printed rationale follow.

Industrial arts teachers maintain that industrial arts is a part of general education—education for all (p. 7) ...the teachers advocate that industrial arts endeavors to help prepare youth for effective living in our industrial society..." (p. 8). "The 1970's may be the decade when the education enterprise becomes performance-based" (p. 14). ..."in the majority of school districts, existing industrial arts programs are very limited and are patterned after and governed by obsolete rather than by and educational practices."

Criteria suggested by the classroom teachers and the rationale committee for guiding our curriculum development have been briefly reviewed. Our study proposal plus subsequent modifications brought about by empirical evidence also suggested that the curriculum should be interdisciplinary in development, stress conceptualization, emphasize learner competencies, and involve the classroom teacher.

From the foregoing evidence provided by the teachers attending the 1971 Phase II workshops, the rationale, and the study proposal, one would reasonably conclude that the curriculum committee should give serious thought to the following criteria as they derive a relevant industrial arts curriculum. Reflect more TECHNOLOGY. Help students ADJUST to the environment. Stress CONCEPTUAL development. Emphasize meaningful learner COMPETENCIES.

And furthermore, they should adhere to these policies in the process of developing the curriculum. Be INTERDISCIPLINARY IN NATURE and involve the CLASSROOM TEACHER.

Now that we have a set of guidelines and policies to guide us in developing a relevant curriculum, we are ready to answer the second question...WHAT IS A RELEVANT CURRICULUM?

We would all probably agree on the desirability of schools being relevant, but chances are great that the meaning of the word relevance varies considerably from person to person. For example, don't you have some acquaintances who contend that relevant schools are those with primary concerns for "preparation" for college, covering the "basics," developing "saleable skills," or utilizing "up-to-date" subject matter?

Then there are those who believe that relevant industrial arts programs are those which have teachers with industrial experience, labs equipped with modern industrial equipment, and/or courses representative of local industries — and so it goes! Obviously, we need to pause and clarify the meaning of relevance before we go any further.

The dictionary suggests that relevance is that which has meaning; it bears upon something, applies to, or is pertinent. It seems that the key thought in this definition is "that which has meaning." In an educational context, we assume that "meaning" relates to the learner rather than to parents, teachers, community leaders, or others, simply because schools are established for the learner. Therefore, we propose that a relevant curriculum is one that prepares learners to cope successfully with their environment in order to achieve their wants and goals. If students learn what is needed to achieve what is valuable to them, it has to be meaningful — hence, relevant.

Perhaps a word of explanation concerning the expression student "needs and wants," as used throughout this presentation, would be in order at this time. A student with a need is one who finds himself in a state of disequilibrium, a condition exists whereby the learner is lacking in a competence to restore equilibrium. With such a need evident, the learner starts looking for a way to satisfy the need. This is accomplished by obtaining some wanted condition or object. Consequently, needs originate the drive necessary to seek out and find a want-satisfier. Let's illustrate what we mean.

I'm ready to tune the engine on my bike, but I don't know how — that's disequilibrium — a need for the competence to set the spark plug gap or replace and adjust the points exists. To get things back to "normal," I want to learn the competencies to adjust clearances in plugs and points in order to get me to my goal! It should be evident, then, that wants grow out of needs — if the student sees value in the activity — and these wants are the main ingredients of motivation. Incidentally, if the curriculum has this relevance, one which helps the learner cope with real-life needs, it helps resolve the motivational problem so prevalent in schools today. But what does this all really mean?

Have you ever considered that our environment is the source of all subject matter that we use in schools? As people encounter this environment, they interact with the various objects and events that surround them. From this interaction, something is learned about those objects and events. We call this knowledge. The objects and events in our environment constitute what is commonly called subject matter. People learn initially from interacting with objects and events in their real world rather than from abstract statements about their environment.

This subject matter is traditionally made available to students in abstract form such as printed matter or through a verbalization process. What we know about learning suggests that the use of abstract subject matter is not the most productive means of causing learning, but that learning is best accomplished through encounters with the objects and events of the real world. This is especially true in the initial stages of learning.

In order to cope successfully with objects and events in the real world, it is necessary for one to develop a set of concepts, skills, and habits regarding the nature of this environment. One does this by learning how to manipulate the things in the environment necessary to achieve personal wants or goals. This means that learners need particular competencies which equip them with abilities to manipulate environmental objects, such as cars, tools, materials, etc., and events, such as designing products to meet needs, selecting materials to resolve problems, researching data to increase validity of judgments, pouring, casting, etc.

While in the process of manipulating environmental things, learners are developing, or learning if you please, competencies needed to "achieve" self-imposed goals, and furthermore, the learning activities relate directly to the students' real environment.

Hence, when students learn those things needed to achieve their goals, the achievement problem alluded to earlier is helped. Secondly, when learning experiences relate to the real world of the learner, the curriculum setting becomes more relevant.

Because the things in one's environment operate on a set of rules, one must learn these rules in order to use them in pursuit of one's goals. If you plan to join two wooden members together with an adhesive to form a joint, there are certain factors relative to joint-making that should be followed to assure an effective joint, such as the species of the wood being considered and the type of adhesive selected. If we can provide learning experiences which relate directly to the students' "real goals," in the environmental setting, the competencies developed in school will be useful to them in the outside world, thereby providing a more relevant curriculum.

It has just been suggested that curricula are more relevant when they give attention to the personal goals of students that grow out of their real world. And also, learners will develop a conceptual understanding of their real world whenever given the opportunity to manipulate environmental things which are useful to them in the pursuit of their goals. Since these conditions are not too numerous in classrooms today, what would education have to be like in order to provide this relevant learning environment?

To enhance relevance, education should take place in a school setting which is representative of the learner's total real world outside the school. Traditional curriculum planning in schools today has resulted in an emphasis upon the humanities and science education for the masses. Does this adequately represent all the real world today. Won't all learners also need competencies related to the technological characteristics of their environment?

Neither learners nor curriculum developers can escape the fact that the present notable environmental characteristic is technological in nature, consequently, the problems students face predominantly stem from this source. Students are confronted with problems relating to ethical decision-making, fuel shortages, safety, consumer literacy, career choices, leisure time, parking, and a host of others. Should or do these have implications for industrial arts. Just what could we do. Let's briefly review these problems and consider some related questions.

Can decision-making competencies be used by learners in these activities? How can these competencies be used by learners if their teachers continue to make all the decisions relative to pupil personnel organizations, industrial arts clubs, group projects, mass production activities, individual projects, units or problems to be studied, etc.?

Will students develop useful concepts about power source efficiency and conservation by engaging in real-life experiments related to these problems or by reading about what others have said or done? Or should these problems be reserved for adults to ponder?

Should mature teachers impose their safety program upon learners, or should it be student-developed with teacher guidance. Which procedure will probably receive more student acceptance? Why?

As an industrial arts teacher, do you consider yourself a good consumer of industrial products? If so, do you tell your students the concepts they should learn about in order to be a good consumer. Or do you intentionally provide real-life engagements dealing with consumerism whereby your students develop concepts about consumer products?

A review of our professional literature reveals an enduring interest in recording data relative to careers. But in actuality, have we placed much emphasis upon making learners aware of career opportunities? Wouldn't concepts regarding career choices be helpful to one struggling with decisions relative to working?

When our industrial arts curriculum emphasis relates to strongly to wood and drawing, doesn't this place quite a restriction upon what recreational devices learners can build in our laboratories? Doesn't it also restrict opportunities for investigating and/or exploring new hobby interest pertaining to tools, materials, and processes?

A quick perusal of the quantity of teenagers driving automobiles today leaves one convinced that parking problems directly relate to their real lives. Should we in industrial arts get concerned about such problems—or should all our problems be restricted to materials, or tools, or processes?

Would any of these ideas be relevant to students? Do they focus more on learner needs than some of the activities we now pursue in our labs? You decide!

In our opinion, it is not until students are prepared to cope with these and similar problems brought about by technology in their real world that the curriculum can be considered sufficiently relevant to them.

In order for learners to cope with problems encountered in life, they are constantly confronted with the necessity to make decisions. In order to be competent as a decision-maker in this environment, it would be helpful for one to have attained the broad industrial arts goals of self direction, economic responsibility, and technological literacy. In order to attain any goals requires certain abilities, therefore, what are some of the competencies required to attain these industrial arts goals? Here are a few. No doubt you can suggest others.

Industrial arts "goal one" is to be a self-directed person; consequently, this requires competencies in identifying problems, accepting responsibility for seeking valid data upon which to base decisions, making and executing decisions with an awareness of their probable consequences.

Industrial arts "goal two" is to be an economically responsible person, which requires competencies in assessing one's potential, selecting a career based on one's interests and abilities, preparing oneself adequately for a career in his chosen field, consuming of the products of industry, purchasing, using, and maintaining products of industry in the best interest of one's family and society, providing for the economic needs of oneself and his family, improving the environment, and conserving natural resources.

The last industrial arts goal is to be technologically literate; therefore, this requires competencies in viewing the technological culture in historical perspective, using and maintaining the products of industry wisely, relating basic scientific principles with their application in industry, understanding concepts of industry such as labor, management, research and development, quality control, mass production, sales psychology, etc.

Learners in this culture should be able to function in a more responsible way if they are to achieve the above goals. Industrial arts, as a part of the general education of all youth, must contribute significantly to the goals of education designed for our dynamic culture. It must, therefore, help students acquire the competency to make reasoned decisions.

Technology permeates the very fabric of life, consequently, it is relevant. It is on this aspect of our culture that industrial arts focuses its attention. Therefore, it is a relevant part of the school environment.

Learners encounter it every day of their life and are confronted with decision-making responsibilities pertaining to technology. Learners need valid concepts about technology in order to make reasoned decisions.

We started with the question — "What is a relevant curriculum?" It is one which has meaning to learners. It is one that provides learners the opportunity to develop the concepts and competencies needed to cope with their environment to attain their wants and goals? It is one that provides learning experiences to encompass those rules that govern how things behave in the real world. It is one that takes place in a school setting that is representative of the real world.

In our judgment, a curriculum adhering to these four ideas will be relevant, however, before this can become a reality, a defensible answer must be found to the following question....WHICH CURRICULUM MODEL MEETS THESE GUIDELINES?

Before we propose an answer to this question, perhaps we should first explain the meaning of the word "model" as used in this presentation. Most people are probably familiar with the term model when it relates to someone posing for a photographer, but when used in the phrase "curriculum model," it may not communicate as vividly. And this is quite understandable, because none of us have identical backgrounds or interests; consequently, we may not have had the opportunity to learn about curriculum models. Therefore, let's briefly review the meaning and merits of using models when dealing with educational problems.

Educational models can be thought of as the initial step in developing an idea or theory about something. This procedure is especially helpful when one is confronted with complex and dynamic processes, such as the communication process, the teaching process, etc. Models are usually rendered in some graphic manner, because in this form the numerous variables related to the problem can be made more apparent.

The reasons why educators draw models of their ideas as they probe for solutions to educational problems no doubt varies between people. Even in this study, we have found that as we drew models seeking to explain the processes of learning, curriculum derivation, and curriculum development, we accrued at least these benefits:

1. It identified the key elements in the process.
2. It indicated the interrelationship of the key elements.
3. It explained the dynamics of the process.

A Phase III symposium was conducted in Austin to assist the curriculum committee in selecting a curriculum approach. Among those reviewed in the symposium were the Maryland Plan, America in Industry, and the IACP. Other ideas which have influenced this study dealt with technology as a discipline, principles of curriculum development, and ideas regarding how people learn. However, all curriculum developers must ultimately make this final decision. "Which curriculum model should we follow to develop our curriculum?"

To guide the curriculum committee in making this decision, the four criteria developed earlier in this presentation, which emerged from the teacher's input in the 1971 workshops, the rationale, the proposal, and the Phase III symposium were applied. These criteria, you will recall, are that the industrial arts curriculum should reflect more technology, help students adjust to the environment, stress conceptual development, and emphasize meaningful learner competencies.

Before examining any of the available curriculum models which we could pursue, let's briefly review the meaning of these four criteria.

Criterion One — Reflect more technology. This should be self-evident to us because we agreed in the 1971 workshops that the emphasis upon wood and drawing in our classes today does not adequately represent the technology that has the capability of putting people on the moon.

Criterion Two — Help students adjust to the environment. It has been previously mentioned that a relevant curriculum is fundamentally concerned with helping learners to cope, or adjust, with their environments. This adjustment, or change, is what we commonly call learning.

Criterion Three — Stress conceptualization. Concepts are those things generated by our minds of entities that do not exist in reality. They are formed by the mind based upon data provided by one's sensory receptors. Learners should have the opportunity to engage in suitable activities whereby they develop or formulate personal concepts rather than memorize conceptual statements provided by teachers or textbooks. Concepts are especially important because they guide one's behavior. Therefore, their development is of great importance in the educational process.

Criterion Four — Emphasize meaningful competencies. A competency is the ability to perform a given task. Therefore, the curriculum should be designed to produce those abilities necessary to perform acts relevant to the learner. In our technological culture, the ability to make reasoned decisions and to perform numerous tasks related to tools, materials, and processes should increase one's probability of making suitable adjustments to this environment.

These four criteria will serve as a guide in the selection of the curriculum model we will follow. We will review four curriculum models to determine which alternative more nearly meets these standards. The four models to be considered are community needs, subject matter, trade analysis technique, and conceptual based.

Community Needs. In this model, one typically conducts a community survey to ascertain current job opportunities and, based upon these data, plan an educational program accordingly. Producing a curriculum using this approach places the educational focus upon what appears to be best for the community. Is it not probable that so-called community needs identified by this technique are based upon vested interests, upon unexamined prejudices, or upon occupational biases. Will an emphasis upon meeting changing community needs be likely to meet in-life learner needs such as being self-directed, economically responsible, and technologically literate?

Moreover, how long will students be expected to remain in the community which they are educated to help? Should schools be established foremost to satisfy the needs and wants of the community or of the learners? If learners developed competencies for daily real-world encounters while also supporting community needs, this approach would not be particularly objectionable — but how can one be certain?

Subject Matter. This is the classical curriculum model founded upon the assumption that one learns knowledge because inherently it is good for him. This model emphasizes the memorization of data. This acquisition of knowledge becomes the guiding criteria for curriculum planning. Those sharing this posture should provide satisfactory answers to the following questions. Is the possession of verbal information tantamount to being educated? What percentage of this knowledge is meaningful to students today — tomorrow? Are you listening? This next question is one we must all come to grips with — To what extent does memorized knowledge influence or alter one's daily in-life behavior? Should our elementary and secondary schools produce "scholars" with bodies of knowledge or students having competencies with which to cope successfully with their environments?

Is the memorization of meaningless verbal information in order to pass examinations as useful to learners as the engagement in direct meaningful experiences? We think not, because meaningful experiences produce concepts which guide one's behavior. Evidence suggests that meaningless knowledge has a negligible contribution toward modifying behavior. Consequently, educators should increase their understanding of learner behavior and of the nature and function of concept development in planning curricula rather than continuing the emphasis on acquisition of knowledge.

Trade Analysis Technique. This is no doubt the most widely used model in developing industrial arts curricula; it was used to produce our present curriculum. It is a sound and valid procedure to learn the critical properties of phenomena. For example, to learn what a tradesman, or a musician, or a doctor does, just analyze the tasks they perform. To learn about an industry or business, analyze its component parts. But how does one go about analyzing industrial arts, or should it be analyzed?

Should one start the curriculum development process designed for all students by analyzing industrial tools and materials or the processes and tasks related to occupational categories? Or should we analyze the in-life acts learners engage in while transacting with environmental things in order to ascertain the competencies they need to function successfully in their real world?

To follow this trade analysis approach implies that our primary concern is to gain knowledge about tools, materials, processes, or jobs related to a selected group of trades. To justify this approach, one must pre-suppose that knowledge gained from it will effectively and efficiently help students cope with their environments, or that it is relevant to their goals. Much evidence exists to refute this assumption. Perhaps we are asking the wrong question or analyzing the wrong components. We'll see.

We have very briefly reviewed three of the models typically used for developing industrial arts curricula. Even though these models, or as some say, these "approaches," have some commendable points, all three rate very low against the four-point criteria being used to select the most appropriate curriculum model for our program. We consider this sufficient evidence that we should continue our search for a better model.

But there is still another significant reason why we have rejected certain aspects of the community needs, subject matter, and trade analysis approaches as inappropriate for our curriculum model. In our opinion, one of their greatest weaknesses lies in the fact that they too often resort to being just verbal information models, or what we commonly call knowledge-based models. We affirm this because these approaches too often tend to have as their goal the accumulation of knowledge. The attempt to "put knowledge" (note the word "put") into learners is psychologically unsound because the mere accumulation of knowledge has relatively little hope of affecting the in-life behavior of learners—the main purpose of education.

If we want to affect the in-life behaviors of our students, we must provide learning situations wherein they are permitted to develop their own understandings of the world. These learning situations should be based upon personal interaction with objects and events—and not upon meaningless memorized information about objects and events.

Now let's conclude this discussion of industrial arts curriculum approaches by considering our fourth alternative—a conceptual-based model.

Conceptual-Based Model. Schools are established to prepare learners to cope with the problems they will encounter outside the school. We call this transfer of learning or making schools relevant, and most of us probably would agree we need much improvement on this goal.

This transfer of learning is possible to accomplish, however, if meaningful real-life learning experiences are provided learners because the consequences of these experiences will develop desired concepts, and it is these concepts which will alter or modify their behavior. This altering of behavior is commonly called learning—and isn't this what the educational enterprise is all about?

Behavior, as used in this presentation, is what people do, whether the response is a visible act or a thought (invisible). In other words, if your students can construct a desk, or visualize an idea, both constructing and visualizing are behaviors. Consequently, the emphasis about learning is "concept development"—which is the basis of behavior modification.

Changing concepts then should become the focal point of education. And our concern as teachers and curriculum developers should be to structure a curriculum that facilitates concept formation. Just stop and think—isn't the primary goal of education to develop concepts that modify behavior rather than memorize meaningless information, which has little effect on modifying behavior. Then, too, a focus on behavior rather than concept development is on the wrong dynamics. Why? Because it is one's concept which modifies behavior.

How can the behavior of students be changed? Let us repeat — it's by changing concepts — and this is not an impossible task. We in industrial arts have an ideal environment in which learners can form concepts by interacting with real objects and events which they encounter in pursuit of their goals. Thus, we have the ideal setting for concept development, but have we had the ideal setting and objects and events for learners to encounter in this setting to have a relevant curriculum? Again, we'll let you decide.

Perhaps an explanation of our learning model would reinforce what we've done well in industrial arts and also suggest some areas of improvement. Keep in mind that this model is our way of explaining how concepts are modified in a relevant educational classroom setting.

This is our learning model — an act, or behavior, if you prefer, upon a thing results in a consequence, forming a concept which changes future behavior. Now let's analyze this model to appreciate its message.

The way to produce a conceptual change is to have students participate in learning activities needed to get to their goal, not memorize information about it! Participation implies an act. Learning is proportional to the reality of the learning activity, and students must be engaged in an activity for learning to occur. They must be doing the task, such as welding, casting, etc.

The act must be practiced upon something. These are the objects (saws, drill presses, wood, etc.) and events (processes, procedures) that are found in the real world. The thing acted upon is usually what the learner has in mind as a goal. For example: If I want to construct a metal tool box (goal) for my pickup truck, it is obvious that I must perform several acts upon various materials (things) used in the production of the tool box. To the industrial arts teacher, then, "things" are natural and man-made materials of our environment.

The consequence of an act can have only three possible outcomes: positive or satisfying, negative or annoying, or neutral or of no effect. After acting (e.g., cutting, welding, drilling, etc.) upon the thing (tank steel), I either like the results, dislike the results, or I am neutral about the outcome. We traditionally call these characteristics of a consequence "attitudes." As teachers, we are very sensitive to the role of attitudes as they relate to the motivation of learners in our classes. We know that when students are successful, they are highly motivated, and the chances of success are enhanced when they are engaged in (learning) things of value to them. Ergo — another relevant class!

The competencies acquired while acting upon a thing and the attitudes developed as a result of the consequences of the act produce mental concepts in the mind of the learner. These concepts are strictly personal because they are interpretations of the input provided by the interaction of the learner's act upon the thing with the resulting consequences. Concepts are extremely significant because they function to guide behavior in future situations. It is also important to note that these concepts, which mediate behavior, are developed by learners and are not learned from a book or a friend. Therefore, it must be obvious that concepts cannot be taught — they must be developed by the learner as he transacts with the environment.

This learning model seems psychologically sound, and in our opinion, it is also quite compatible with the four criteria mentioned earlier, which are being used to select the most desirable curriculum development model. Remember the criteria are that the industrial arts curriculum should reflect more technology, help students adjust to the environment, stress conceptual development, and emphasize meaningful learner competencies.

Do you see any relationship between the learning model just described and these four criteria? We see solid relationships on all four counts. For instance, to make our curriculum depict more technology and to assist students to adjust to their environment suggests that we need a list of real-life acts and a list of things they act upon that grow out of an analysis of what people do as they adjust to life in a technological environment. Such lists are currently being developed by the curriculum committee and will be explained in detail subsequently.

Next, conceptual development is more apt to take place when learners are permitted to act upon the real-life things in their industrial arts labs rather than read or hear about them.

Finally, we recognize that competencies must be identified which enable students to practice the above-mentioned acts. These acts help students attain their goals by engaging in the behaviors identified in the lists of acts. Therefore, we conclude that a concept-based curriculum model which is concerned about technology, about helping learners adjust to their environment, and about learners acquiring needed competencies is the most valid approach to follow in developing our industrial arts curriculum.

Having determined that a concept-based curriculum model is the preferred one to follow, we are ready for the fourth question—HOW IS THIS CURRICULUM BEING DEVELOPED?

Throughout the course of this study, we have attempted to derive a curriculum that is structured around the learner. This is not a new educational idea, but it is one that has not been adequately put together for industrial arts. The decision to pursue a curriculum that stresses conceptual development gives us confidence that we are about to "put it together" for industrial arts in Texas. With your help, we know that we can.

We feel that a reasonable understanding of our learning model will provide a basis for recognizing the consistent relationship between our analysis of learning and the reason for this unique approach in deriving the curriculum. Therefore, let's review the learning model at this time. Remember, it is an act—upon a thing—resulting in a consequence—forming a concept—and the formed concept guides subsequent behavior.

Note that one of the significant elements in this model is an "act" or behavior. We have defined acts as being what people do. For anyone to be able to act, he must have certain abilities or competencies. We recognize that if one of our students wants to construct an item, which of course is an act, it is our role as teachers to guide the student in the development of the necessary competencies he needs to perform the act. Therefore, to remain consistent with our learning model, the curriculum derivation process must yield competencies needed by learners. Then, too, doesn't competency development support one of the four curriculum development criteria?

A second element in the learning model is "things." People act, and these acts are upon things. Things as used here denote the objects and events that people interact with in the pursuit of their in-life goals. If the curriculum derivation process is to remain consistent with our learning model, it must have a procedure for identifying these objects and events.

Obviously, we view learning as consisting of both acts and things. And because we are professional educators, we should be particularly concerned about learning, thus, it must follow that we would of necessity have to be interested in both acts and things. Therefore, it would appear that one of our primary considerations as industrial arts teachers has to be, "How is the curriculum committee deriving a valid list of acts and things suitable for industrial arts courses?" We'll start this explanation with a brief overview of the entire curriculum derivation process in Diagram 1 and then indicate how the lists of things and acts are being developed.

This model graphically portrays the entire curriculum derivation process. It may initially appear complex, but after a brief explanation, the process is clarified, and confidence in the procedure should result. The principle of the process is to identify the specific things that people transact with in their daily in-life activities. To locate these specific things, start with the world, the recognized source of all things. Then, arrange things with similar characteristics into groups. These groups are subdivided, then the subgroups are also divided. This division procedure continues until the level of specificity has reached step 6, which is recorded in the slide as "whole things." These whole things are the specific items people interact with in their daily lives, such as trees, fish, plant food, homes, hand tools, rocks, fluids, etc. Now that we have the list of whole things, we need to produce the list of "acts."

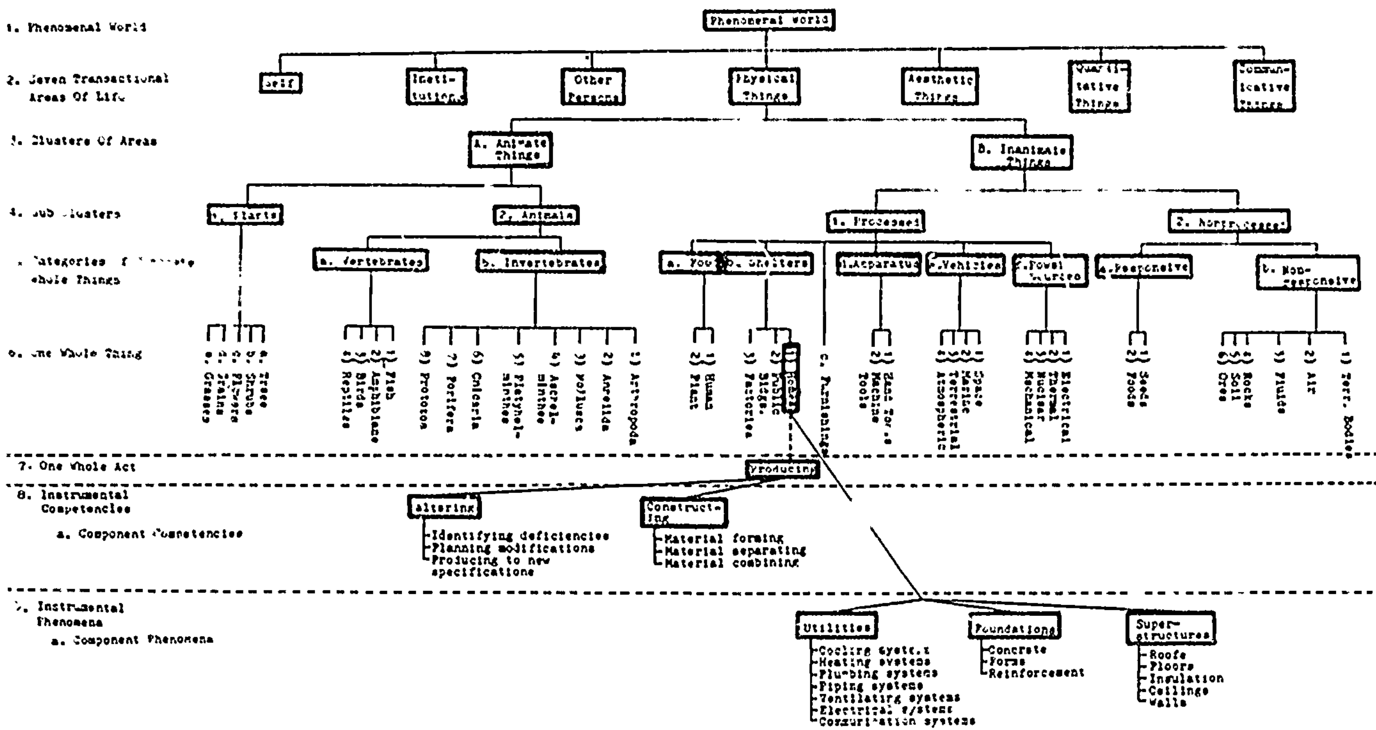
A list of acts is generated by asking the question, "What do people do in their daily in-life encounters with each of these whole things that are personally want-serving?" Responses to this inquiry provide the list of acts for this curriculum. In other words, acts are identified by determining how people act upon the things identified in step six.

With the list of "things" and "acts" produced, the entries in each list are classified and placed into properly categorized groups. Thus, we have completed two ingredients of our learning model, and the remaining two ingredients can be activated by the learner by "acting" upon these "things" resulting in "consequences" to produce "concepts" that will guide the learners' behavior. Doesn't this appear educationally sound? Isn't this taking place in your classroom daily? We think it is!

We have been reviewing briefly the recent work of the curriculum committee. They

DIAGRAM 1.

CURRICULUM DEVELOPMENT MODEL



have produced lists of things and acts and have organized them into categories called taxonomies. We have not explained in much detail this aspect of the curriculum development process, inasmuch as most of us will not likely have to do these chores, since they are so near completion. However, what takes place after these two taxonomies are developed should interest everyone because it relates directly to what transpires in the classroom.

After the acts have been placed in taxonomies, it is easy to show how teachers can accurately determine the competencies needed by learners in their classes. All the teacher does is to analyze the acts to discover which competencies, or levels of competencies, are needed by the learner in order to perform the acts. With these competencies identified, the teacher has a valid basis for making instructional decisions. Let's illustrate this process.

The act of "producing" a home, step seven in our model, might be analyzed by the teacher as follows. To produce a home, the learner would need first-level constructing competencies (step eight) such as separating materials, forming materials, and combining materials. If this level of competency specificity is too high, a further analysis can be made, e.g., what competencies are needed in the separating of materials. This might include even lower level competencies such as sawing wood, chipping rocks, cutting asbestos shingles, etc. If this analysis is not sufficiently detailed, then the analysis could be continued until the desired level is attained. Question: Isn't this consistent with the curriculum development criterion to "emphasize meaningful learner competencies?"

We have just stated that the teacher analyzes acts to identify the various levels of competencies required of the learner. Now, doesn't the learner also need to be familiar with the objects or events that he will be acting upon? Certainly! Note that an analysis of the home (step six) reveals phenomena about the home, e.g., the superstructure consists of walls, floor, insulation, ceilings, a roof, etc. If these components are not specific enough, then these, too, may be further reduced until the required level of specificity is reached.

We have just illustrated the procedure being used to identify in-life competencies needed by learners to engage in the acts located in step seven of our curriculum development process. This, of course, relates directly to the act component of our learning model. It also is consistent with the "meaningful learner competencies" criterion guiding this study.

We have also illustrated the procedure being used to identify the smaller parts of the "whole thing" that learners need to become familiar with if they want to practice their competencies upon them. Remember, the "whole things" are step six in our model. You no doubt can see that these smaller parts relate to the "thing" component of our learning model, as well as being potential subject matter for courses.

Some may be wondering, when are we going to select what is to be taught in the classroom? Before subject matter is selected, it is necessary to determine the goals for the program. The goals for a given curriculum should be identified from the competencies needed by learners to cope with their in-life problems. If the competencies needed to handle certain in-life problems can be handled best by industrial arts, then these should help us set out curriculum goals. Please note, however, this unique approach to goal setting. We are suggesting that goals for any curriculum should evolve from the competencies learners need.

After the competencies needed by students have been identified and goals established to guide us in attaining these learner competencies, we are ready to select subject matter content. It is identified by inferring what things people act upon when they practice the desired competencies if, of course, it is consistent with the goals of the curriculum.

It should be evident that deriving a curriculum as just expressed should provide a relevant curriculum because

1. It is structured around the real in-life problems of people, hence, it is meaningful.
2. Real in-life problems are fused with technology.
3. Solving real in-life needs will help students to adjust properly to their environments.
4. Subject matter is selected, permitting learners to practice needed competencies upon objects and events, which will develop concepts, and it will be these concepts that will guide their behavior.

Upon the completion of Phase III, the phase in which we are now engaged, we will immediately begin Phase IV. Funds are now being sought with which to conduct this phase of the study. If funds are not obtained within the next few days, it will become necessary to delay the study until financing is secured. The principal objective of Phase IV is to plan in detail the instructional system for the exemplary courses.

Phase IV has the following four objectives to accomplish:

1. To generate a scope and sequence list of industrial concepts and competencies for teaching in an industrial arts laboratory.
2. To analyze and validate the industrial concepts and competencies that were generated to determine the extent to which they serve the needs of general education and or occupational education.
3. To compile the validated industrial concepts and competencies which have implications for general education and or occupational education.
4. To plan and develop an exemplary instructional program.

Four tasks are required in order to complete objective one. It will require the involvement of several committees, each of which will be allotted expenses and a token contract fee to do its assigned job.

Task #1, which is to be completed by the Rationale Committee, is to expand the six original objectives of industrial arts so as to provide a full understanding of the meaning intended for each goal.

Task #2 provides for a committee of fourteen members to identify a list of industrial behaviors which they will next organize into a taxonomy.

Task #3 consists of identifying competencies needed to practice the industrial behaviors produced in Task #2. This is a very large assignment, requiring a coordinator and thirty people in the field who represent the various disciplines and geographic areas of the state.

And, finally, in Task #4 the curriculum committee and others will take the work of the taxonomy analysis committee and arrange the acts and things (the competencies and the subject matter) into courses to be taught at various grade levels in the schools.

Objectives 2 and 3 are to be contracted out to the evaluations committee. Their assignment is to analyze and validate the above mentioned concepts and competencies to ascertain their validity for use in general education and/or occupational education. This validating will be done with a jury of 50 state directors of occupational education. Those competencies which are deemed valid for career and occupational purposes will be given to the Texas Education Agency for use as guidelines for developing the broad goals of industrial arts programs in the state.

With this complete, a team of industrial arts teachers, evaluation specialists, illustrators, curriculum writers, etc., will be employed full-time during the summer of 1974 to develop the exemplary courses which are to be taught in the Phase V experiment.

Then, last, the project will be completed during the summer of 1975, when an evaluation of the entire curriculum study will be made and a final report written and placed in the hands of the TIAA, the sponsor of this study, and those agencies and foundations which have provided financial support for this study.

The presentation thus far has attempted to avoid, in so far as possible, the use of unfamiliar terms which are being used in developing this curriculum. However, in order to more fully understand the significance of your input today, it will be advisable to explain in greater detail certain aspects of the curriculum development process. Let us return to our learning model as a point of departure for this discussion.

According to this learning model, people act upon things in their environment. These acts, you may recall, may be either visible or invisible. There is nothing else people do but act upon things, and while interacting with these things, they are learning. Therefore, if schools wish to cause learning to take place, they must locate and classify an exhaustive list of things people act upon. Where can schools find these things?

They are found in every area of life in which people engage. For the purpose of this study we have identified these areas of life as communicative things, other persons, physical things, quantitative things, aesthetic things, institutions, and self. Grouping areas of life in this extensive manner facilitates developing lists of things that people transact with, or act upon, in their daily activities. Inasmuch as this is the procedure that we followed in developing our list of things, we conclude that it is quite comprehensive.

After identifying the comprehensive list of things, we next decide what acts man performs upon these things. Inasmuch as our list of things is comprehensive, it follows that the list of acts identified therefrom would also be comprehensive. From this list of acts, we are now able to infer the competencies needed for their performance.

Dr. Ballard teaches at Southwest Texas State University, San Marcos, Texas.
Dr. Williamson teaches at North Texas State University, Denton, Texas.

ITEC*—Impact of the Innovative Programs

Joseph J. Littrell
Louis J. Pardini

During the 1960's, there were numerous curriculum proposals presented for industrial arts education in various localities throughout the nation. Most of those receiving federal funding were widely publicized, but when funding stopped, much of the momentum was lost. However, direction was identified and the need for follow-up became evident.

The industrial arts education programs in the secondary schools of Arizona have been in need of direction, yet problems arise as to what that direction should be for each community.

At Arizona State University during the early 1960's, the pattern of courses was developed to prepare industrial arts majors, revolving around six areas of specialization (automotives, drafting, electricity-electronics, graphic arts, metalworking, and woodworking). Gradual shifts and alterations have been made, but the basic pattern has been about the same, with a somewhat "in-depth" technical area being emphasized. This program has been good, educationally sound, and well received by Arizona's employers of industrial arts teachers. Yet it now appears that for the current secondary schools, two major teacher education thrusts are needed for 7-10 grades and for 11-12 grades. The 11th and 12th grade programs may be best served by the present ASU industrial arts program of "in-depth" study in a technical area. This will serve the advanced industrial arts programs and the evolving pre-vocational education in grades 11-12. The problem then tends to focus on the preparation of industrial arts teachers for grades 7-10, where they will exercise broadly planned and flexible industrial arts offerings.

Faced with this challenge, several faculty members and graduate students from industrial technical education agreed on the concept that a student's capacity to specialize can best be developed by building a foundation based on depth and by the elimination of artificial barriers of courses taught in such a manner as to be fragmented by existing curriculum.

The goal was to develop a program which would provide an educational environment within which students might exercise their capacity to solve problems as related to industrial arts teacher preparation by establishing an interrelationship between the disciplinary subdivisions of industrial arts courses. Although a degree of mastery of tool skills is expected, the development of in-depth skills and technical information is to be gained later in the advanced technical classes.

TEAM APPROACH TO CURRICULUM DEVELOPMENT

Several faculty members and graduate students from industrial technical education examined various contemporary programs, consulted with representatives from the Arizona State University College of Education and from the State Department of Vocational Education, and then arrived at a feasible approach for a revised program.

The faculty and graduate students involved reviewed contemporary on-going curriculums in industrial arts with the view of coordinating facets of these into a program that is feasible and workable with the faculty and facilities available at Arizona State University as they prepare teachers for the schools of Arizona.

As the result of a series of "after-school-hours" meetings which commenced on November 12, 1970, it was recommended that a block of time be set aside and scheduled for a group of new majors for the Fall Semester 1971-72. Twenty-four students were enrolled in the following four courses, Industrial Construction Processes, General Metals, Power Conversion, and Industrial Arts Design. This scheduling technique allowed the students to be scheduled together for large blocks of time each day. These four courses have now been reorganized into one course and redesignated Integrated Industrial Studies for 10 semester hours credit.

To maintain continuity of the momentum established, and realizing that the curricula offered at any time should not be sacred, but must be altered and modified as technology and educational concepts evolve, the faculty and teaching interns involved in ITEC began to meet on a weekly basis to evaluate the program and institute changes as needs became

*Acronym for Industrial Teacher Education Curriculum.

apparent. These meetings are an integral part of the team teaching concept involved in the ITEC approach. The ITEC plan proved to be timely, since at the same time that it was being developed other major changes in the program of studies were being planned. The Arizona State University Department of Secondary Education tested, and put into operation, a professional education sequence called On-Site Observation and Participation. Students in industrial arts education thus have an opportunity early in their program to spend several hours each week at one or more local public schools. This is not a student teaching experience, rather, it provides the opportunity to look at a total school operation, as well as participate in various activities of a department. Short seminars are held on-site at the secondary schools.

Another major change was the addition of an industrial internship. With its inception, students have an opportunity to work in technical positions with local industrial companies. Thus they are under supervision of both university and industry personnel. Students may receive up to six semester hours credit to apply toward their degree. Internships are available in the summer as well as during the school year.

Several advanced students are selected each semester to become part of the ITEC faculty. Each enrolls as a teaching intern and works directly under the supervision of one of the regular ITEC faculty. Interns participate in the weekly faculty meetings, where they are free to contribute as they desire.

GOALS FOR IA TEACHER PREPARATION

1. Develop an educational environment conducive to industrial arts teacher preparation for grades 7-12.
2. Develop skill in experimental and problem solving methods of instruction.
3. Acquire sufficient technical knowledge and manipulative skill to be versatile in handling a variety of future teaching positions in industrial arts.
4. Develop professional and managerial knowledge and skills applicable in teaching industrial arts.
5. Understand current instructional practices and curriculum in a major field.
6. Explore individual abilities and interests through a broad integrated study of industry.

Through the ITEC structure, these goals are implemented by:

1. Orientation to a better understanding of modern industry and its technology.
2. Working with and being exposed to a variety of materials and tool processes.
3. Cooperatively (team approach) planning a major activity and carrying the activity through to completion.
4. Recognizing the basic concepts of management in American industry.
5. Cooperatively (team approach) organizing and operating an identifiable activity.
6. Independently researching and/or experimenting with an identifiable problem of industry.
7. Recognizing and solving a specific problem which would help improve an aspect of production.
8. Recognizing the carry-over of the Arizona State University program to its use in Arizona's public schools.
9. Articulating and reinforcing the relationship of other disciplines to industrial arts education.

The Integrated Industrial Studies course is scheduled for 20 periods per week. This large block of time permits a variety of learning experiences not possible under the conventional plan. For example, a visiting speaker on personnel relationships is not confined to one period, or a field trip to a nearby copper mine can be scheduled for half a day without interfering with other classes, or a student can spend several hours in the laboratory on any given day.

Content for the course breaks down into approximately one week for orientation and eight weeks for the study of industry. To do this, students form committees and model companies. During this eight-week period, the group is broken down into 4 separate companies with an assignment to design and mass produce a product. All of the essential documents inherent in a manufacturing organization are also developed.

During the last eight weeks, individual student contracts are developed. These contracts must cover processes which were not included as a part of the mass production experience.

Included in the concentrated blocks of time are individual instructional experiences related to teaching. Field trips are made to a junior high school and a senior high school industrial arts department. The following semesters are devoted to students gaining in-depth technical experiences, general education studies, on-site observation and participation, industrial internship, special methods, curriculum construction, and student teaching.

Dr. Littrell is Professor and Chairman of Industrial-Technical Education, Dr. Pardini is Associate Professor of Industrial Education, Arizona State University, Tempe, Arizona.

The CBIE Project

L. Howard Runft

A challenge was issued at the American Industrial Arts Association Convention in Dallas two years ago to define "new philosophies of changing industrial arts curriculum." New terms — such as construction, manufacturing, materials and processes, visual communication, and power and energy — were mentioned. New rationale was set forth at that time. One question, "Where is the material we need for the classroom," was voiced repeatedly. Prior to that time, Kansas had begun development on a curriculum which would answer that question.

THE NEW KANSAS STATE PLAN FOR INDUSTRIAL EDUCATION

Since 1917 there have been major conflicts between industrial arts and vocational education as two separate entities endeavoring to present a relevant curriculum in each area. This has led to duplication of equipment and educational efforts, and competition between the two in vying for students. Students have been deprived educationally because of this conflict.

Today the vital issue is to offer meaningful, relevant, sequential education to students. The move in Kansas is to recognize that both disciplines are important and compatible. Changes have evolved — from reorganization at the State Department of Education level down through the writing and testing of new curricula. The Vocational Division of the Kansas State Department of Education proposed a new State Plan for Industrial Education in March of 1971.

The main thrust has been to combine industrial arts and vocational-technical education into one cohesive unit. Other areas of instruction — such as home economics, cooperative education, health occupations, and business education — could also develop courses under the same type of plan. The blending of vocational-technical and industrial arts programs should be complementary to both and directed toward one end, the well-being of the student. Neither program can be eliminated if put into proper perspective. Industrial arts must deal with industrially-related concepts and pre-vocational and pre-technical issues, while vocational-technical education must deal with in-depth skill development. No doubt industrial arts will develop some incidental skills, but should not concentrate on in-depth skill training.

The State Plan for Industrial Education is designed so that the junior high school student moves from broad-based conceptual courses, through narrower cluster activities, toward individualized activities. The courses are developed to encompass an understanding of the industrial world toward five major goals: avocational, vocational, technical, college preparatory, or general education which simply acquaints students with the operation of an industrial society. Dependent upon individual interests, students have the opportunity to choose from many options developed by exploratory hands-on experiences of many exposures in an industrial setting. All courses are designed around actual practices used in industry. At an early age, the student may explore his intended interest. If he likes it, he is then guided through a sequential pattern. If he finds he does not like the chosen area, he has ample time to select another cluster area, thus optionally moving either horizontally or vertically through the state model, receiving training and knowledge in the exact area and depth he chooses. Each student selecting his own destiny according to his capabilities and interests promises a happier student, a rewarding employee for the future, and a contented teacher who knows his students are taking the class because they are genuinely interested in it.

By the eleventh year, a student has enough generalized exposure to choose several options:

1. The student may continue the industrial arts curriculum in the high school to explore several different areas, to pursue individual study in one area to prepare for junior college, college or university study, or post-high school technical training, or to continue industrial arts courses because of avocational interests.

2. The student may opt to enroll in a vocational school to gain in-depth skill training in his chosen area toward employment through day trade, cooperative training, or post-high education, to gain in-depth skill training to enter an apprenticeship program, or to gain in-depth skill training to enter a trade or technical school or college. Industrial arts must be equipped to speak to all students according to their interests, regardless of age, ability, race, or sex. This is going to put the new dimension of counselor into the teacher's role.

The State Plan is inclusive of adult education through the continuing education division. If an adult wishes to further his knowledge in his occupational field, to train in a second area of interest, or to develop avocational interest, he can do so at night or on Saturdays. Hence, the State Plan speaks to the whole community.

RATIONALE AND OBJECTIVES OF THE CONCEPTUAL BASE FOR INDUSTRIAL EDUCATION (CBIE) PROJECT

To develop meaningful objectives for curriculum such as the CBIE Project, there must be a clear definition of industry. The definition that the CBIE Project used to establish its rationale is taken basically from early writings of Henry Fayol. As in the 1900's, today's industry has the same basic structure. Technical function (engineering and production), Commercial function (buying, selling, and exchanging), Financial function (search for and optimum use of capital), Security function (protection of property and persons), Accounting function (stocktaking, balance sheets, costs, and other statistics); and Managerial function (planning, organizing, coordinating, controlling, and decision-making). Whether the industrial pursuit is simple or complex, big or small, Fayol thought the above six functions are always present.

While it is true that present industrial organizational structures do not look exactly like Fayol's conception, they have essentially the same characteristics. A notable difference between Fayol and present industrial structures is that present industrial structures place a much clearer emphasis upon the function of personnel and labor relations.

In developing rationale and objectives, we have expanded and modernized Fayol's concepts to the following: Research and Development, Production, Finance and Controllership, Sales and Marketing, Procurement, Legal, Accounting, and Industrial Relations.

Probably the most outstanding thought expressed concerning these eight functions is that they are closely interdependent. One function cannot and must not be considered in isolation from the other seven functions. Expressed in Gestalt terms, "The whole is greater than the sum of its parts." The technical function, for instance, cannot exist without raw materials, sales outlets, capital, security, and foresight.

Although our industrial system involves a substantial part of man's activities, it is just one element of the total social system of our culture. Sociologists often group man's activities into five major categories that they call the institutions of man. The institutions are Familial, Political, Religious, Educational, and Economic.

Sociologists argue that each of these institutions is present in every culture, whether primitive, highly civilized, small, large, ancient, or modern. The relative importance of an institution in comparison with the other institutions varies from time to time and culture to culture. As cultures grow, some of the institutions seem to lessen in importance, while others gain in prominence.

With a clear definition of "the wholeness of industry," the following objectives were established for the CBIE Project.

I. To develop an informed citizenry in a highly industrialized society—a society that must learn to use and control the technologies.
   A. Functions of Industry. To consider the interrelatedness of the underlying principles of the functions of industry

B. Sociological Implications. To consider both the beneficial and detrimental effects of industrialization and technology on society

II. To provide an environment in which students may apply industrial principles to problem-solving situations. Representative industrial and technological experiences will be selected on the basis of their educational worth.
   A. To provide exploratory experiences in the correct and safe use of materials, tools, machines, and processes of industry
   B. To provide fundamentals of good product design

III. To provide occupational information concerning the world of work.
   A. Information concerning composition of the labor force
   B. Information concerning talents and abilities required by the labor force

Industrial arts is viewed as the link between academic and vocational education. It should also be viewed as an interdisciplinary approach that affords the student the opportunity to apply the theoretical principles of mathematics, science, social studies, English, speech, drama, and business education through practical, meaningful situations that are of an industrial nature. The student is able to "try on" his strongest area of interest and, in addition, may discover new areas of interest that he never knew existed. By its very nature, the IA curriculum speaks directly to the concepts of career education, with a structured hands-on approach presented in logical sequence.

DEVELOPMENT OF THE CBIE PROJECT

Implementation of new curricula into the public schools requires logical orientation, exploration, and experimentation. The first step of innovation is to examine closely what is currently being offered in a program to determine if it meets the needs of the student. Then, comparison of that program to national concepts will bring about a recognized need for change.

Education for teachers who are already certificated and for students who are entering the field plays a relevant role in innovation. This need must be answered by teacher training institutions. A most vital role in innovation is played by the teacher. That teacher must be used to fullest capabilities, not only in teaching, but also in making decisions as to the relevancy of programs and in contributing imagination and professionalism to the writing and development of the curriculum. Communication with the teacher through all phases of project development must be stressed.

In 1969 Mr. Smiley Ebert, Director of Industrial Arts Education, Wichita Public Schools, and Dr. Wayne Becker, Associate Professor of Industrial Education, Wichita State University, initiated a cooperative effort between the two institutions. In 1970 a prospectus entitled Conceptual Base for Industrial Education was written and submitted to the Board of Education. During the 1970-71 school year, graduate courses were arranged at Wichita State University for the purpose of studying many of the innovative programs, such as Industrial Arts Curriculum Project (IACP), American Industry Project, Galaxy Plan for Career Preparation, Orchestrated Systems Approach, and Functions of Industry, which were developed during the 1960's. The first graduate course inspired movements to pilot the IACP courses in three Wichita junior high schools for two years. IACP has been piloted, revised, and evaluated, and in January of this year the Wichita Board of Education approved the placement of the IACP programs into the remaining sixteen junior high schools in Wichita.

During the spring semester of 1971, the second graduate course was established to write the next level which would follow the IACP courses. From the second course, groundwork was laid for three cluster courses, Materials & Processes, Visual Communication, and Power & Energy. At about the same time, the new Kansas State Plan for Industrial Education was compiled and adopted by the State Board of Education.

In 1972, a proposal to develop, write, and pilot Level II curriculum of the State Plan: Materials & Processes, Visual Communication, and Power & Energy was submitted by Wichita to the Vocational Division of the Kansas State Department of Education. The proposal was accepted and funded for $129,000 over a two-year period. The CBIE Project is a cooperative effort among the Kansas State Department of Education, Wichita State University, and the Wichita Public Schools. These courses have been developed in compliance with the new State Plan for Industrial Education.

During the summer of 1972, workshops were established in each of the three areas, The university professors (Dr. Wayne Becker in Materials & Processes, Dr. Ronald Bass in Visual Communication, Mr. Edgar Acob in Power & Energy) worked with teachers from all over the state of Kansas and established conceptual study areas within each course. During these summer workshops, nationally known educators with expertise in the three new conceptual areas were contracted to work with the university staff and teachers. Leading educators, such as Dr. Joseph Duffy, Central Connecticut State College, Mr. Nelson Parke, Southwest Missouri State College, Dr. Ray Schwalm, Western Washington State College, and Dr. Fred Kagy, Illinois State University, lent valuable input into the development stages. The Project is continuing to exchange ideas through correspondence with these educational consultants.

As a result of the summer workshops, rough curriculum guides were compiled in each area. During the following school year, 1972-73, eight teachers were hired in each area, under the direction of the university consultants, to refine goals and objectives, develop student activities, and designate software and hardware for the courses. By August 1973, refined guides were published, containing daily lesson plans, suggested student activities, student readings, and lists of suggested software, hardware, equipment, supplies, tools, and audio-visual aids. Also developed were CBII slide presentations to complement each of the three courses. In July 1973, methodology workshops were held to prepare teachers to pilot the courses. The three courses are presently being taught in three separate Wichita high schools, and the prepared curriculum guides are being tested and refined by the pilot teachers. These materials are now ready for dissemination and may be obtained through the Kansas State Department of Education, 120 East 10th, Topeka, Kansas 66612, or The CBII Project, 301 South Grove, Wichita, Kansas 67211.

EVALUATIONS

Since these were new courses, being taught with new material, evaluation measures had to be developed. Input into the techniques to be used for evaluation purposes was made by the Wichita Public Schools Research and Evaluation Department, the four pilot teachers, the three original Wichita State University consultants, the Director of Industrial Arts, and the Coordinator of the CBII Project. Evaluation procedures were established.

The consensus of the writing teams was that a summer workshop should be held after the first year of the pilot to revise the guides on the recommendations of the pilot teachers, the University consultants, and the State Department administration. It was also suggested by the research team that a two-year pilot would be much more valid than a one-year pilot, because of revisions in the teaching materials and a more established evaluation system. Plans are to present the results of the two-year evaluation of these three pilot courses to the Board of Education for approval to implement them into the seven senior high schools and most of the sixteen junior high schools in the Wichita Public School System.

NEW CURRICULUM ACCEPTANCE

The CBII Project has had its share of trials and errors, as does any innovative curriculum development. Nevertheless, the over-all view of the project is very encouraging. The various statewide universities and public school systems, as well as the Kansas State Department of Education, have displayed remarkable commitment and assistance. The dedication exhibited by the teachers, even those not directly involved with the development of project materials, enhances the entire theme of the project.

While the CBII participants could visualize the broad scope possible for the three courses in other curriculum areas, they did not foresee the enthusiastic acceptance of these areas for the interdisciplinary action that is being perpetuated. At this time specific curriculum areas effecting this change in the Wichita Public Schools are art, English, home economics, and social studies. Industrial arts non-pilot teachers, examining the published CBII material, have responded with spontaneous requests to incorporate these concepts and activities into their existing programs.

Last summer four major teacher-training institutions implemented institutes in Manufacturing, Construction, Materials & Processes, Visual Communication, and Power & Energy. Again this summer all four institutions will offer institutes in the five areas.

Each state department of education in the United States has received a set of curriculum guides from the Kansas State Department of Education. Requests for material have been arriving at our office from all over the country. Kansas is excited about and proud of the progress that is taking place in the state.

STUDENT ACTIVITIES

As teacher guides were developed for the CBIE Project, slide presentations were developed to speak to two purposes. These slides may be used in conjunction with the teaching guides as supplemental material or as public relations information, illustrating rationale of CBII as well as demonstrating student activities. The uniqueness of the presentations is that some were developed as a project by Visual Communication students, under the guidance of teachers, and others were developed by teachers to enhance the guide material.

"What Is Visual Communication" illustrates the rationale of Visual Communication and was developed by the Visual Communication class, with the guidance of the pilot teachers and consultants, as a class project for a photographic essay. Students filmed the subject, developed the film, mounted the slides, wrote the script, and taped the narration with background music. "What Is Visual Communication" deals with almost every type of communication that man has attempted, symbology and art forms of primitive man as well as the mass technical media of today. The slides point out communication forms like unspoken and unwritten language, sounds that create mental images, human relations, creativity, spiritual concepts, and subconscious images. The presentation also refers to consumer protection, the business aspect of advertising, environmental aspects, entertainment, and career awareness. The main emphasis of "What Is Visual Communication" is man's communication with man.

"Visual Communication. Introduction and Overview" describes each unit of instruction and some of the suggested products by which the concepts are taught. Units of study in Visual Communication are Orientation to Visual Communication, Photographic Communication, Printed Graphic Communication, Technical Graphic Communication, Communication Dissemination, and The Visual Communication Industry.

"Materials & Processes I" explains rationale. The first element of the course is materials. All materials are classified as:

Metals, which are derived from earthy materials and characterized by their luster. They have electrical and heat conductivity, and heat fusibility. At room temperature, most are solid and opaque.

Non-metals, which are all materials that are not metal (for example, wood, glass, concrete, rubber, plastics, and textiles).

Organics, composed of or containing matter of plant or animal origin and therefore containing large amounts of carbon.

Inorganics, composed of matter having no appreciable amounts of carbon. Hence, these materials are relatively inert, meaning they do not react chemically.

The second element of the course is processes, by which man makes materials more useful to himself. Materials are processed by forming, separating, combining, and finishing.

The third main element of Materials & Processes is products. Each product is selected for its unique characteristic, whether it be of a mechanical, electrical, optical, chemical, thermal, or aesthetic nature. The units of study in Materials & Processes are. The Productive System, Classification of Materials, Forming Materials, Separating Materials, Combining Materials, Finishing Materials, and Development of Products.

"Materials & Processes II" shows a few suggested products that students produce in the Materials & Processes classroom based on Materials & Processes concepts. Two important components, testing of materials and tooling, are also depicted in this presentation of student classroom activities. Other subjects are pollution, effects of industry on environment, and recovery of materials.

"Power & Energy I" deals with the rationale for the Power & Energy course. All machines serve as extensions of man, his limbs, eyes, or ears. There are only six known sources of power: mechanical, electrical, thermal, nuclear, chemical, and radiant. The six simple machines are studied relative to the concepts of source, input, control, transmission, and output. Whether natural or man-made, forces can be captured or converted to be used by man to lighten his work load. By combining two or more systems, man creates machines to work for him. An example is the automobile, a combined electrical, mechanical, and fluid system, which does many types of work for man. Units of study in Power & Energy are. Introduction to Power & Energy, Mechanical Systems, Fluid Systems, Electrical Systems, and Combined Systems in Industry.

"Power & Energy II" demonstrates student activities. Students study the areas of natural or man-made sources, methods of control, methods of transmission, and methods of output. An important aspect is studying a type of industrial use for a particular system. Students are made aware of and given the opportunity to relate to exploratory career experiences. Two important elements of study in Power & Energy are environment and pollution. Students start their Power & Energy study with commercial experimenters, then move to teacher-developed activities. Finally they are involved in light product service work relating to their unit of study at the time.

FUTURE PLANS IN KANSAS

During the same period of time that the CBIE Project was in the developmental stages, there was also a new curriculum study being conducted at Kansas State College of Pittsburg. The Secondary Exploration of Technology (SET) Project was developed under the direction of Dr. Victor Sullivan and Mr. Harvey Dean. It was funded for a three-year period under Title III funds from the United States Office of Education. The SET Project obtained permission to pilot its programs in three school districts in Kansas. There are some differences in the way the SET material is presented, but its rationale and basic structure are very similar to that of the CBIE Project. Both projects are concerned with the areas of manufacturing, construction, materials and processes, visual communication, and power and energy. In fact, Levels I and II of the State Plan are pretty well established in Kansas, and considerable action is being taken by all institutions. However, there must be a more concentrated effort to set guidelines for total implementation and dissemination.

In October 1973, a member of the Kansas State Department of Education staff presented the United States Office of Education in Washington, D.C., with a set of CBIE curriculum materials. The U.S. Office ordered three additional sets of curriculum guides for preview. On October 25, 1973, the CBIE and SET staffs were called to Topeka. The U.S. Office of Education requested that the two projects submit a combined prospectus of plans to complete the State Plan. They indicated the availability of funds for this type of developmental work. The combined project would be identified as Kansas—Plan for Industrial Education (K-PIE). As of yet, no word on funding has been received from the United States Office of Education.

Plans include seeking help from the Kansas Industrial Teacher Educator Council (KITEC), of which all teacher training institutions are members. The Kansas State Department of Education is lending guidance to the efforts of the K-PIE Project and all teacher training institutions to finalize, disseminate, and implement Level I and Level II programs, and to decide what is needed to develop Level III. When Level III is developed, written, and disseminated, industrial arts writing efforts will be completed.

SUMMATION

This is an exciting time in education, particularly in industrial education. It is simply asked that you study the efforts of the developers before you disregard or criticize them. The curriculum is new, it is exciting, and the main thrust of the whole effort, which all educators have spoken about for years, is the well-being of the student. Given a structured logical progression of educational events, such as outlined in the State Plan for Industrial Education, male and female students alike explore society at their option and discover their proper identities and where they fit into the world of work.

It is also recognized nationwide that many teachers, universities, school districts, and other educational agencies are developing the "new look" in industrial education curriculum. The CBIE and SET Projects have made major contributions to education by establishing a firm base of implementation in keeping with innovative curriculum and have contributed to the sound education of youth, in all parts of the country.

Mr. Runtt is project coordinator of the Conceptual Base for Industrial Education Project, Wichita Public School System, Wichita, Kansas.

Humanizing the Curriculum by Focusing on the Learner

M. James Bensen

The curriculum project began in the summer of 1971 in a workshop sponsored by the University of Wisconsin-Stout for industrial education departments that wished to improve their programs. Thirteen schools attended this workshop, with each one represented by at least three-fourths of their departmental personnel. The workshop was based on program improvement through the use of the Wisconsin Guide to Local Curriculum Improvement.

The Shawano School System followed up on this initial professional activity with a locally-funded curriculum-writing venture and, with cooperation from Stout, procured ESEA Title III funds for an innovative pilot project in industrial education. The success of the pilot project has stimulated an additional three years of funding to support the development of learning activities.

The project was based on the Guide, which proposes the following five program objectives:

1. To work with elements of industry to gain understanding of how they function in producing goods and services.
2. To understand the interdependence of society and industry.
3. To explore the context in which industry has developed and continues to develop.
4. To explore occupational areas as a basis for selecting a career and understanding the pursuits of others.
5. To prepare for entry into appropriate industrially-related occupations and develop a base for further occupational education.

The conceptual structure that organizes the study of industry as an aid to meeting the five objectives in the Guide is as follows:

SYSTEM ELEMENTS:

Research & Development
: Investigation & experimentation conducted for the purpose of arriving at a solution to an identified need.

Production
: The methods and processes used in the output of goods and services.

Marketing & Distribution
: Flow of goods and services from producers to consumers.

Maintenance & Services
: Servicing property, equipment, & people.

RESOURCE ELEMENTS:

Finance
: Acquisition and utilization of financial resources in industry.

Manpower
: Human resources essential to industry.

Materials
: Substances from which products are produced.

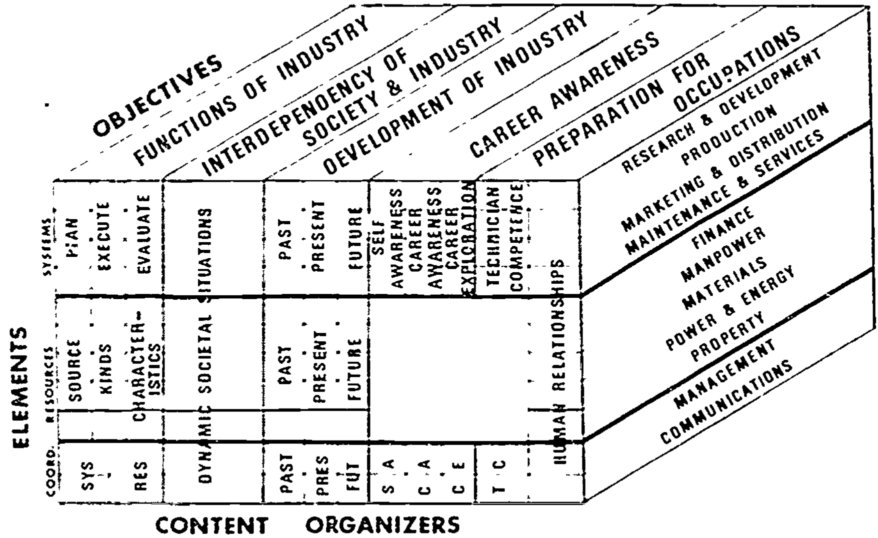
Power and Energy
: The fundamental ingredient in all mechanization & technological development which may be transformed into work.

Property
: Holdings or possessions of an enterprise upon which value can be placed.

COORDINATING ELEMENTS:

Management
: Operational activities which provide for the leadership of an enterprise.

Communications
: Interaction resulting in the exchange of ideas and information.



The relationship between the objectives and the elements of industry are shown in the model in Figure 1.

The planning sessions to better meet the needs of the learner in the Shawano Project generated the following rationale and two major project goals:

The Rationale:

Because industry, its technologies, and occupational opportunities are changing at an ever-accelerating rate, the content of industrial education must change to reflect contemporary industrial practices.

Content change does not insure equal learning opportunities for all students who participate in industrial education because of varying learning abilities, styles, and interests, therefore, learning alternatives must be provided to enable each student to learn in a way compatible with his individual learning style.

Goals of the Project:

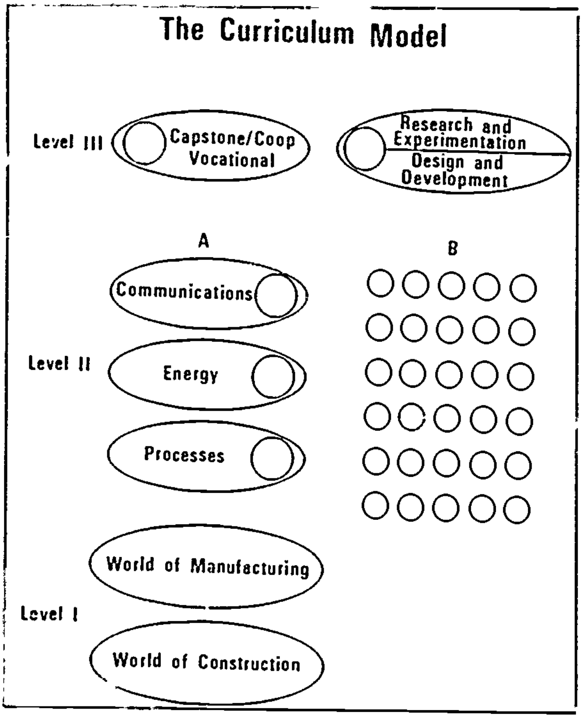
1. To implement the study of contemporary industry in the public school.
2. To individualize, humanize, and personalize the instruction through offering learning alternatives to the student.

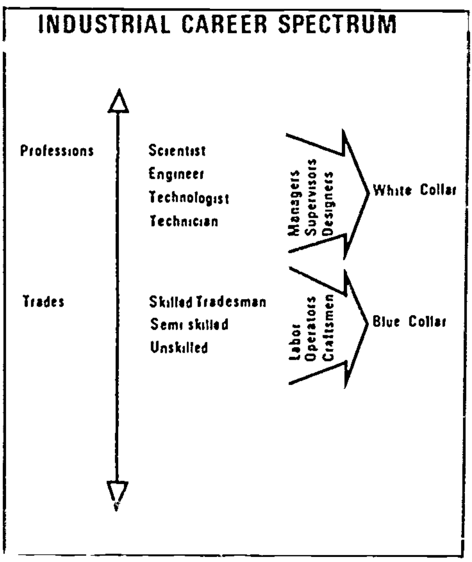
As a result of the decisions to provide a contemporary study of industry and to focus on the learner in providing these experiences, an initial program model was designed.

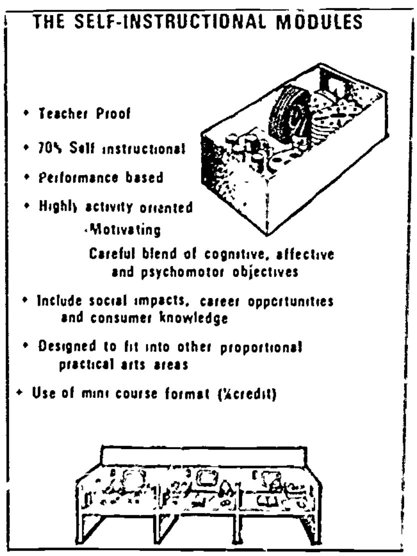
The first level in the program indicates a general broad study of industry through a grouped teacher-led approach. The second level provides for both grouped teacher-led exploratory experiences, A, and smaller flexible student-led modules, B. The third level experiences are for specialized interests to provide opportunities for both the future vocational student and the "high flyer" who may some day pursue a position on the professional level in industry. The model was designed to include the total career spectrum of industry as depicted in Figure 3.

Six self-instructional modules were designed during the pilot project and field-tested for their effectiveness. The criteria used in this development are shown in Figure 4.

The intended use of the modules was to provide for flexibility in "customizing" the instruction of each of the learners who were in the program. This would be possible through the use of the modules in the level III portion of the curriculum model as well.


The Curriculum Model
Level III
Capstone/Coop Vocational
Research and Experimentation
Design and Development
A
B
Communications
Level II
Energy
Processes
World of Manufacturing
Level I
World of Construction


INDUSTRIAL CAREER SPECTRUM
Professions
Scientist
Engineer
Technologist
Technician
Managers
Supervisors
Designers
White Collar
Trades
Skilled Tradesman
Semi skilled
Unskilled
Labor
Operators
Craftsmen
Blue Collar

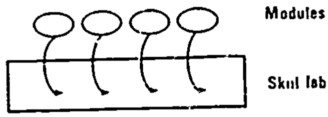

THE SELF-INSTRUCTIONAL MODULES
• Teacher Proof
• 70% Self instructional
• Performance based
• Highly activity oriented
-Motivating
Careful blend of cognitive, affective and psychomotor objectives
• Include social impacts, career opportunities and consumer knowledge
• Designed to fit into other proportional practical arts areas
• Use of mini course format (¼credit)

The example illustrated in Figure 5 of a customized vocational experience highlights the uniqueness of the modules' potential.

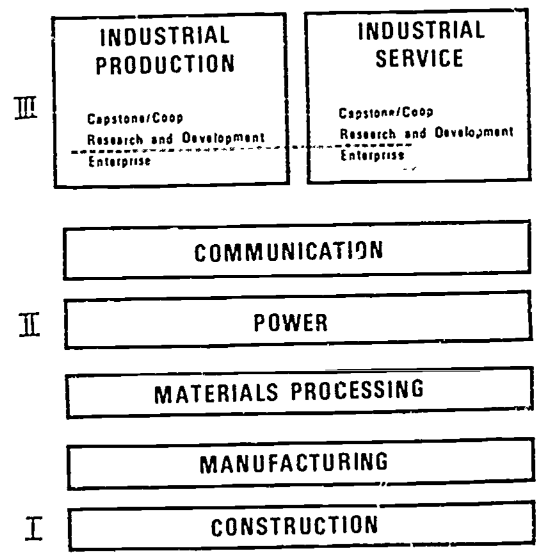
The learner, through guidance and information supplied by his teacher, states a career objective. From this objective, the learner selects the appropriate learning experiences to design his/her own course of study. A skill lab is attached to the instruction to provide the needed practice to become proficient in the area of study chosen by the learner.

As the project moves into the three-year writing phase, some changes are being implemented in the program model to better meet the needs of the student. Figure 6 depicts, in model form, this slight re-orientation.

A "Customized" Vocational Curriculum



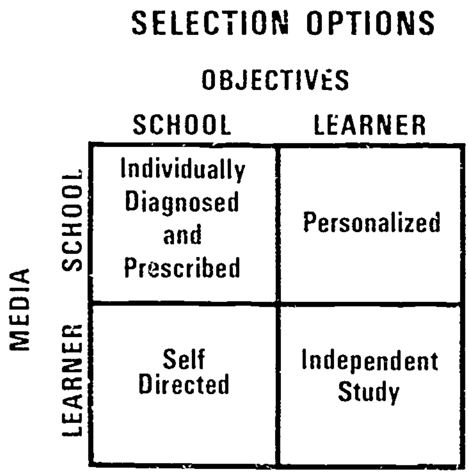
AN INDUSTRIAL EDUCATION MODEL

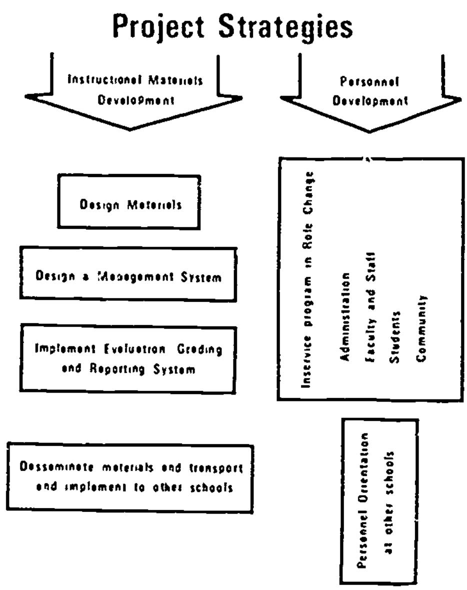


Level I in the model will remain parallel to Level I in the initial planning model. Level II will become more flexible by offering each of the courses through a self-designed, self-instructional mode. The modules will probably become split into smaller activities. Figure 7 illustrates how various selection options can provide differing types of individualized instruction.

The level III opportunities, which provide for specialized objectives, were redesigned slightly to point out to the learner that numerous group or individual experiences are available to him/her in the goods-producing and goods-servicing elements of industry.

The strategies involved in carrying out the three-year improvement project involve the development of both people and instructional materials.





The future perspectives of such a program are endless. It becomes apparent from the work that has been done thus far that curriculum improvement is a continuous change. The dynamics of acting as change agents in both people and curriculum is an exciting one, as the project directors are experiencing. Future contacts for more information on this project will be available from Mr. Fred Beyer, Project Director, ESEA Title III Project, Industrial Education, and Mr. Fred Ponschok, Local Vocational Education Coordinator, Shawano Public Schools, Shawano, Wisconsin.

Dr. Bensen is Director of the BS Degree Program in Industrial Education, University of Wisconsin-Stout, Menomonie, Wisconsin.

Electronics

Computer-Assisted Evaluation in Industrial Arts

D. L. Jolden

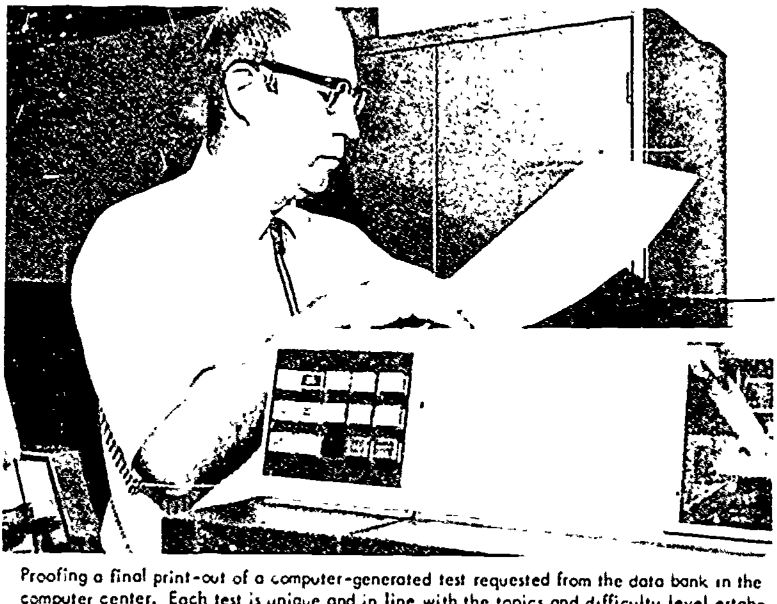
How would you like to have the following capability for evaluating your students in industrial arts classes?

1. Individual cognitive tests for each student in the class. Unique to that student.
2. The freedom to choose which specific topic, concept, or principle you wish to evaluate for each student.
3. The opportunity to determine the level of understanding within three general categories for any specific topic, concept, or principle in your course of study.
4. The ability to have available an updated item analysis for each test question within your evaluation library.
5. A master file of all your test questions available sequentially for a given course of study coded with the correct answer.
6. An infinite number of test variations determined by the computer in line with the topics being studied and the level of understanding desired for each student.
7. Freedom to add or take away individual test items as your course changes without having to re-write your tests for each class as the content or emphasis of your classes change.

If the answer to one or more of these questions is yes, maybe computer-assisted evaluation is the process you have been looking for.

BASIC PREMISE

Computer-assisted evaluation is based on the idea that education is in fact an individual process where each student can, in consultation with the teacher, approach a given subject knowing full well what he/she is attempting to learn and what, at this point in time, is already known about the material. It is an adjunct to a more realistic approach to learning, that of individualized instruction. At present it is limited, however, to the cognitive domain and does not attempt to measure the psychomotor or affective domains (skills and attitudes).



Proofing a final print-out of a computer-generated test requested from the data bank in the computer center. Each test is unique and in line with the topics and difficulty level established for the student.

A personal interview with each student determines the units to be evaluated, topics covered within each unit, and level of difficulty for each test item.

ORGANIZATION OF THE SYSTEM

The basic evaluation system is presently set up on an operational basis in the field of electronics. It was organized and developed in the following manner. An understanding of the procedure might provide insight into adaptation to other subjects and to improving the system as it now exists.

Step 1.

An analysis was made of most of the available text books and references in electricity-electronics. This analysis evolved into a topical outline for five courses in electricity-electronics which would provide a basic understanding of the field without regard to specialization. Its prime purpose was to identify which topics of information were contained in the books and, from a frequency of occurrence, to get an idea of which topics were thought important by the authors of those books.

The master analysis resulted from looking at approximately fifty books in the field published from 1960 to 1974. This compilation netted 226 general topics of information which were then organized sequentially into an instructional outline. In addition, these topics were blocked and divided for convenience into sheets for the preparation of learning activity packages. This further breakdown resulted in 22 general units or blocks.

Step 2.

Because of an interest in determining if in fact the authors of the books were in tune with industry and what is under development there, these topics of information were submitted to a representative sample of the electronics industries who were engaged in manufacture, design, installation, service and or operation of electronics equipment. Twenty-four major industries were involved in this classification process. The industries were asked to determine if, in their judgment, the topic should be required, preferred, or unnecessary information as it would relate to a general understanding of the field. The results of this evaluation netted a topical outline where emphasis on topics could be established and an instructional system developed.

Step 3.

To facilitate a more usable outline, these general topics of information were then expanded into specific behavioral objectives which could be used by teachers to set up an

Computer request cards are punched to allow the selection and printing of test questions from the computer data file to meet the requirements of the student.

instructional system or educational experience. This step also made the exact content, purpose, and/or aim of the topic clear for the student. It provides a good channel of communication between the student and the teacher regarding the electronics information that needs to be learned by the student.

Step 4.

The next step was to write individual test questions for each of the specific performance objectives or to accumulate sample test items from many sources. Over a period of several years, approximately 5000 sample test items have been gathered and classified into sequence related to the topics and/or units. This procedure of accumulating many questions over each topic and specific objective gives the evaluation file its tremendous versatility, as many questions could evaluate within reason a given objective or topic.

Step 5.

Once the original classification scheme was established and the test items categorized by unit and topic, it was essential to determine the approximate level of understanding evaluated by the individual test item. A taxonomy of seven levels of the cognitive domain established by Bloom and others was used, but it was modified into three major sections. These were low-level recall, medium-level application and analysis, and high-level synthesis and evaluation. By reading each question or test item, a judgment was made to determine which level of information was evaluated by that particular item. An attempt was also made at this time to have approximately the same number of test items in each of the three categories. The result, however, provided a larger number of items in the low category, with the medium category second and the highest level of learning containing the fewest test items. This could be assumed, as the purpose of the whole instruction program was orientation and not specialization.

Each test item then contained the following information which could be processed by the computer:

1. The general course from which the item was taken (5 courses in the entire program of studies).
2. The general unit of instruction or block from which it came (the master analysis contained 22 units or blocks of instruction).
3. The specific topic of information or performance objective which this test item was evaluating (226 topics in the original analysis).
4. The approximate level of understanding or the difficulty of the question in relation to the three broad categories used.
5. The correct answer to the test item.

For practical reasons in data processing, multiple-choice questions were the dominant format for the test items, with a few true-false items included.

In cases where drawings or schematic diagrams were to be used, a notebook was made with appropriate reference to unit-topic-figure for easy reference. This procedure did not require the computer to draw diagrams, only to type specific test items and provide proper reference data.

UTILIZATION OF THE SYSTEM

The following explanation is a sample of how the computer-assisted evaluation system can be used.

A student entering a program or course needs a pre-test to determine what is already known in the field. In consultation with the teacher, a selection of course(s), unit(s), or topic(s) is made. An agreement of the level of learning to be evaluated is determined. A request is then made to the computer for a given number of questions on a specific level over a given topic, unit, or course. Instructions to the computer are to give a random selection of available possibilities, and if the number of items requested is beyond the number of items in the file, make up the difference from a category above or below the requested level of learning.

The test items are to be numbered sequentially as they are printed. Do Not put the answers on the student's test, but make the teacher a duplicate copy of the same test with answers. Also provide at the top of the test the name of the student for whom the test was made, the teacher making the request, the date of the request, and the topics, units, course, or level requested. These items are on the program of the computer and are provided for each test made.

The computer can print approximately twenty-five, one-hundred-question tests in about 10 minutes (this is based on the type of storage system used (disk), the kind of program written (cobal), and the speed of the printer (1000 lines per minute)).

The computer can print a long pre-test, a comprehensive unit test, a general post-test, or a combination of levels of learning on any test. It has proven to be a very useful tool to enhance education and help in some of the problems of evaluation.

Take heart, teachers! The time has come when the drudgery of midterm, final, and quickie quiz construction is now available by request from your friend, the computer. Now you can get down to the business of evaluating your students' skill and attitude, where your professional judgment is more needed.

Dr. Jelden is a Professor of Industrial Arts at the University of Northern Colorado, Greeley, Colorado.

Using Monolithic Integrated Circuits in the Laboratory

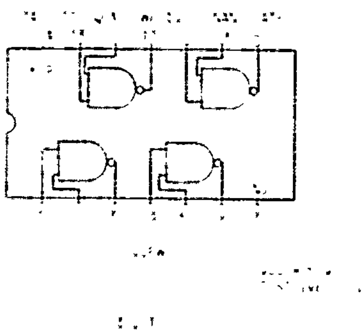
William H. Rigby

Since their development in 1968 by Texas Instruments, monolithic integrated circuits have made dramatic inroads in the field of electronics and are primarily responsible for the growing field of microelectronics. Dollar volume sales of integrated circuits surpassed that of discrete transistors as far back as 1969, and the volume of sales and new applications for IC's continues to grow.

It therefore seems imperative that industrial arts educators make an effort to technologically catch up and utilize greater numbers of IC's in their laboratory activity. This paper, then, attempts to coax the uninitiated electronics teacher into using IC's and may suggest a few applications to those already familiar with this new field.

DIGITAL IC'S

Integrated circuits designed for digital application are grouped according to compatible families or types. These families go by a variety of names and acronyms. For example, a contemporary, extremely popular, and reasonably priced family of digital IC's is the Transistor Transistor Logic, or TTL. This particular family, often referred to as the 7400 series, utilizes the basic NAND logic gate as its basic "building block." From this gate, all other logical gates, flip flops, and other digital functions radiate. An example of a typical TTL Logic IC is the 7400 Quad Two Input NAND Gate.



This device, like many modern IC's, is contained in a 14 Pin Dual Inline Package. Notice that the pin numbering sequence begins to the left of the keyway and proceeds down the lefthand side and up the righthand side of the device. An important difference between transistors and IC's is that, schematically, the IC pin numbering is identified from the top rather than the transistor-oriented bottom view. The 7400 contains four individual NAND Gates, each having two inputs, a V_{CC} requiring positive 5 volts in a ground connection. This family operates on a positive logic system where a logical 1 implies a positive voltage greater than 2 but equal to or less than 5 volts, while a logical 0 is a voltage less than .8 volts or circuit ground. Using the basic NAND Gate, the user of IC's can easily construct all of the traditional logic gates and solve many interesting logic problems.

Figure 2 illustrates the versatility of the NAND Gate by showing its modification into the common NOT, AND, and OR gates. Of course, other circuits such as flip flops, adders, etc., can likewise be constructed. Naturally, manufacturers have already prepared all of these and many other logic functions in individual IC's. However, the act of parleying these single gates into many interesting combinations may be a valuable learning experience in itself.

A contemporary and visible application of digital IC's is in digital readout devices such as counters, digital voltmeters, radio tuners, and digital tachometers. A basic digital counter is a relatively easy device to construct. It requires only two IC's and a

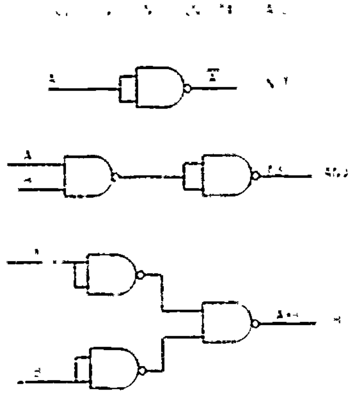


FIG. 2

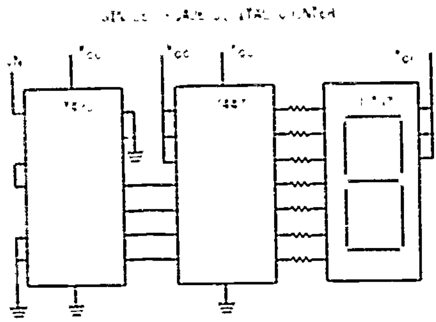


FIG. 3

readout element. More elaborate systems are available, some with storage capacity, however, the uninitiated may feel more comfortable with a simpler system, as shown in Figure 3.

Figure 3 shows a complete single decade digital counter. This system uses a 7490 Decade Counter, a 7447 Seven Segment Decoder Driver, and a Seven Segment LED readout. By starting at the input to the decade and dividing into its component parts, we find that the 7490 decade counter is a 4 bit binary counter designed to count from 0 to 9 and then automatically reset back to 0.

This counting element requires a V_{cc} of 5 volts and a ground, along with a few other external connections. The pulses to be counted are fed into the IC via pin number 14 labeled A Input. This is the first of four flip flops. Its output pin, number 12, labeled A Output, must be externally connected to pin number 1, labeled B Input, so that the remainder of the ripple counter may be connected and allow the count to accumulate higher than 1. Pins labeled B, C, D, and A Output are the outputs of the 4 flip flops, with D being the most significant binary digit. Two reset variations are available to the user of the device. Normal counting is accomplished if the pins indicated R_0 and R_g are grounded, while a reset to binary 0000 is made if both pins marked R_0 are momentarily given a logical 1 or positive voltage. The pins indicated as R_g will reset the count to binary

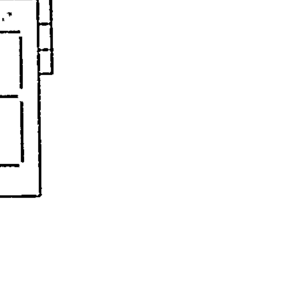
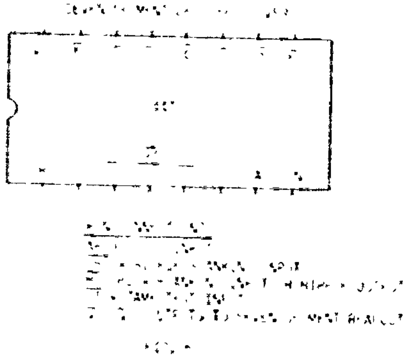


FIG. 4

9 (1001) if momentarily given a logical 1. The user must remember to hold all resets to ground unless the reset function is desired.

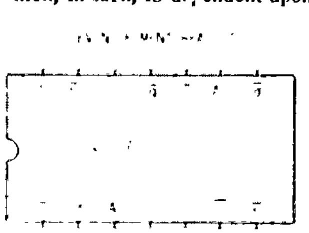
The second segment in this decade counter is a decoder driver, which decodes the four binary outputs (A,B,C,D) into a corresponding digital number, 0-9. The particular decoder used in Figure 3 is the 7447 Seven Segment Device. This IC shown in Figure 5 is a 16 pin dual inline package. The 4 binary lines from the counter are indicated as A, B, C, and D and match up A to A, B to B, etc., with this decoder driver. The pins marked by the lower case letters ā through ḡ match up to the seven segments of the LED readout.



Three interesting pins are labeled $\overline{LT}$, $\overline{RI}$/RBO, and $\overline{RBI}$. The first $\overline{LT}$ is a Lamp Test input which, when pulsed, will activate all 7 segments at once for test purposes. To those familiar with digital notations, the bar over the LT indicates a negated function and points out that the lamp test will operate when pin 3 ($\overline{LT}$) is provided a logical 0 or ground. Pin 5, labeled $\overline{RBI}$, is the Ripple Blanking Input. This function will allow the designer of decade counters to eliminate zeros in a count. To prohibit a decade from displaying a 0, the $\overline{RBI}$ pin is held low or logic 0. This Ripple Blanking Output will blank the zero or zeros in that count. $\overline{RI}$ RBO allows designers of multiple decade counters to blank 0 when not needed, however, they can be reinstated when displaying a count such as 10, 100, or other application where zeros are needed to the right of a digit other than zero. To utilize this feature, the left or most significant decade would have its $\overline{RBI}$ connected to ground. The $\overline{RI}$, RBO of that left hand stage would be connected to the $\overline{BI}$ of other less significant stages. This then would always blank the left-most zero but redisplay the right zero or zeros on counts above 9.

The third portion of the counter is the displaying unit. The unit chosen for this circuit is a Seven Segment Common Anode LED.

The lower case letters ā through ḡ match up to the output of the decoder driver and act as the ground connections for the readout. Three anodes are marked A, and each must be provided with a positive 5 volts. The display is, of course, dependent upon the state of the decoder driver which, in turn, is dependent upon the accumulated count in the



210

decade counter. When the decoder driver sinks its output, a - g, to a logical 0, that particular segment or segments conducts and lights due to the electron flow toward the common positive anode.

One minor problem arises with this and other LED readout devices. That is the limiting of conduction current through the lit segments of the LED. The current limit in most readouts is 15 to 20 mA per segment. This necessitates current-limiting resistors of 120 to 160 ohms in each of the 7 legs feeding the LED.

Figure 7 again shows the complete single decade counter, complete with all interconnections, limiting resistors, $\overline{RBI}$, $\overline{RI}$, RBO, and $\overline{LT}$ held high and resets R_0 and R_9 held low for normal count sequence.

SINGLE DECADE DIGITAL COUNTER

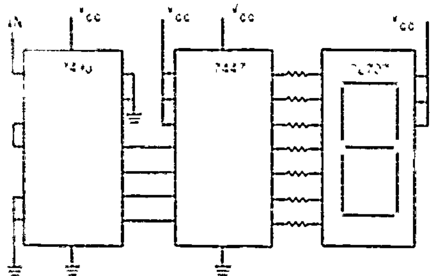


FIG. 7

If such a counter is to be operated or triggered manually, another circuit must be introduced. Due to the sensitivity of digital integrated circuits, manually triggered or toggled inputs must be electronically conditioned before entering a counter such as the 7490. The manual closing of a switch creates multiple pulses as the metal contacts bounce together. These multiple pulses for one switch closing, of course, give erroneous counts and poor results. To alleviate this problem, a circuit called a Bounceless Switch is used to condition the signal and allow only one pulse per switch closing. The circuit shown in Figure 8 consists of an RS flip flop. When the single pole double throw switch is in the 1 position, a high logic level is generated at the output. When the switch is reversed and placed in the logical 0, a low logic level is placed at the output. Many users of bounceless switches prefer to place a one-shot multivibrator following the RS flip flop. This device then produces "clean" high or low outputs, based on switch position. This multivibrator allows a pulse of predetermined width to be generated, regardless of the length of time the switch is in the 1 or 0 position. This overcomes extremely slow or very rapid switching action. The user of digital integrated circuits will find this bounceless switch an invaluable circuit.

BOUNCELESS SWITCH

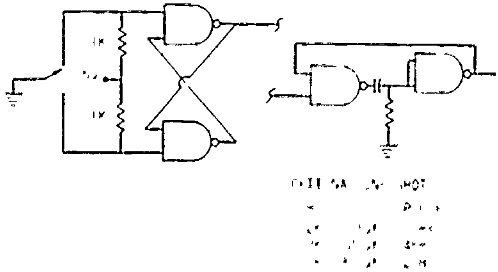
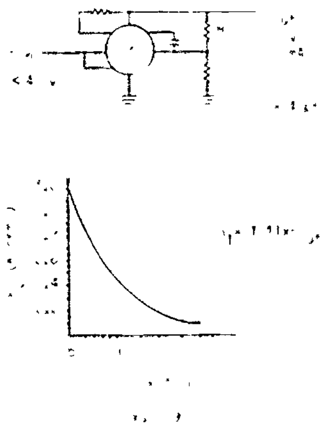


FIG. 8

LINEAR IC'S

After getting off to a rather late start compared to digital integrated circuits, linear IC's have quickly grown in popularity so as to now command an important role in the field of microelectronics. This segment of integrated circuits may be subdivided into a number of classifications in order to further identify the variety of linear products available. A few linear IC's are the common operational amplifiers (Op Amps), power amplifiers, voltage regulators, communications circuits, and an exciting new addition, the solid state timer. While it is impossible to present all of these devices and their numerable applications, an effort will be made to illustrate the use of two linear IC products.

The first of these linear devices is the IC voltage regulator. Next to the Op Amp, the regulator is the most common linear integrated circuit. Like any discrete voltage regulator, the IC regulator controls and regulates, as necessary, the output voltage and/or current of a power supply. Instead of a major engineering project, the design of an IC regulator is a matter of minutes, at a component cost comparable to a conventional zener diode. The user need only determine the power supplies, current and voltage output requirements, select the most economical unit, and then compute the voltage setting resistors. The voltage regulator chosen for illustration here is the popular LM305, manufactured by National Semiconductor Corporation. This 8 pin device in the familiar TO-5 can is available at reasonable prices from many electronic suppliers and manufacturers surplus vendors. The device in a typical application is shown in Figure 9.



The 305 is capable of regulating outputs from 4.5 to 30 volts with output currents possible up to 10 amps using external pass transistors. The circuit shown in Figure 9 assumes an input voltage of something less than 40 volts and a desired output level of a positive 12 volts at 20 mA. The two resistors R_1 and R_2 form a voltage divider, which is selected to maintain 1.8 volts on pin 6 of the LM-305. The necessary values of R_1 and R_2 are easily found. R_1 in K ohms can be determined by multiplying the constant 1.11 times the desired votage. The value of R_2 in turn is located by using the graph also in Figure 9. The desired voltage is located on the graph's abscissa, projected to the curve, and the necessary R value in K ohms is located on the on the ordinate. These two resistors then serve to adjust the regulator to any desired output level within the limitations of 305. If the user wishes to add current limiting to the current, resistor R_{SC} must be added. The value of R_{SC} is computed from the formula $R_{SC} = 325/I_L$. For example, the current limit desired for this circuit is 25 mA, then to the formula the R_{SC} necessary would be 13 ohms. From this example can be seen that designing a voltage regulator to produce a given output level and even adding current limiting capabilities takes but a few minutes. Figure 10 illustrates how an external pass transistor added to the circuit of Figure 9 to increase the regulator's load current current capacity to 500 mA. In this circuit, the output capacity is required to suppress oscillation in the transistor's feedback loop. Design and selection of component values are identical to that of Figure 9.

Another and even simpler type of voltage regulator to work with is a relatively new 3 pin device. This fixed voltage regulator is available from Fairchild, National, and others in a variety of common voltages such as 5 and 12 volts. These regulators, available in the 1 amp range, are quite simple to use in that they require no external components and have only three leads: an Input, an Output, and a Ground. Furthermore, no output adjustment or calculations are necessary, and they are vitrually impossible to destroy. This form of regulator is shown in Figure 10.

The second linear device to be presented is the newly developed IC timer. This device, often referred to as the 555 timer, is produced by a couple of manufacturers, including Signetics and National. A versatile device, it serves many functions, including an astable multivibrator, monostable multivibrator, timer, Schmitt trigger, and others.

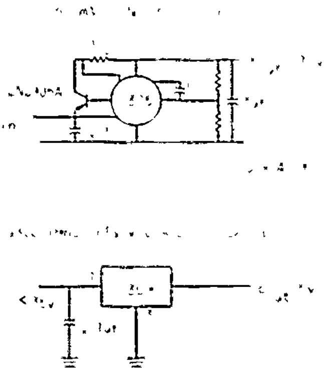


Fig. 10

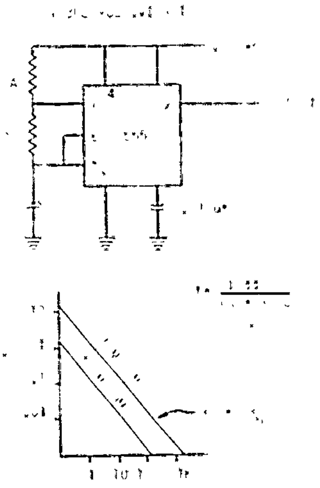


Fig. 11

The 555, often found in a mini-dual-inline package, is shown in Figure 11 connected as an astable multivibrator. Resistors R_1, R_2, and C form the RC time constant which regulates the frequency and duty cycle of the output waveform.

Multivibrator frequency is determined by the indicated formula. However, one may wish to use the graph to select a capacitor for a given output frequency. After selecting the desired frequency on the abscissa, project vertically until one of the two curves is intersected. The required capacitor for the chosen frequency and resistors is then found on the ordinate.

The versatile 555 timer, of course, has many more applications and deserves much investigation.

In summary, it is reasonable to conclude that, with little effort and proper information, IC's can and should be introduced into the industrial arts electronics laboratory. The use of IC's will undoubtedly enhance the program by providing both the instructor and the student an opportunity for experimentation and the satisfaction of being reasonably technologically up to date.

BIBLIOGRAPHY

Hantek, Eugene R. A User's Handbook of Integrated Circuits. New York: John Wiley and Sons, 1973.

Kahn, Michael. The Versatile Op Amp. New York. Holt, Reinhardt and Winston, Incorporated, 1970.

Linear Integrated Circuits. Santa Clara, CA. National Semiconductor Corporation.

Rigby, William H. "Monolithic Integrated Circuits. Implications for Industrial Education." Unpublished Ed.D. Dissertation, University of Northern Colorado, 1972.

Streater, Jack W. How to Use Integrated Circuit Logic Elements. Indianapolis. Howard W. Sams Company, 1969.

Timers. Sunnyvale, CA: Signetics Corporation, 1973.

Dr. Rigby is an Assistant Professor in the Department of Industry and Technology at Northern Michigan University, Marquette, Michigan.

A Humane Technology: Teaching Color Television for the Future

Norman H. Sprankle

A Humane Technology for the Future is this year's AIAA convention theme. As a humane technology, allow me to consider the teaching of color television. Is there a need in the future?

Dr. Olaf Helmer stated that three-dimensional television would be a reality by the year 2000. During another speech for the Electronics Industries Association in Chicago, Dr. Larry Adler from Zenith pointed out that the newest advances in research for consumer electronics were aimed at video tape recorders and large-screen television. In the latest issue of Popular Science, John R. Free writes about Sony's new color video projection system that can project a television picture to a 50-inch diagonal measure TV screen. In the same magazine, R. C. Levine reported on a new system for transmitting slow-scan TV pictures over telephone lines. Of course, all of us here are somewhat aware of the many recent advances in the field of color television, and one wonders what else is to come in the future. From the view of a changing technology, are we to withdraw or advance in our training efforts?

Consumer electronics products are generally grouped into five divisions, including television receivers, radio receivers, tape recorders and players, audio systems, and now electronic calculators. The Electronics Industries Association reported that in 1970 approximately 500 million consumer electronic devices were in use, and that 80 million new units were produced annually. Now, only four years later, new estimates are for 575 million devices in operation, and an annual production of 110 million units. Of these, 11 million are new television receivers and 20 million are electronic calculators for consumers. In comparison, the service technician associations estimate only 120,000 service technicians are currently in the field. E.I.A. estimates an additional 33,000 service technicians are needed annually to meet present and future servicing needs.

Facts seem to point out a cold mathematical need for television service training, but what about the human element? In a recent article of our journal, Man/Society/Technology, Edward J. Roberts supports an anthropological approach to teaching a technology. He writes, "By placing today's technology in perspective with the past, the student can see how man's achievements came into being and why."

We as educators seem to have left out man's achievements in color television that affect the human side to electronics servicing occupations. Today most people think of the serviceman only in terms of images set twenty years ago. New roles and job opportunities need broad exposure. Many capable young men and women are not finding opportunities and possible employment at a time when jobs are open and skills are required for color television and other consumer electronic product servicing. A need for teaching color television is quite apparent.

Allow me now to present some ideas on how to teach color television for the future. Last fall, Dr. Edger Dale at Ohio State University wrote an article for Man/Society/Technology titled "Toward Excellence in Instruction." He points out a short-coming in some current instructional practices:

> The modern teacher realizes motivation to learn is a key goal of all instruction. However, we now seem to be operating on a reward-punishment system of learning as contrasted with one based upon successful growth where failure is seen as a temporary interruption on the road to success. Indeed, nothing motivates like success.

It appears that lack of turned-on students and teachers toward learning and teaching principles of color television links directly to the programs being reserved as a reward for outstanding students or as punishment by restriction to poorer students from other electronics courses. Consideration of a direct motivational approach to teaching color television is in order.

System diagnosis is an established technique for solving problems and promoting learning. The doctor of medicine asks questions of his patients, requests measured and photographical data, and uses his basic senses prior to analysis and hopeful correction of a problem. Diagnosis is based upon study, knowledge, and testing of related systems.

It should be appropriate, therefore, to promote the concept of Television Symptom Diagnosis.

Television Symptom Diagnosis (TSD) as a method of teaching has been used for many years by industry and various teachers, but it is only more recently that it has been packaged for commercial distribution. The Electronics Industries Association brought together the many ideas from industry, and Richard W. Tinnell developed the TSD manuals for our use.

In brief, the TSD system combines dynamic motivational methods and sensitivity training with basic content theory to achieve three kinds of television servicing skills demanded in a vast majority of repair problems:

1. The ability to observe and recognize symptoms in the television picture and sound.
2. An understanding of the television receiver system which allows the technician to relate trouble symptoms to a particular section of the set.
3. A sufficient knowledge of electronic circuitry to allow isolation of the problem to an individual component. (page vi, Tinnell TSD manual)

From the humanist approach, TSD is set to give students positive experiences often and with less background training in electronics than is required in other instructional methods. First-day solving of TV problems is not uncommon. Joseph J. Littrell wrote in M S T last september, "Industrial arts must give each student a challenge to tap his intellectual, emotional, and physical activity in attaining personal achievement. True achievement is a series of personal experiences." A typical TSD lesson does just this.

Using the Television Symptom Diagnosis approach, a classroom teacher would stress the block diagram method for teaching as associated to sectional failures. Television theory would be interrelated, starting from the simple and moving toward increasing complexity, depending upon time and students' abilities. Multimedia devices such as television receiver trainers, film loops, slides and cassettes, and standard CTV receivers are available to stimulate student interest and promote learning. During laboratory periods, students can work in teams or alone to solve servicing problems. Students would systematically diagnose unknown prefixed troubles in television receivers using laboratory diagnosis sheets, theory lesson materials, and appropriate instrumentation. Individual study of film loops or the slide-cassette units reinforce directed instruction.

We have proclaimed many times as an objective to study the tools, materials, and processes of industry. To effectively teach color television servicing for the future at whatever appropriate grade level, we need to cooperate with the member companies that represent the E.I.A.

The Electronics Industries Association has established a Student Technician Development Program (STDP) to in part "attract, prepare, and place young men (and women) in careers as service technicians for the purpose of providing reliable service in the consumer electronics industry." Industry needs us, and they desire to cooperate in every way possible with our training programs. Two years ago, E.I.A. cooperated with educators to support 12 summer consumer electronics teacher training workshops that helped teachers to be up-to-date with industry. Last year the number of E.I.A. workshops was increased to 17, and this summer 23 workshops are being offered. They realize, "It is an established fact that servicing represents one of the most important segments of the electronics industry." Also in line with our convention theme, industry believes, "The ability to deal with people and to care is one of the most satisfying and important assets we can have."

Teaching color television servicing for the future is an apparent must for us as industrial arts educators. The Television Symptom Diagnosis approach is a new method to be experienced, and now is a most appropriate time.

REFERENCES

Helmer, Dr. Olaf, "The Future State of the Union," a speech at the 36th annual American Industrial Arts Association Convention, April 18, 1974.

Adler, Dr. Larry, "Recent Research in Consumer Electronics" a speech at the Electronics Industries Association Instructors Conference in Chicago, February, 1974.

Mr. Sprankle teaches in the Industrial Arts Department, California State University, Humboldt, Arcata, CA.

Foreign Programs

Technology Programs in Quebec Schools

John B. Gradwell

Je voudrais présenter un nouveau programme, "Initiation à la technologie." Perhaps this is the first time that a presentation has been started at the American Industrial Arts Association Convention in French. I have not done this to demonstrate my knowledge of the French language, unfortunately, my abilities in that direction are somewhat below par. My reason is to illustrate as vividly as possible one of the major differences between this program and other new programs which emerged in North America during the nineteen sixties.

AMERICAN PROGRAMS

It is characteristic of the country which is the top dog — the most advanced country — to look inward toward itself. We might speculate that this is one of the reasons that all advanced nations have eventually fallen but that is a philosophical question to be discussed in other circles. Nonetheless, it is a fact that the U.S.A., being the most advanced nation during the last fifty years, has been inclined to look no further than its own shores for new ideas. It has taken an event of major proportions such as Sputnik to suggest to one sector of the educational community that other countries may have progressed further. This kind of shock did not happen in the practical and vocational arts. The programs described by Leslie Cochran in his book concerning programs which emerged during the sixties did not evolve from observations of ideas in other countries, as was the case in the United States at the end of the nineteenth and beginning of the twentieth century. Areas bordering on the U.S.A. reflect this same approach. In Canada and Puerto Rico, programs bear the title industrial arts, thus indicating that the major influence was the United States as, of course, industrial arts is an American-coined phrase.

In saying that all the programs which surfaced during the nineteen sixties tended to be developed by looking inward is to imply that somewhere on the outside there were other countries developing programs which in some ways were different. The initial most obvious difference in these programs is the title of each. The term industrial arts is peculiar to the first half of this century and, as mentioned, only where United States influence has been the greatest. It could not exist until the late nineteenth century because, by definition, industrial arts indicates an acceptance of industrial mass production methods coupled with a reaction by the arts and crafts movement against the dehumanizing aspects of factory work and the poor design of objects produced. Industrial arts is thus a term peculiar to a particular point in time. We may ask, as others have done before, "What's in a name." Perhaps nothing of itself, however, other nations which developed new programs in the late sixties chose different terms, and the programs do reflect these name differences. For comparison purposes I will mention two of these, the programs in Japan and Britain, before progressing to the main topic for discussion, the French program and its offshoot in the Province of Quebec.

JAPANESE EDUCATION

In Japan, the emphasis for the middle school changed in the middle sixties from a watered-down version of the senior high school vocational program to "engineering education." Major components in the program are design and technical drawing, the properties and workability of materials, mechanical movements, electrical engineering, and gardening, coupled with the practical application of each component. Considered as isolated units, these parts may appear to be similar to many industrial arts programs, however, the points emphasized are creative imagination and the scientific method of selecting and treating material systematically, accurately, and precisely. Mechanisms of working machinery are examined through a study of the fundamentals of machine elements and mechanisms, and by understanding power transmission and the functions and capacity of machinery. Electrical engineering includes machines related to everyday life, including lamps, heaters, motors, and home equipment. Gardening is studied through the cultivation of flowers and vegetables and the observation and analysis of soil and weather conditions. Above all, practical applications are emphasized through the design, construction, and completion of a machine, apparatus, or model which includes mechanical, electrical, and materials science aspects. In summary, the Japanese engineering program for the middle schools emphasizes the understanding of mechanical, electrical, and materials sciences through rational thinking and experimental work creatively conceived.

The term "engineering" would appear to be less restricted to a particular time frame than is the case with "industry." Man engineered bridges and designed all forms of edifices many centuries before industry was ever thought of. Perhaps the term implies that man must have reached a fairly high level in his ideas and work before his articles can be said to be engineered. Thus it is not as timeless as technology, the term used by the other programs to be examined.

BRITISH PROGRAMS

In Britain, programs at the middle school level had, from 1900 to 1960, emphasized the arts and crafts movement's reaction against industry. Hence, objects made were very well designed but were constructed primarily by handcraft methods and reflected the program title, craft education. The usefulness of these programs was questioned in the middle nineteen sixties, with the result that a Schools Council Project examined various alternatives, particularly a study entitled "A School Approach to Technology" and "Engineering Among the Schools." The term technology was eventually chosen as one which would embrace the purposeful use of man's knowledge of materials, sources of energy, and natural phenomena, regardless of the time period.

Work done by the students has many commonalities with the Japanese program. Creativity, production of prototypes, and analysis of the results are paramount. Some examples of student-conceived and -designed work are:

Hovercraft — design and construction of fan, ductwork, stability, and directional control
Linear Motor — design and construction, useful application
Moiré Fringe Applications — measurement, analysis of numerical machine control, interference patterns
Rocketry — design and construction of firing mechanisms using solid fuels, experimental data obtained
Stress Analysis — strain viewing using polarized light
Structures — design, construction, and testing of simple structures made to scale

FRANCE AND THE PROVINCE OF QUEBEC

Previous programs have been mentioned primarily for the purpose of illustrating the similarities between programs developed outside North America. The program in Quebec is, however, the main point of this presentation.

During the middle sixties, the Government of Quebec studied secondary education and published the Parent Report. A major directive of this report was, "...all young people when they enter the secondary grades should take language, science, art, and technical courses. In consequence, they will become aware of the main aspects of the culture and knowledge of their day" (Volume II, Article 212, Page 128). This was interpreted as giving students a knowledge of technology without aiming at specialization.

A committee established to discover the best answer to this directive initially examined industrial arts as taught in the Province of Quebec, but was unhappy with the watered-down introduction to trades. Visits were made to the United States, but programs were in the process of being changed and either they had not been finalized or they were, the committee felt, being presented as the ultimate answer.

Quebec is 80% French-speaking, thus the next logical place to visit was France. Three teachers were delegated to go there with the object of familiarizing themselves with the French method of teaching technology. Upon their return, three school commissions were authorized to try out an adaptation of the method in pilot classes during the 1969-70 school year. The schools chosen were Commission des Ecoles Catholiques de Montreal, Deux Montagnes Regional High School, and Le Royer Regional High School.

From nineteen seventy to the present time, this program, Introduction to Technology, taught at the grade eight level, has become increasingly accepted, as evidenced by the number of pupils enrolled. Last year this acceptance extended to the English-speaking population of Quebec with a teacher education program during the summer at McGill University. Early reluctance by Anglophones was partly the result of certain teachers feeling "comfortable" with the traditional approach, but there was more to it than that. The new program was French, and there had been relatively little consultation with

English-speaking teachers prior to its adoption. In fact, material available today is still largely in the French language.

OBJECTIVES AND PEDAGOGICAL FOUNDATIONS

Technological education as taught in Introduction to Technology enables the teacher to bring students to a greater awareness and understanding of technical objects, develop in the students qualities of judgment, method, contemplation, and imagination, using the technical object as a basis, develop ability to analyze, research, synthesize, and express themselves verbally and graphically.

Technological education is not lessons about things, popularized science, initiation to industrial techniques, initiation to trades, initiation to employment, traditional teaching, or mass-producing things. Methods advocated within the Introduction to Technology program encourage a great deal of freedom and involvement on the part of the student. Immediately, because of the French context, one thinks of Rousseau, however, Carl Rogers' thoughts have had the greatest influence. The curriculum has been written with the idea that the best education is one which is based on a desire to find out for oneself. Through continuing contact with the technical object, the student discovers certain physical laws and solves the problems which present themselves, on his own. The whole of this work must be done by the student. The teacher is there only as a guide who channels, motivates, and directs the student's efforts. He poses problems and asks questions which lead to the solution of problems, rather than passing along information or enumerating facts.

It is an activist pedagogy where discovery is more important than transmission of information, and where the problem is always open-ended. The student observes, reflects, abstracts, constructs, and evaluates technical objects, as shown in Diagrams 1 and 2. Simultaneously, the teacher guides and motivates him by the use of technical objects containing principles or learning experiences shown in Diagram 3.

Logical diagram of process from conception
to production of the technical object.

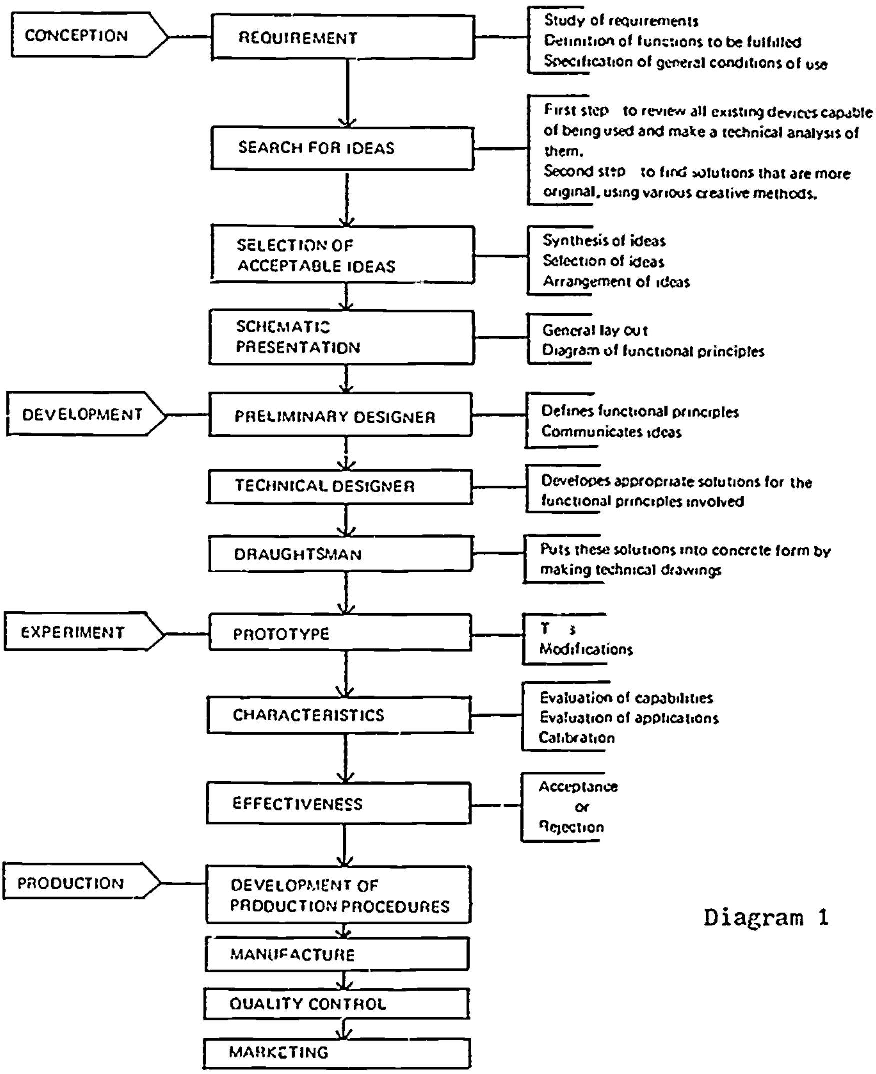


Diagram 1

Source; Government of Québec, Department of Education, Document 889A, Page 11.

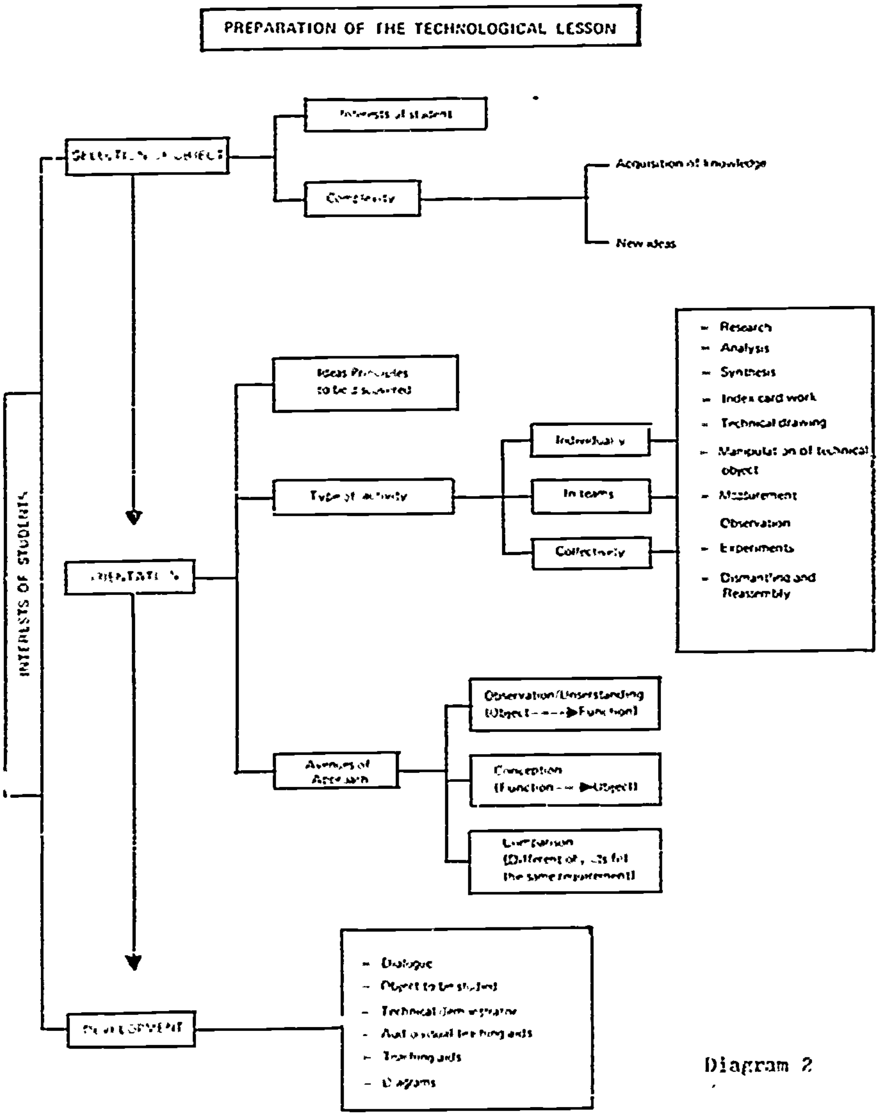


Diagram 2

Source: Government of Québec, Department of Education, Document 880A, Page 16.

Diagram 3

PARTIAL LIST OF PRINCIPLES & OBJECTS

Principle or learning experience	Technical object
1. Meaning of technology —History of technology —Technology today	
2. Graphic expression & measurement —Graphical media —Measurement; length, diams., angles, and weights —Diagram types; layout, functional, technological —Sketches, perspectives, sections —Lettering	Rule, calipers, micrometer, dynamometer
3. Elementary mechanical functions —Bonding —Guidance —Articulation —Lubrication	Portable vise, fishing reel, hand-operated grinder, hand-operated drill
4. Forces —Concept —Uses	Caulking gun, tumbler switch, weighing scale, ratchet jack.
5. Translation —rectilinear —guidance in translation —different linear motions	Barrel bolt, stapler, oil can with pump, tire pump, curtain rod
6. Rotation —types of rotation —speed ratios —conversion of motion —guidance in rotation	Pulleys, speed reducer, pipe cutter, hand mixer, friction drive.
7. Translation & rotation —conversion of translation to rotation —conversion of rotation to translation —screw-thread systems	Internal combustion engine, fishing reel, gear puller, automatic screwdriver
8. Electricity —simple series & parallel circuits —combined series & parallel circuits —magnetism	Electric bell, lights, switches, instruments

THE FUTURE OF INTRODUCTION TO TECHNOLOGY

Efforts to expand this program will depend on the amount of teaching time available; that is, whether or not the program can be expanded into a higher grade level. Consideration should be given to other aspects of technology. It is not only important how an object is designed and made, of greater significance is the use or abuse we make of technological objects in our environmental systems.

The two most obvious examples which affect our daily lives are housing and transportation. Houses can be isolated boxes or part of a community where people of all ages interact and where children can walk to school without ever crossing a street. Transportation can likewise be good for us all, or it can be smog-producing and land-gobbling.

The technological object is never bad in itself. It is what we do with it. Thus, it is hoped that the next phase of Introduction to Technology will be the humanizing one. This will be the McGill University and Anglophone sector's contribution.

Dr. Gradwell is a member of the Faculty of Education, McGill University, Montreal, Quebec.

Polytechnic Education in Soviet Secondary Schools

Lorin V. Waitkus

Polytechnic education is a term which has existed with educational leaders since the beginning of the Soviet regime in 1917. The term has undergone a series of modifications and revisions since the early Soviet leaders proclaimed it as a Communist Party objective of education.

The Soviet educational system consists of nurseries, kindergartens, primary schools, secondary schools, special secondary schools, vocational and technical schools, institutes, universities, correspondence schools, adult schools, part-time schools, and non-degree schools. (3:275-276) Many of the educational institutions deal with polytechnic education in various degrees. This presentation will consider only the polytechnic education provided in selected ordinary and special secondary schools of the Soviet Union.

Before reviewing the various directions that polytechnical education has taken in the Soviet Union due to changing situations and needs, it might be well to present in abbreviated form a general outline of characteristic features which put together might form a heritage of Soviet education.

OVERVIEW OF SOVIET EDUCATION

The goals of education in the U.S.S.R. have certain characteristics, and these in two words would be quality and quantity. The goals or problems may not be different from other countries. However, there remain several peculiar features when compared to other countries.

Fifty-five years ago, 70% of the population was illiterate. At the establishment of Soviet power, leaders in the country had to look after the problem of providing instruction in the 3 R's. To provide these skills became the goal for about the next twenty years.

The revolution ushered in an era of so-called experimentation in Soviet schools. Education at this time meant learning by doing and learning only those things which were currently practiced or showed immediate results. Self-management by students, the absence of disciplinary action, the abolishment of textbooks and homework were practiced wholeheartedly. Education came to mean productive work. Most accounts of this period conclude that the educational system was chaotic.

The Unified Labor Schools which had replaced the pre-revolutionary schools developed into the schools of the 1920's. "Unified" meant that all grades were in one school, and "labor" meant socially productive labor as a basis of all education. (2:62-63) A redefinition of the purpose of the Unified Labor Schools where children received information about nature, labor, and social life began to reveal a desire for compulsory education. In the 1920's, compulsory four-year education was established. A dissatisfaction with progressive education came to the surface in the early 1930's. The Central Committee of the Communist Party ordered the schools to "apply themselves more seriously to instruction." (2:71) Albert P. Pinkevitch, Anatol V. Lunacharsky, and Paul P. Blonsky, who advocated that education was a process of learning by doing, as many other progressive educators advocated, disappeared from the scene. Anton S. Makarenko rose to become the outstanding educator of conservative educational practices. The conservatism was reminiscent of pre-1917 years.

Whether the events that occurred can be attributed to a sincere searching of the place of education in the new Soviet society or whether, as Fred M. Hechinger, education editor of The New York Times, reported, there was a plan to eliminate pre-revolutionary educators from a position of perpetuating the foundations of a bourgeois system cannot be fully assessed. (4:49-50) For whatever reason, a party directive was issued in the early 1930's. Where the schools of the 1920's had been progressive, the edict of the 1930's was that schools had the responsibility of producing the new Soviet man. The educational plans were progressing from revolutionary to evolutionary steps. It was in the 1930's and 1940's that seven years of education became compulsory. After World War II, planning and implementing had to start all over. A quarter million schools were destroyed, and four million teachers were lost in the war. In the 1950's, the Soviets began moving to eight years of schooling. In 1952, plans were including a universal ten-year school.

In the late 1950's, a nationwide campaign by parents, teachers, and government officials started asking what is wrong with education. What should be the aims? Dr. Zoya

Zarubina, Chairman of the Education Commission, stated that education was being taken too seriously. It was too formal and too academic. The final product, the graduate, was familiar with literature, history, and antique subjects, but was divorced from the practical aspects of life and society. Student interest was not being satisfied. Since not all students were destined to be foreign ministers, the schools had the task of bringing them back to realities of life.

With the explosion of scientific knowledge, it was felt that people were needed not only for higher training, but also for training in the middle ground. People were getting an education, and not all were destined necessarily for higher education. A form of technical or practical education was needed. The people started with the idea of how they would like a school, and this school was a general polytechnic school, a dream that people had from October 1917. That was the dream, and the people felt they really needed that kind of school. Financially, this was not to be. The new regulation read ten years of schooling and one final year where the students would do practical work to bring them closer to the necessities of society.

Sharp criticism was voiced, saying that the new plan really did not serve the purpose or do the job. It was probably more desirable to encourage parents and teachers to look for talents and branch children off to specialization as soon as these talents or interests were recognized. Parents said, "I think my child has a talent for music, but you want to make some sort of craftsman out of him, and I know he will not like it or be happy." There were many more similar examples.

After approximately four years of experimentation, compulsory schooling was reduced to ten years. In 1975, the first results of ten-year compulsory schooling will be known.

Soviet education extends beyond the classrooms of the schools. The extracurricular activities are oriented toward ideological indoctrination and the molding of the Soviet man, however, there are also many non-political activities. There are children's theaters and nationwide clubs, such as the Young Technicians and the Young Naturalists. (7.118) An establishment of Pioneer Palaces provides a range of social, artistic, technical, recreational, and hobby activities, government support of these activities is extensive. Three popular extracurricular groups are the Octoberists, Pioneers, and Komsomols.

The Octoberists are children who range in age from seven through 10. The boys and girls are provided with experiences that center around an understanding of people around them, a respect for teachers and adults, a knowledge of the various work activities done for the benefit of children, and the realization of the necessity of practical work. Nearly all youth are members of this group.

The Pioneers range in age from 10 through 14 and have activities housed in Pioneer Palaces. These palaces are centers for cultural education where values are instilled. One would expect to see luxurious surroundings in these palaces, and one does. Ninety-five percent of the youth in school are members of the Pioneers.

The Komsomols range in age from 14 through 28 and are a political organization. Their responsibility is to the community. Approximately 80% of the children in school are members.

The Octoberists, Pioneers, and Komsomols play an eminent role in the moral upbringing of students. Numerous technical activities are available through these groups.

There are many Soviet educational achievements of the 1970's. Three of the major accomplishments deal with curriculum. Elementary school is covered in three years rather than four. In the fourth year, students begin to study separate subjects and go to different teachers. They also begin the study of the elements of algebra.

The sciences have more content and a logical continuity in the curriculum. A nationwide project enlisted the aid of professors, scientists, and others knowledgeable in physics, mathematics, and science to write books for school use. In 1972, books appeared which were written not by people in education but by people in a position to know of all the advancements in the various fields.

Advanced courses in science and humanities have been introduced in the secondary schools. Teachers come from other schools to instruct the advanced students if specialized teachers are not on the staff.

Polytechnization of the curriculum has been the dominant theme of official party directives. While inextricably a part of compulsory general education, definitions and modifications of polytechnization can be examined. Let us investigate the thread of polytechnic education in the total fabric of Soviet education.

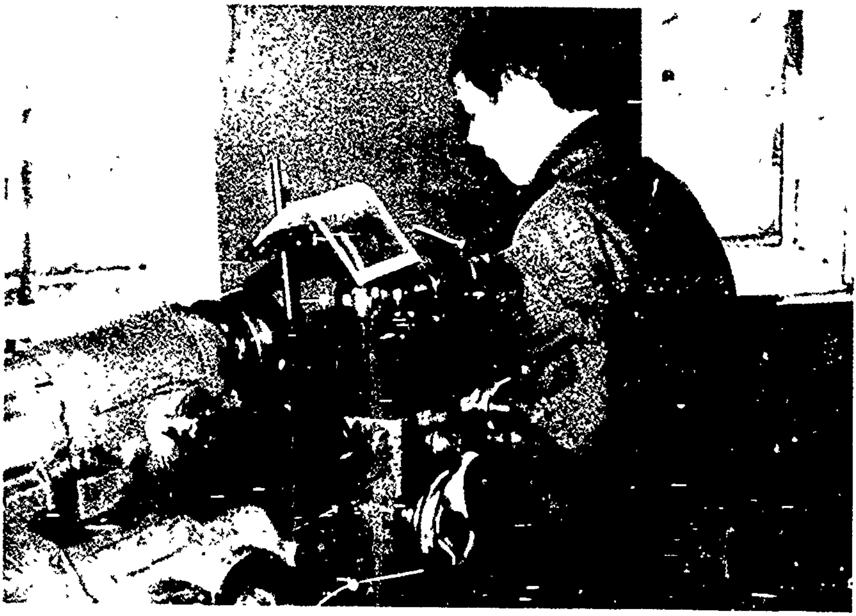
POLYTECHNIC PROGRAMS IN SOVIET SECONDARY SCHOOLS

The concept of polytechnic education has existed since the inception of the Soviet State. The installation of the concept into a workable form within the curriculum has not been as successful as one might expect or imagine. The principles were based on the Marxist-Leninist doctrine of Communism, which proposed a greater effectiveness of education if taught through manual labor. Three elements considered basic to education were mental, physical, and technical. The technical can be described as polytechnic education, or the knowledge of the scientific basis of production and skill with the use of tools. Nadezhda Krupskaya, in her writings concerning education, seemed to set a tone for polytechnic education in the 1920's. She emphasized a close relationship of education and labor. When first conceived, the term probably designated a type of teaching which familiarized students with basic principles of production processes and provided students

Museums in schools are oriented to ideological indoctrination.

with the skill with which to use those tools. The establishment of polytechnization had finally begun. However, the lack of shop facilities, equipment, and laboratories hindered a complete polytechnization of the curriculum. Unwittingly, theoretical learning was pushed into the background unless it had a direct application to practical work. Dissatisfaction with this viewpoint grew in the 1930's, since the education that evolved seemed to be nothing more than vocational training. The program had grown to contradict the basic thoughts of Marx, Lenin, and Krupskaya. Regardless of the proper fact or reason of why the Central Committee changed its stand on polytechnic education, the original approach was lost or at least temporarily tabled. The 1920's was a period of experimentation and showed much interest in Western ideas, especially Dewey's theories of "learning by doing" and James's philosophy. The emphasis in the 1930's was on a traditional academic curricula and conventional teaching methods, polytechnic education was to rest for 20 years.

In the 1950's, the Party Congress proposed to undertake again the realization of polytechnic education. The Nineteenth Party Congress in 1952 ordered a reintroduction of polytechnic instruction. One of the most outstanding features of Soviet education had been the establishment of the relationship of general and polytechnic education. To promote education divorced from a mastery of the natural and physical sciences had a de-



Student in secondary polytechnic class learns basic machining skills.

terring effect on the underlying principles of polytechnic instruction. The previous plans had failed to prepare fully competent people in this aspect. Polytechnic education in the 1950's came to mean that theory and application are interdependent and must be equally emphasized. It was assumed that to be effective polytechnic courses had to include vocational training. (5:28)

At the central level, plans had to be made for the improvement of laboratory facilities, a reduction of time for book learning in favor of instruction by doing, providing shop facilities, and making agricultural and industrial training part of school. This meant teacher retraining, rewriting syllabi, and developing new teaching methods. A proliferation of literature appeared suggesting how polytechnic knowledge could be included in many school subjects. The change was slow, as you might expect.

"The Ministry of Education of the RSFSR (Russian Socialist Federated Soviet Republic), in cooperation with the Academy of Pedagogical Sciences, designed an experimental syllabus in polytechnical education and introduced it in 500 of its schools in 1956-1957." (2:257)

Korol states that the lack of shops and shop equipment vital to polytechnic education hindered the total implementation of the program. Also, the inability to provide the necessary number of teachers with a polytechnic outlook hindered total adoption of the plan in secondary schools. (5:32)

Polytechnic education was a tremendous adventure and thrust of efforts in preparing youth for vocational purposes. The movement of polytechnic instruction in the secondary school setting moved slowly. This may have prompted Khrushchev to take more vigorous action in establishing such instruction. In 1958, Khrushchev announced that work was an essential part of a Communist society and that the schools had departed from Marxist-Leninist principles. Students should have more labor experiences. Parents, teachers, and government officials also felt that schooling was divorced from the realities and necessities of life. The October 1917 meaning of polytechnic education was again coming to life. The term would take on the meaning of "work-study." (6:104) An eleventh year was added to the curriculum in order to provide more work experience for the student. This was to be made universal in 1965. As polytechnic education was redefined by the Party Congress, so were the methods of implementation within the schools revised by educators.

After the year was added to the curriculum, parents, teachers, and government officials felt that the plan was not doing what it was expected to do.

Several arguments against the eleven-year school are worth noting. First, more capable students were losing one school year on their way to higher education. Second, work experiences that students derived were not as valuable as first imagined. Workers who were assigned students complained that they could not meet production quotas because of the added responsibilities. Students, on the other hand, did not see the total production process. These were but a few of the many complaints voiced by those concerned. (1.26-40) The goal of polytechnic education which came to life was the joining of theory and application. While guides were written showing how the application could be made from theories, the shortage of equipment, shops, and laboratories prevented a realization of this ambitious venture.

The problem concerning the development and implementation of efficient polytechnic education was discussed with Mr. Bronevchuk, Deputy Chief of the Department of Methodology and Curriculum of the Ministry of Education of the R.S.F.S.R., Moscow. He reaffirmed the Soviet position on polytechnic education. He stated that the problem is complicated for many people and nations seeking solutions. In the Soviet Union, semi-skilled, skilled, and highly-skilled manpower are needed for industrial and agricultural production. Physical laws must be demonstrated within the curriculum where they can be applied. Further, physical laws on which polytechnic education can be based must be isolated. His response implied that future endeavors in polytechnic education would be grounded in physical laws where they can be applied to aid in industrial production and fulfilling agricultural expectations, two major problem areas.

Presently, polytechnic education in secondary schools generally means performing various production practices and learning to use tools common to woods and metals fabrication. Drafting may be included in this category.

OBSERVATIONS OF POLYTECHNIC PROGRAMS IN SELECTED SCHOOLS

Shop courses were offered in forms (grades) four through eight in School 34 located in West Moscow. The facilities consisted of five rooms. The fitting shop contained equipment and tools for instruction in hand processes in metalworking. A milling shop contained several milling machines, and the turning shop contained metal lathes. A toolroom was located near the metal shops. A joinery shop was equipped with woodworking benches and a variety of woodworking equipment. The hand tools at each bench, square, mallet, and rule, appeared to be hand-made. Another Moscow school had a basement room for shop instruction. There appeared to be an adequate supply of materials for the various shops. The projects were skillfully completed by the students.

Other schools visited contained essentials of metalworking and woodworking. Drafting was studied by both boys and girls. Girls in several home economics classes were observed designing dress patterns to scale prior to sewing them.

Textbooks used by the students in drafting in the various forms were judged to be well organized. Textbooks are inexpensive in the U.S.S.R. and are revised every five years. The drafting book used in the seventh form, which was obtained from the Ministry of Education in Moscow, cost approximately 13 cents. The book used in the eighth form cost approximately 20 cents. Western educators generally agree that the content of textbooks is superior, while the purchase price is inexpensive.

The uniformity of curriculum, textbooks, and methods are characteristic of Soviet education. Theoretically, one can expect to find the scope and sequence of courses the same throughout the ten forms or grades. Realistically, however, one can find qualitative differences between schools located in urban centers and schools located in rural areas. Schools are sponsored by enterprises or social agencies. The extent to which a school is sponsored can cause qualitative differences. Sponsors of schools, whether enterprises or other social agencies, can and do provide equipment and materials that can set apart and enrich schools. A Moscow school in a fabric-manufacturing area, for example, may be sponsored quite differently than a school in an area where electrical heavy equipment is produced. A school in Novosibirsk near Akademgorodok (Academic City) may have as a sponsor an institute devoted to research in the hydroforming of metals.

Shop work in woods and metals usually began in the fourth form and advanced to the eighth form in the schools visited. Variations and discrepancies in polytechnic courses occurred in special schools where foreign language instruction was stressed.

Representatives of the Leningrad Pedagogy Institute reported that entrance require-

Typical school in Moscow.

ments were being modified to attract more men into teaching. Polytechnic teachers completed training in institutes where experience could be gained to supplement the pedagogy requirements.

There have been many experiments, changes, and counterchanges in polytechnic education in the secondary schools. The following are some of the accomplishments and shortcomings as viewed by the author in the selected schools that were visited.

Accomplishments

1. Shop classes and drafting have been added to the curriculum.
2. Drafting is studied by both boys and girls.
3. Centralized planning provides scope and sequence to the secondary school curricula.
4. Textbooks are rewritten every five years.
5. Provisions for teacher retraining are provided.

Shortcomings

1. There is a shortage of shop facilities, equipment, and tools.
2. There is a shortage of schools.
3. Polytechnic curriculum centers around production practices but neglects other components such as management and personnel practices.
4. While knowledge has been structured in science subjects, the structuring of polytechnic subjects has not taken place.
5. There is a shortage of polytechnic teachers.
6. Financial outlay for equipping shops is not available.

COMMENTS

Free and universal public education at all levels is a national policy in the U.S.S.R. Education is viewed by the Communist Party as the process for the formation of a Communist state. The accomplishment of this end can only be realized through the formation of the new Soviet man.

Students in primary school learn their native language or Russian, a foreign language, mathematics, natural science, geography, history, drawing, singing, handicrafts, and physical education. (3:287) Pupils learn skills in handicrafts through the use of fabrics, paper, and cardboard.

Secondary schools add literature, history, mathematics, geography, physics, chemistry, biology, foreign languages, and military training. The curriculum is large, and the discipline is strict. Students must actually know the subject before they are passed. Students work at the frontiers of knowledge at an early age. Most Western observers say the system yields results.

After seven years of schooling and having attained the age of 14, a Soviet youth has completed seven years of mathematics, four years of biology, two years of physics, one year of chemistry, three years of foreign language, and one year of drawing. Regular secondary schools offer work training in industry or agriculture. Shop experiences include working with metals and woods. The purpose of the practical work is to learn production practices.

The U.S.S.R. is committed to education as a means of national progress and advancement. Every leader, which includes Lenin, Stalin, Khrushchev, and Brezhnev, has vigorously supported general and polytechnic education.

REFERENCES

1. Benton, W. The Teachers and the Taught in the U.S.S.R. New York. Atheneum, 1966.
2. Bereday, G. Z. F., Brickman, W. W., and Read, G. H. The Changing Soviet School. Boston: Houghton Mifflin Co., 1960.
3. Foreign Area Studies. Area Handbook for the Soviet Union. Washington, D.C., Government Printing Office, 1971.
4. Hechinger, F. M. The Big Red Schoolhouse. New York: Doubleday, 1959.
5. Korol, A. G. Soviet Education for Science and Technology. Cambridge: M.I.T. Press, 1957.
6. Shimoniak, Wasyl. Communist Education, Its History, Philosophy and Politics. Chicago: Rand McNally & Co., 1970.
7. U.S. Department of Health, Education, and Welfare. Education in the U.S.S.R. Washington, D.C.: Government Printing Office, 1959.

Dr. Waitkus is a member of the faculty at Wiley Junior High School, Cleveland Heights-University Heights School District, University Heights, Ohio.

Futurology

Technology Assessment: Implications for Industrial Arts

Donald P. Lauda

Sec. 2. The Congress hereby finds and declares that:
(a) As technology continues to change and expand rapidly, its applications are:
(1) large and growing in scale; and
(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.
(b) Therefore, it is essential that, to the fullest extent possible, consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems (Public Law 92-484).

This law established the Office of Technology Assessment on October 13, 1972. Since that time, the concept of Technology Assessment (TA) has been expanded and is currently a new area of study in many universities. At the same time, a great deal of confusion has arisen, since several offices now exist for TA, as well as an International Society for Technology Assessment. This paper will trace the development of this movement, identify the function of the various agencies, and consider the implications for industrial arts education.

Three sources of input provided much of the content for this paper. Number one was the First International Congress on Technology Assessment held at The Hague, The Netherlands, from May 27 to June 2, 1973. The writer was in attendance at this Congress. Number two was a personal interview with Mr. Andy Chinni of the Office of Technology Assessment on March 29, 1974. Number three was a personal interview with Mr. Jeffrey Forman of the Office of Technology Assessment and Forecasting on March 29, 1974. The writer wishes to express his gratitude to Mr. Chinni and Mr. Forman for their assistance.

DEFINITION

The general term, Technology Assessment, has been used loosely to mean any or all aspects of four types of TA: policy-oriented, issue-oriented, technology-oriented, or methodology-oriented. All groups share a central theme: the identification of "second order" and other indirect effects of technological innovations and the use of this information to improve decision making on the social use of technology. When Rep. Emilio Q. Daddario proposed the Office of Technology Assessment on March 7, 1967, he defined TA in this manner:

> Technology Assessment is a form of policy research which provides a balanced appraisal to the policymaker. Ideally, it is a system to ask the right questions and obtain correct and timely answers. It identifies policy issues, assesses the impact of alternative courses of action, and presents findings. It is a method of analysis that systematically appraises the nature, significance, status, and merit of a technological program.... (It) is designed to uncover three types of consequences—desirable, undesirable, and uncertain.... To assess technology, one has to establish cause and effect relationships from the action or project sources to the locale of the consequences.... The function of technology assessment is to identify (all impacts and trends) both short-term and long-range.... The focus of Technology Assessment will be on those consequences that can be predicted with a useful degree of probability (11, 10).

Countless definitions have been offered since this time. To the writer, TA represents a systematic, comprehensive, and value-free analysis of the consequences of a technology that is introduced, extended, or modified.

HISTORICAL DEVELOPMENT

The concept of Technology Assessment is nothing new. Assessments of inventions and innovations have always taken place. Admittedly, these were initially very crude and were utilized to judge the effectiveness of war implements or the profitability of new techniques. Nonetheless, every tool, product, and innovation was evaluated in some fashion. Unfortunately, only the primary effects were evaluated, and countless numbers had to suffer tragic human indignity. Even today, in the so-called modern era, every human suffers from the mis-use of our technology.

As the growth of our technological world progressed and random invention and innovation gave way to systematic efforts, the need for more detailed assessments became apparent. The industrial revolution brought formal opposition into the limelight, which was a forerunner of the multifaceted nature of TA we are seeing today. People consciously raised issues which went beyond profit. These issues were human safety, human welfare, and human dignity. Karl Marx was probably the forerunner when he pointed out that technology has social and cultural ramifications beyond the first-order effects.

Unfortunately, our society failed to undertake formal assessments and watched as failure after failure forced us into irreversible situations. The use and mis-use of DDT is a prime example. It took 100 years for society to identify the dangers and stop its usage. Even prior to the synthesization of DDT, groups were available for handling assessments. In 1830, the Franklin Institute was asked to investigate boiler explosions, resulting in workable legislation 22 years later. Later on in that century, the National Academy of Sciences was formed, but asked for advice too infrequently to make a worthwhile impact. Even today, according to Vary Coates (14, 91), TA has been performed in federal agencies only in the sense of narrow consideration...only a few studies can be cited as serious attempts, and most of these have been performed outside the federal government.

It was not until the 1960's that individuals and groups took action to formulate an "early warning system." Members of the House Committee on Science and Astronautics raised concern over the dangerous side effects of technology during the 1960's. This concern was raised because the role of technology played an important role in the legislation under their consideration. On October 17, 1966, the Subcommittee on Science, Research, and Development published a report that examined the secondary impacts of technological innovations. This report was the first to use the term "Technology Assessment." The subcommittee was concerned with topics such as unemployment, pesticides, pollution, exhaustion of resources, radioactive wastes, and the invasion of privacy.

On March 7, 1967, Rep. Emilio Q. Daddario proposed the creation of a Technology Assessment Board. He raised concerns about the population explosion, freedom of choice, the power of technology, and the fact that science and technology had become a way of life. Needless to say, the $157 billion of public and private funds invested over the past decade influenced his thinking. This proposal resulted in the publication of three reports published by three different groups, National Academy of Sciences, National Academy of Engineering, and the Legislative Reference Service. Armed with these reports, among others, Daddario's subcommittee held hearings on TA, exploring the need for legislation. During this period, many meetings were being held throughout the world to discuss the potential of TA. The Organization for Economic Cooperation and Development met in Paris in 1972. That same year a meeting was held in Milan, made up of representatives from NATO, NSF, and the International Institute for the Management of Technology. During the very same month that the Milan meeting took place, the Third World Future Research Conference addressed the topic in Bucharest. It was apparent that TA was an international concern.

After numerous proposals and amendments were made, Public Law 92-484 was signed by the President on October 13, 1972. This law created the Office of Technology Assessment.

Two other important groups were formed during this period. The first International Society for Technology Assessment was formed with offices in The Hague, Washington, and Montreux, Switzerland. On May 27—June 2, 1973, this group held the First International Congress on Technology Assessment at The Hague, The Netherlands. This conference was attended by 225 persons from twenty countries. Over 85 papers were presented, covering a wide spectrum of academic disciplines, industrialists, government officials, students, and citizen activists. The writer, who was in attendance, was particularly impressed with the interest expressed world-wide and the multi-discipline approach proposed by literally every presentor.

The other group which was formed during this period is the Technology Assessment and Forecast Office, located in the Department of Commerce. This office published its first materials in May of 1973, followed by a subsequent publication in December of that same year. The function of this office and the OTA is as follows.

OFFICE OF TECHNOLOGY ASSESSMENT

The OTA is within and responsible to the legislative branch of the Government. This is only the third time that Congress has set up an independent entity within the legislative branch to serve its own needs. Within this jurisdiction, the OTA was given the charge to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which could assist the Congress. Specifically, it is to:

1. Identify existing or probable impacts of technology or technology programs,
2. where possible, ascertain cause-and-effect relationships;
3. identify alternative programs for achieving requisite goals;
4. identify alternative technological methods of implementing specific programs,
5. make estimates and comparisons of the impacts of alternative methods and programs,
6. present findings of completed analyses to the appropriate legislative authorities,
7. identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates; and
8. undertake such additional associated activities as the appropriate authorities may direct (11, viii).

Assessment activities undertaken by the Office may be initiated upon the request of: (1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members, (2) the Board; or (3) the Director in consultation with the Board.

The Technology Assessment Board consists of 13 members made up of 6 senators (3 majority), 6 representatives (3 minority), and a nonvoting Director. The Chairman (currently Sen. Edward M. Kennedy) is selected by the Board, but he/she must be from the House of Representatives during even-numbered Congresses, and the Vice Chairman must be from the other House. The Board also has a Director (currently Emilio Q. Daddario) who is appointed by the Board for a 6-year term, a Deputy Director, and a staff. In addition, the Board has an Advisory Council made up of 12 members with staggered 4-year terms. Ten of these members must be from the public sector, eminent in one or more fields of the physical, biological, or social sciences or engineering, or experienced in the administration of technological activities. One member must be the Comptroller General, and the 12th person must be the Director of the Congressional Research Service of the Library of Congress (11,6-9).

On February 12, 1974, Senator Edward M. Kennedy (1, 2) announced the first six areas of investigation by the OTA as food, energy, the oceans, materials resources, technology and international trade, and the bioequivalency of drugs. Transportation problems are also being considered for assessment. As of March 29, 1974, the only study being done is one on the bioequivalency of drugs, which is designed to guarantee the bioequivalence of drugs throughout the country. Although the Office received only $2 million of its $5 million budget due to its late opening date, it is expected that for FY 1975 the full $5 million will be granted to work in the other areas.

The OTA actually acts as a liaison group between Congress and the assessment team which is contracted. Ad hoc task forces will carry out the actual assessments, since the OTA by law cannot operate any laboratories, pilot plants, or test facilities. The Office may enter into contract with any person, firm, association, corporation, educational institution, or with any agency of the United States, with any state, territory, or possession. Assistance is also to be provided by the General Accounting Office, the Congressional Research Service, and the National Science Foundation when practical.

Although the OTA staff is currently 16 in number, it is expected to increase to approximately 40 members. This group will consider proposals which revolve around the areas previously mentioned. Senator Kennedy has announced that interest is beginning to be generated for assessments on food production through the influence of Senator Hubert H. Humphrey, on alternative energy supplies, the ocean as a resource through the influence of Senator Ernest F. Hollings, natural resources, and international trade. However, these assessment contracts have not been submitted for bid as of this date.

OFFICE OF TECHNOLOGY ASSESSMENT AND FORECAST

The Commerce Department recently instituted a new program called the Technology Assessment and Forecast Program. This was established under the Office of the Assistant

Secretary for Science and Technology, and constitutes a new information source for business, industry, and the government. The program was initiated through the efforts of Alfred C. Marmor as a result of his research while a Department of Commerce fellow. He is currently serving as Director of the program.

A basic premise of the program is that the changing patterns of patent activity, now listed in 85,000 subclasses, can be an accurate indicator of technological activity throughout the world. It can be used to help appraise the comparative technological strengths and weaknesses of the United States and competitive trading nations. The program has two basic objectives: To identify those areas of technology in which a high proportion of the activity is of foreign origin and to spotlight areas of technology exhibiting unusually rapid over-all growth (17, 2).

Several factors support this premise: For a patent to be granted, the law requires that the invention be new. Any significant technological advance usually will be the subject of significant patent activity. Generally, the costs of obtaining a patent are expended only in the expectation that they will be recouped with a profit through the commercialization of the invention (17, 3-4).

Since the cost of filing multiple applications to gain patent protection in a number of countries is expensive, it is normally undertaken only for the more significant inventions. The United States is almost always one of the countries in which a patent is sought. Residents of over 100 foreign countries have sought and received U.S. patent protection. Foreign-origin U.S. patenting has increased from 17% in 1961 to 29% in 1971. It is expected to rise to an average of 31% for the next five years (17, 4).

The data in this program consists of over 11 million U.S. patent documents, classified into 300 broad divisions of technology called classes. These are further subdivided into 85,000 categories of technology called subclasses. Each year approximately 250,000 new U.S. patent documents are added to this file. It is this flexibility that will make it possible to study the interdependence of patents, technology, and the economy.

In one of the sample reports done in 1973 (17, 82) a technological grouping concerned with "Apparatus for Spinning Yarn" revealed that foreign nationals have received an average of 72% of all U.S. patents in that grouping over the last three years. This figure is almost three times the 27% share of patents foreign nationals have received over the last three years in all technologies combined. The foreign share in this area is projected to grow over 90% in the next few years.

When broken into its component subclasses, the specific area of "Open End Spinning of Yarn" was identified. In this area, the foreign share is somewhat higher than that of the primary grouping, and the rate of over-all growth is considerably higher.

Eventually requests for information from this program may take many forms. For example, the user may wish to have data on factors such as: over-all growth (rate at which patents are being added to an area), foreign share (percentage of patents in an area obtained by residents of foreign countries), extent of government ownership (percentage assigned to the U.S. government at the time of issuance), country profiles (effort that a country is devoting to different areas), R & D expenditures, and export-import figures.

Although this program is new, just as is the OTA, it has valuable information for use by the governmental and private sector. Decision-making has been enhanced by the identification of trends and comparative efforts throughout the world. This will become increasingly important at a time when other countries move into the new technologies and as the number of multinational corporations continues to grow. To serve this need, the program will provide regular reports on those technological areas exhibiting, or expected to develop, significant activity.

IMPLICATIONS FOR INDUSTRIAL ARTS

As educators, we must be concerned with current and future societal concerns. This becomes increasingly important as we develop technologically at a frightening pace. The environmental movement of the past decade has increased our sensitivity to the consequences of an unchecked production and consumption system. William D. Ruckelshaus put it most succinctly when he stated:

> Too long in the past most technologists were euphoric about the future of man—technological development was the master and received total dedication. Technology, today, must be responsive to societal goals and values (6, vii).

This statement implies a host of issues which must become a part of the curriculum of today. Shane (13,4,5,99), a noted futurist, isolated societal problems that must be studied in our public schools. Several are listed below which relate to TA:

1. Crisis of the crises (The accumulation of crises in the past seven or eight years).
2. Disagreement over the "good life."
3. The value crisis.
4. Lack of a future-focused role image for youth.
5. Insensitivity to changing patterns of survival behavior.
6. Naive use of the technology.
7. Threat to the biosphere.

By its very nature, IA addresses itself to all of these issues, since it is human-oriented, future-oriented, technology-oriented, value-oriented, problem-oriented, and multi-disciplinary.

If we refer back to the discussion of the OTA, we see that this office has isolated seven areas of investigation. Of these seven areas, four relate directly to the field of industrial arts. These are: energy, materials resources, technology and international trade, and transportation. Whether we realize it or not, the average industrial arts teacher does assessments in these areas. However, most teachers fall into the trap that has jeopardized the potential for a humane society. This is our reluctance to address ourselves to 2nd, 3rd, 4th...order consequences. We look for assessments which appease us as teachers without concern for altering societal values.

Even teachers who profess to use a study of technology as a discipline base neglect this concept. They do a tremendous service to the student by teaching him about the latest technology, but also do a disservice by denying the student the right to make cross-impact analyses. An example will serve to clarify this point. In the area of transportation, we study new types of engines from a technical standpoint. Students learn a number of psychomotor skills, cognitive skills, and even venture into the affective domain. However, if we expect them to feel comfortable in a technological society, and if we expect them to be knowledgeable citizens, we must allow them the freedom to consider other factors. For example, when does the student assess new engines in terms of ecological impact (e.g., air and noise)? When does he ask how the new technology affects the highway system? What about their effect on elderly persons? What about the international effect? These questions imply a multi-disciplinary approach, and this is what the study of technology is all about. This is what a realistic educational system is all about.

The industrial arts teacher may be concerned about TA technique, and justifiably so, since it can involve elaborate computer simulations, statistical analyses, and techniques yet to be designed. However, in the final analysis, the Swiss housewife of a TA specialist was probably right when she said, "TA is nothing but common sense." We must involve our students with common sense tools. Although there is no general method for conducting a TA, students can follow several basic steps as they do assessments. In simplified form, they are:

1. Definition of the assessment task
2. Generate a description of the technologies
3. Generate a description of societal impacts
    a. values and goals
    b. environmental
    c. demographic
    d. economic
    e. social
    f. institutional
4. Identify options
5. Come to conclusions (3, 19-22)

Your students will find a whole host of new challenges through TA. For example:

1. Assess impacts in your community (e.g., park or highway locations).
2. Assess the utilization of natural resources in your laboratory (e.g., wood, metal).
3. Assess events in your school (e.g., noise pollution, traffic flow).
4. Study the OTA and follow its impacts.
5. Study laws which affect the utilization of technology in your community.

Of course you, as a professional educator, will have to become familiar with the concept of TA to be able to assist your students. We all will need to take another look at our own value systems before we can expect to change those of others. With this in mind, the writer would make the following recommendations:

1. The AIAA should address itself to the concept of TA via a monograph, conference theme, and workshops.
2. A general session should be held at the 1975 convention on TA.
3. Teacher education institutions should begin to offer experiences with TA at all levels. In-service training for current teachers is also needed.
4. Multi-disciplinary efforts should permeate all attempts.

Wentworth Eldredge, who spoke at the ISTA Congress in Holland last year, and who also spoke at the Atlantic City Conference (AIAA), stated: "We won't have a beautiful society until we have beautiful people." This is what TA is all about. Once a holistic concept of assessment (technological, educational, et al.) becomes natural for all humans, we can expect to have that "beautiful society."

BIBLIOGRAPHY

NOTE Special attention is directed to a reference list which appears in Volume 1, Number 1 of the Technology Assessment Journal, pp. 75-83. This valuable list provides bibliographic data in the areas of TA history, legislation, industry, multidisciplinary efforts, methodology, and case studies.

1. Congress of the United States, Office of Technology Assessment. News Release, February 12, 1974.
2. International Society for Technology Assessment. Memorandum to Membership from Walter A. Hahn, President. July 1973.
3. Jones, Martin V. "The Methodology of Technology Assessment." The Futurist. February 1972.
4. Kasper, Raphael G. Technology Assessment. New York: Praeger Publishers, 1972.
5. Kranzberg, Melvin. Historical Aspects of Technology Assessment. Occasional Paper No. 4 of the Program of Policy Studies in Science and Technology, The George Washington University, August 1969.
6. Lauda, Donald P. (Editor). Growing Together To Insure the Future. A monograph prepared for the AIAA, 1973.
7. Lauda, Donald P. "Meeting Change With Change," Man/Society/Technology, January 1974.
8. Martino, Joseph P. "The Role of Forecasting in Technology Assessment." The Futurist. October 1972.
9. Mishan, E. J. Technology and Growth The Price We Pay. New York: Praeger Publishers, 1970.
10. 92nd Congress. Public Law 92-484, H.R. 10243. October 13, 1972.
11. Science Policy Research Division. Congressional Research Division. Office of Technology Assessment. Background and Status. U.S. Government Printing Office Publication 99-672 0. August 1973.
12. Senate Hearings Before the Committee on Appropriations. 93rd Congress, First Session. Legislative Branch Appropriations, Fiscal Years 1973 and 1974, H.R. 7447 and H.R. 6691. U.S. Government Printing Office Publication 99-767 0. 1973.
13. Shane, Harold G. The Educational Significance of the Future. A report prepared for Sidney P. Marland, Jr. Indiana University, October 1972.
14. Subcommittee on Computer Services. Committee on Rules and Administration, United States Senate. Technology Assessment for the Congress. U.S. Government Printing Office Publication 85-598. November 1, 1972.
15. Toffler, Alvin. Future Shock. New York: Random House, 1970.
16. United States Department of Commerce. Office of Technology Assessment and Forecast. Early Warning Report. Washington, D.C., December 1973.
17. United States Department of Commerce. Office of Technology Assessment and Forecast. Initial Publication. Washington, D.C., May 1973.

Dr. Lauda is Coordinator of Technology Education at West Virginia University, Morgantown, West Va.

An Introduction to Studying the Future

Earl C. Joseph

In this paper, the study of futures will be introduced. It will touch upon a number of alternative possible future scenarios using humane technology and discuss future trends, alternatives, and mandates for industrial arts education.

Education's primary purpose is to prepare students for the future that they will exist in during their life. This involves becoming literate of the futures possible and includes: 1) Assessment of the past and present, 2) Forecasts of trends (where we are headed) and alternatives, 3) Assessment of possible futures—making visible the opportunities the future offers and possible future threats and crises, and 4) Planning, design, and management of the future—forecasting, goal selection, mapping futures attainability, and directing change.

Society is now entering into an era when its basic parameters are increasingly capable of being dynamically directed by its accelerated change state through choosable long-range goals. Change is ever increasing in scale, range, frequency, and impact, thereby giving society the opportunity to move even more rapidly toward desirable futures—if we are willing to steer such societal movement. We now have the forecasting, organizational, systems design, and management tools to do so. Needed is a new societal framework, a philosophy, that includes knowledge now obtainable about possible futures and rooted in and built upon past knowledge (but is referenced towards managing the possible opportunities the future has to offer rather than preserving the past)—i.e., pro-futurism. The essential fabric of this philosophy is counsel against the attainment of future dooms and maximizes the attainment of desirable futures for humans.

Since new knowledge causes change, and since our growth in knowledge is accelerating, naturally such change will make the future different. Therefore, it is not surprising that the nature of much of the future is counter-intuitive to past and present thinking. However, the problem which exists in our movement into the future is that our knowledge and education has been almost solely based on the past and present, thus, we tend to make decisions which attempt to cast the future into the mold of the past. When we systematically study future possibilities, the messages and knowledge obtained are most often counter-intuitive to the past traversed. Education's new role is to provide an environment for students to become literate about future possibilities by illuminating future alternatives so that societal decisions for the future, based on what is desirable for the future, can become intuitive (second nature) rather than counter-intuitive.

But, what part of the future is controllable? The future starts now, this moment, and extends forever. The future as viewed from today, any today, is made up of a multiplicity of possible alternative futures toward which we can move, with or without control. The farther ahead we project, the more alternatives exist. These alternative futures can be considered as planning horizons from which we can select for the purpose of expanding our control over the futures we bring into fruition. But before we can plan our control over the future, we must be aware of what part of the future we can control. The future can be broken down into five basic planning and control periods (as an extension of today).

<u>Now</u>—the immediate future (this year). Frozen, dictated by the past, thus uncontrollable and unlockable except by a major event—usually a catastrophe. Present decisions or actions have little or no effect over this time frame, however, minor choices are available.

<u>Near-term, short-term futures</u> (next 1 to 5 years). Largely a past-programmed future, but present crisis can program some change, thus, incremental change is possible. Evolutionary advances become possible to be implemented during this time frame, but only partially controllable from today. Decisions made today can cause major shifts in this time frame, but major efforts are required to bring about such change. Policy choices available for new programs, systems, institutions, and leaders, once initiated, can cause impact in this time frame.

<u>Middle-range futures</u> (5 to 20 year futures). Almost total choice is available over alternative opportunities this future offers—if awareness of alternatives exist in the present. This future is almost completely controllable and decidable today. Revolutionary change is implementable in this time frame from directed evolutionary (small) changes initiated today. Almost anything imaginable becomes possible to bring about; thus, the future available in this time frame is almost totally inventable and shapeable

today. Today's decisions can solidify this future.

Long-range futures (20 to 50 year futures). Opportunities and/or crises are triggerable 'seedable today for this future. Many alternative opportunities can be made visible but are largely uncontrollable (from today), thus, this future is primarily open to control to the future.

Far futures (50 years and beyond). Largely invisible and uncontrollable (from today); however, utopian and distopian speculation about its character is possible.

Thus, the prime ranges for obtaining desirable futures starts today to give a measureable control over the 1 to 5 year future and total choice and control over the 5 to 20 year future.

An environment of rapid change causes the time-scale of the impact of change to be collapsed. Thus, the cutting edge of the future now approaching is rapidly accelerating toward us (to the present), rapidly bringing a future very different than even recent past expectations. As a result, the fabric of the past-present, its values, its culture, its technology, its politics, throughout the world and most institutions, is ripping apart as viable new alternatives rapidly become operative. The insistence by many institutions, and especially educational, on molding the future into the casts of the past is thus justifiably under criticism and being challenged. This acceleration of change, causing considerable alienation toward old ideas, is producing a chasm separating the near future from the recent past at an ever faster rate. Old assumptions and old methods, in earthquake proportions, are being torn down as new ideas thunderously ripple through society, soon to be replaced by even newer ones. Schools play a major role in this process of bringing new ideas and new insights to society (new to the public they serve) and thus are a societal force for encouraging and speeding this process of change. In this role, they tend to transmit ideas from the past to the present. An emerging role for education is to add the dimension of transmitting ideas from the future to the present (knowledge about possible futures now learnable from studies of future alternatives).

The education institution, until very recently, did little to put education into the context of the future. That is, none systematically (scientifically) studied the future, other than by speculative guesswork, and thus forced the publics they served to correlate the past they purveyed for relevance to and in the future. Most assumed that what was found good in the past was good for the future, or that the future should be (or only can be) programmed from the past. That is, an insistence upon forcing the future into the mold of the past. However, today, with the forecasting tools now available, it has become relatively easy to demonstrate through the extrapolations of present trends that such "programming hindsight of society" leads to the expectation of many problems and crises for both near- and far-term futures. The inescapable implication is that such trends must be altered, if we desire to avoid such doomsdayish paths to the future, and that the future must be considered together with the past. The high-risk route for society is to be driven along the trend paths dictated and programmed in and by the past. This is not to imply that much of what is learnable from the past is not relevant and useful for the future. The determination of what to use from the past cannot be logically evaluated by knowledge of the past and present, without consideration of the context and environment of the future forecastable in which it will be operative. It is analogous to requiring mentally sick patients to diagnose themselves.

Past dreams, as signified in literature throughout the ages, for obtaining the gift of knowing the future almost always picture humans with the capability of "knowing" ahead of time the actual future to be unfolded. Today, we have powerful forecasting tools giving us the gift of knowing the future, but in a very different sense than the expectations of the past. They are capable of allowing us to see ahead of time the direction of our past-present movement into the future, the opportunities and problems that such extrapolated trends point toward in carrying us to such futures. Additionally, forecasting can make visible many other alternative paths that we could take, other than the trends, to achieve different sets of more desirable opportunities (and the avoidance of problems foreseen) and pointers to what we must do. That is, knowledge now obtainable about possible futures gives an even more important ability than knowing ahead of time the actual future, the insight of what's possible and thus the ability to select, shape (invent), and control the future!

Thus, the question, "Why forecast?," is answerable. It may not be able to tell us specifically what tomorrow will bring, but in attempting to do so, it forces us to define our assumptions about the future upon which we stake our future and thus helps us make today's decisions. In the process, it gets these images (trends and alternatives) out into the open for public view, debate, change, and improvement so that more realistic and logical decision inputs are obtained for use in deciding the future under our control.

MAJOR FORCES OF CHANGE

Operative in society today and for the future are numerous forces which, when extrapolated, cause the expectation of very different futures. In general, these forces will create many shifts in society and have little or no past precedence. Forces which are expected to impact heavily on industry and thus change industrial arts education are:

Explosive growth of cybernetic fields (computers and communications technology)
- Rapid automation of industrial process and service industries
- National and multinational computer networks
- Incorporation of 'intelligence' (smart devices) into factories, offices, homes, appliances, automobiles, etc.
- Rapid transition toward "paperless" electronic communications for the capture and dissemination of information
- Economy of scale tipping away from centralized control towards distributed-function local control systems
- A millionfold technological advance in cybernetic technology is forecast to occur during the next 20 to 30 years

Shifting geography of acquisition of resources
- Causing manufacturing to move to nations (or areas) where resources are available, where cheap labor exists, resulting in forcing more automation of factory operations to forestall such shifts
- Creating rich nations from poor ono vice-versa over a decades time frame

Rapid and continued acceleration of change
- Rapid growth toward a multiplicity of crises (energy, material, paper, food, etc.)
- Rapid growth of new opportunities resulting from advances in technology
- Increase scale of impact of change, causing the requirement for most institutions to adapt to the future
- Approaching limits in certain areas, especially energy and resource usage

Emergence and growth of multinational corporations
- Causing need to redefine public ownership, perhaps employees ownership status
- Shifting international competitive systems
- Growth of world monetary system and capital
- Emergence of international capital and ease of liquidity of capital

Shifting national policy patterns
- Push for steady-state economy
- Visions of limiting growth, population, and energy/material usage

Increasing social overheads
- Demands for automating social and community services

Increasing leisure time availability to individuals

ALTERNATIVE FUTURES

Society in the U.S. is today at the transition stage, moving out of the industrial era into the post-industrial or communications era. The impact on industrial arts education is just beginning to be perceived, and the expectations for the future are now being mapped. The following scenarios are indicative of the studies of alternative possible futures that are expected to have a drastic impact on industrial arts.

World population today exceeds 3 1/2 billion people, and the United States represents about 6% of this population. As a nation, we consume more than one-third of the world's available resources. For most of the rest of the world, their vision of the future is to achieve a quality-of-life materially equivalent to ours. Obviously, it is a foolish goal, both for us and the world, to continue to work toward such high rates of consumption. For example, if only two other nations of about the same population size as ours achieve our affluence, with the same consumption value system, then less than 20% of the world's population would consume 100% of the world's resources, leaving none for the other 80%

of the world. Thus, there is no doubt for the future that we must change our consumption habits from the "throw-away society" toward a "non-throw-away society" attitude.

The basic characteristics of a non-throw-away society scenario of the future consist of using technology which allows:

Designing, building, and manufacturing things to last a long time
- —Structures whose architectural technology are designed to last thousands of years, which are modular, flexible, and adaptable to changing needs, piecemeal updatable, etc.
- —Mechanical things like automobiles designed using fault-tolerant and self-repairing technology which allows them to be useful for hundreds of years
- —Clothes designed and manufactured using materials which last for decades, which are self-cleaning, self-pressing, and self-deodorizing, which expand with us as we grow taller, fatter, skinnier, etc. Clothes that incorporate technology for allowing style changes as new fads develop

Designing such consumables for recycling

The feasibility of this scenario from the use of humane technology viewpoint is simply a matter of putting into practice our knowhow and evolving designs for doing so. The question is, is it economically feasible. Today society's economic value system works best when we speed up the process of getting things from the factory door to the scrap heap. That is, the faster this process can be achieved, the more we sell, and thus the more we profit. However, when we ask which is the most profitable corporation, we find that it is the telephone company. We don't own our telephone. This industry has an incentive to design and manufacture the telephone to last a long time, since they receive their profit from renting it to us rather than selling it to us. Therefore, to achieve a non-throw-away societal incentive, it takes only a single law to be enacted. That is, one which doesn't allow us to own the vast majority of things that we now consume. The result would/could be:

Vast reductions in the use of materials and energy for making things

Higher profits (dollar) from providing services rather than from the sale of products

Giving the total world the ability to achieve a much higher material quality-of-life

There is no doubt that some form of this scenario for the future will become a way of life — and perhaps soon. When it does, the impact on education will demand considerable changes, especially in industrial arts. Some are:

Elevation of the importance of repair and recycling and their automation

Implementing higher quality control and self-repairing techniques

Reducing requirements for labor in production activities

Some other scenarios of alternative futures include:

Mining of space and manufacturing in space

Vertical cities; a city for a few million people in a single building

The communications era with wired cities/nations, substituting information transfers (telecommunications) for the transfer of people and things via community information systems:
- —Working at home
- —Education into the home
- —Shopping from home
- —Remote health delivery into the home
- —Electronic delivery of paperless newspapers, books, and magazines
- —Electronic money
- —Reducing the need to travel for necessity tasks in order to reduce society's use of energy

The major features of each of these scenarios is to allow society to do more with less use of earth's energy and material resources, especially through the use of communications technology. In the process, the need for industrial arts grows, since each is based on the use of more humane technology—even though most assume rapid growth in the automation of the processes involved. However, they also indicate that the number of people required in the industrial arts will decline at the same time that the professional level of industrial arts will be elevated.

FUTURE EDUCATION—TRENDS AND MANDATES

The forces at work in society and visions of the possible futures they are bringing about demand that education change to meet the needs that we now foresee. The alternatives and mandates for the future now loom large; some are:

Futurizing society
- —Providing a learning environment for students to become literate of the future
- —Producing students capable of shaping desirable futures

Humanizing society
- —Providing an educational system to allow students to learn to make constructive use of leisure time
- —Providing literacy for individual and societal values in a pluralistic society

Democratizing society
- —Jefferson felt that we needed mandatory public education if we desired a democracy which was capable of producing citizens literate enough to tell whether or not politicians were lying. To achieve this goal, education must change and be extended.

Life-long learning
- —Adult education, in era of accelerated change, the most needed students in the educational institutions must be all adults
- —Reversing the trend toward an ignorant society. If we plot how good education is through the years, we get a curve that shows that education is continually getting better. However, when we plot what a person needs to cope with the growing complexity of society and the knowledge explosion, we arrive at a curve indicating that we are getting dumber and dumber, and that we are now in an ignorant society.

Non-lock step education
- —Individualized education
- —Multiplicity of learning alternatives

For society to achieve these mandates for education, it would be far too costly if education continues the way education is delivered today. Thus, to achieve desirable futures by implementing these mandates, education must turn toward the use of technology to automate much of the process.

CONCLUSION

Today society is busy building the new world of the future, and compelling arguments now exist for industrial arts education to become involved, to carve out additional new roles in the new post-industrial era that is developing. The (creative) use of the past to aid scientific-based speculations about futures for the purpose of creating more desirable futures can certainly be a part of the virtue which we believe makes education a viable institution for the long haul.

Studies of the future thus have many exciting implications for the American public. Education, by informing the public about the future, becomes an institution for impacting society by transmitting desirable values from the future to today, with the ultimate role of cybernetically steering culture toward desirable futures. In this way, education could become indispensable for "programming futures" (which it is already doing not in terms of the future, but by dictums from the past). To meet this challenge requires that the educational institution undergo considerable change, especially in its expanded use of humane technology.

Dr. Joseph is a Staff Scientist at Sperry Univac, a Visiting Lecturer at the University of Minnesota, and a Futurist-in-Residence at the Science Museum of Minnesota.

Teaching Future Technology Through Industrial Arts

Arthur J. Rossor

The approach to the topic of teaching future technology could be very wide and varied. Historically, excluding the last ten years, curriculum development specialists have advocated a wide variety of approaches to our ever-present problem of relevant curriculum for the students in the middle and secondary schools.

The Bonser-Mossman approach of the 1920's was revolutionary, but not futuristic in any sense of the word. The Warner concept of technology of the late 1940's and early 1950's yielded a new future-directed approach, but it never looked at the future realistically except through Research and Development.

All of the major curriculum developments of the decade from 1960 to 1970 spoke in regard to the question of teaching future technology, but none showed how to do it. For example, the World of Construction and the World of Manufacturing from the Industrial Arts Curriculum Project devote an activity and a reading in their materials to the topic of the future. The text relates to construction in the year 2000, only 26 years away. Students take · Buck Rogers (or a Neil Armstrong) view of prefabricated units, environments in the ocean, out in space, or in an encapsulated city. The World of Manufacturing also contains a chapter devoted to the future and its technology. The students of 1974 are exposed to the use of computers and automation. My challenge to you is — How can we teach future technology in our industrial arts courses today?

I believe that as we teach about our technological past and present from fire and tools to machines, materials, and processes, we should structure our curriculum to reflect the future and its technology.

Most of you are probably wondering what content you can add to your existing curriculum to make it more reflective of what is to come in the next 30 to 50 years. What technologies can or should be studied to reflect those of the future? You must remember that most industrial arts teachers today believe technology includes woods, metals, drafting, graphic arts, electricity, and power. There are also in this day and age of ours a small number of innovative teachers who believe and demonstrate (practice and preach) future-oriented curriculum such as communication technology, construction technology, and power technology (all in the broadest sense).

Let's not talk about how one goes about dividing the curriculum, but rather the content that anyone can put into it as a supplement. If you are seriously interested in a total curriculum about the future, you need to consider a curriculum which suits your needs as a teacher and molds your content into a presentable sequence of activities.

Let me suggest some specific content that one might consider as he looks at the technology of the future. The content areas to be considered in this proposed curriculum of the future are power and transportation, communication, materials, environments, and structures. Others might also include computers, systems engineering, metrics, and energy sources.

Future technology is in abundance today in the area of power and transportation. Many industrial arts programs today study the established experimental power systems. Very few, however, do more than talk about the promising or speculative systems. This is where the action or activity will be in the years to come. Let's look at a few of the new experimental engines of 1974. These include the NERVA, the JERNAES, the SELWOOD, the KAVERTZ, the TSCHUDI, the MALLORY, the WANKEL, the FREON FLYER, and the KROV.

The NERVA engine is a flying nuclear engine. Its name stands for Nuclear Engine for Rocket Vehicle Application. This engine is the outgrowth of research on the KIWI-A and the Phoebus 1B. The forerunner Phoebus has the potential of more than 6.7 million horsepower. The NERVA is a chemical engine. It is powered by streams of pure hydrogen gas. If a NERVA engine were used on the Saturn V, it is estimated that the rocket's payload could be doubled (6, p. 249).

The JERNAES engine is a type of rotary engine with a triangular rotor inside a trochoid housing. It is a single-rotor engine which works on a four-stroke principle. This engine through its gearing allows the shaft to turn at one-third the rotor speed. This is just the opposite of the Wankel principles. However, this engine has high torque at low speed. This four-stroke single-rotor power plant produces the same number of power impulses per output-shaft revolutions as a conventional six-cylinder engine (6, p.210).

The SELWOOD engine is another variation of the rotary principle. Its unique feature is that the cylinder block revolves, while the main shaft is driven. The pistons in this engine number six and really don't reciprocate but actually orbit around the main shaft by moving 30 degrees in each direction. The compression stroke on one side of the piston is the power stroke on the opposite side. This engine operates on the two-stroke principle.

The KAVLERTZ, like the MALLORY, has a vane-type piston. Each axis in the engine has two sets of vanes which continuously change relative positions. There are four combustion chambers which produce four power impulses per output-shaft revolution. A 61.6 cubic inch version of this engine produces 200+ h.p. at 4000 rpm (6, p.209).

The MALLORY is another rotary vane engine which has 16 working chambers. It tests out in an experimental 185-pound model to develop over 400 h.p. at 5000 rpm. An improved model made of aluminum is producing hp for each pound of weight. It weighs 80 pounds (6, p.207).

Another rotary engine rival is the TSCHUDI, which has four curved pistons in a toroidal track. Piston action is not continuous, so two toroids are needed to achieve the four-stroke cycle (6, p.208).

Each of these previous five power plants (excluding the NERVA) are contemporary rivals of the WANKEL or the principle of RC engines (rotating combustion).

Curtis Wright in this country holds the most practical patent on RC engines. Their power/weight ratio is better than any piston engine (6, p.204).

The FREON FLYER is an external combustion engine which uses a fluorcarbon (expanded) that can be condensed and recirculated through an energy-producing heat cycle. The engine is 30 cubic inches in size and needs no transmission. An auxiliary engine of about 15 cubic inches runs the condenser fans. The engine itself is a tyrotor and runs on almost any type of fuel. Propane appears to be a very clean fuel (3, p.39).

The last power plant to be considered is one with the greatest potential for the future. It is known as KROV, which stands for Keller Roto-Oscillating Vane machine. This engine runs on steam, but can use almost any gas or liquid. This engine or converter could be used with steam, geothermal, or solar energy systems. I don't think Florida Power and Light Company executives would be interested in it if it were not potentially promising (4, p. 90)

We could also study about electric vehicles, other steam-powered vehicles, gravity-vacuum transit systems, tracked air-cushion vehicles, gyropowered vehicles, hydro-foil and air-cushioned air vehicles, or HSGT (high speed ground transportation). You might also look at a wide variety of space-oriented vehicles.

One might study, from the fuel point of view, sources of power like hydrogen engines, magnetic fields, liquid helium, fuel cells, solar cells, nuclear energy, chemical arc jet, magnetic plasma iron power plants, rocket, gasdynamic explosion, and thermonuclear fusion.

There is a whole mass of curriculum material related to the super-batteries. These are of a variety of types such as: nickel-cadmium, silver-zinc, zinc-air, sodium silver, lithium chloride, and organic electrolyte. The potential of these various superbatteries is limited only to their cost of production in quantity.

Let us move from the power area to that of communications. A concept of the future when I was an undergraduate 15 years ago was the picture telephone. Today the picturephone is almost a reality. Research and product development have brought this concept into reality in a short time (1, p.288).

The whole world is brought closer together because of the increased use of communication satellites. How many industrial arts teachers relate or explore the concept involved in Telestar II, for example? This satellite, which helps world-wide communications, weighs 175 pounds and is 34-1/2 inches in diameter. Its power comes from 3,600 solar cells on its surface (1, p.298).

Think of the many other forms of communication concepts one might add as enrichment to his curriculum: the laser, the computer, three-dimensional television, supermicrominiaturization of electronic components, new purer electronic equipment materials produced in zero gravity space. The possibilities in the area of communication are only limited by the creativeness of modern man.

As one talks about the future, he must also consider the materials that he may be using. Will the exotic metals of the 1970's be the common metals of 2000? Will new materials be introduced that man has known about for years or even centuries but his technology was not advanced enough to produce for commercial use? Think of the revolution that has occurred in the textile industry with the introduction of some of the new synthetic materials, especially polyesters. What will be the fabrics of the year 2000? Will they be metallics or plastics?

The human body will also be a large receiver of new materials and even old materials in new forms. A new program on television, The Six Million Dollar Man, may not be unreal. There are many materials today being used in the human body as replacements for skin tissue, muscles, joints, bones, and arteries (1, p.386).

The automotive industry is also looking to new materials for the future. Firestone is experimenting with cordless tires. Inventors are building plastic wheels that are stronger than steel, half the weight of magnesium and eight times stronger — a true wheel of the future (5, p.18).

As man develops better and safer ways to travel, he will also develop whole new environments and structures within those environments. Man, today, is discovering these "new worlds." You know most of them by name. They include land, ocean, and space. What unique problems will face the man of 2000 as he seeks to live on land, under the water, or out in space? You will notice that I have deliberately left out life on other bodies in our universe. If you are interested, try reading the tenth and eleventh chapters of Chariots of the Gods by Erich Von Dannikan.

What will the structures within these new environments be like, as compared to 1974? Will the two-story colonial with Early American furniture be like the Victorian house of the 1900's? Many leading authorities, the Wrights and others, believe that one type of structure will be the air structure. There are three major types in existence today: the air-supported, the air-inflated, and the hybrids. A good example of the air-supported is the Telstar Radome. This type structure is an air-in — air-out system. It must be securely anchored to the ground, made of an airproof material, equipped with blowers for inflation and air loss, and entry and exit by way of air-lock devices.

The second major air structure is like the pavilion at the Olympic games in Japan. In this type of structure, inflated tubes hold the top in position and give it its shape. This type structure is much more flexible, since it lacks all the requirements of the air-supported except the need for blowers to keep proper pressure in the tubes.

The last type of structure is the hybrid. The side walls are of more traditional materials, with the roof in some form of an inflated shape.

Can you imagine enclosing several acres of New Jersey's open fields under a giant greenhouse and having a four-crop year (2, p.93)?

These are just a few ideas to stimulate the industrial arts teacher who wants to be ready for the future and its technology. We, as industrial arts teachers, should hold the key to unlock the study of technology in the year 2000. Do you hold that key?

LITERATURE CITED

1. Brownell, Arthur B., Ed. Science and Technology of the World of the Future. New York: Wiley-Interscience, Inc., 1970.
2. "Bubble, Bubble Everywhere." Popular Science. March 1973. Vol. 202, No. 3.
3. "Minto's New Freon Flyer." Popular Science. August 1973. Vol. 203, No. 2.
4. "New KROV Engine Boosts Hope for Steam Car." Popular Science. June 1973. Vol. 202, No. 6.
5. "Plastic Auto Wheel...Stronger than Steel!" Popular Science. October 1973. Vol. 203, No. 4.
6. Walton, Harry. How and Why of Mechanical Movements. New York: E. P. Dutton and Co., Inc., 1968.

Dr. Rosser is Department Chairman at Montclair State College, Upper Montclair, New Jersey.

Scenario Building: A Method of Studying the Future of Industrial Arts

Robert J. Gelina

The study of the future has become an area of interest to educators, and more specifically to industrial arts educators on the college and university level. The majority of efforts by industrial arts educators have been focused on the study of the future using industrial arts as the medium.

A methodology identified as "Scenario Building" can be utilized to study the future of industrial arts. A distinction which must be made in order to understand the use of the scenario building technique is that it can be utilized to study either the future of industrial arts or the future in industrial arts. This distinction is extremely important when one views the individuals involved in the study of the future and the desired outcomes of the scenario building technique.

A number of techniques can be used to study the future. The two most common techniques are identified as regression or trend analysis and the Delphi technique. The technique of regression or trend analysis utilizes facts which can be collected from within a specific time period and projects the outcomes or occurrences which may materialize in the future. In contrast to the trend analysis technique, the Delphi technique utilizes a group of learned scholars to project future occurrences. The individuals chosen to project future trends are those most generally accepted as experts in a specific discipline, who have the greatest potential of accurate projection.

The technique of scenario building can be defined as the development of a specific set of projected facts or occurrences which are most likely to occur within a given time frame. Scenarios can be developed to be realistic, based upon the projections of many experts, while at the same time they may be totally hypothetical, based upon the imagination of a single individual. The development and utilization of the scenario building technique incorporated in the study of the future of industrial arts was based upon many collectable facts and attempted to portray the future as realistically as possible.

The technique was used with university seniors in a course entitled "Educational Foundations of Industrial Arts." The course included the historical development and present trends in industrial education. It was only logical, therefore, that a study of the future potentials of industrial arts be included within the course.

DEVELOPMENT OF SCENARIO

The development of a realistic scenario presented a number of problems to a group of neophytes in the area of the study of the future. The group was confronted with such problems as: What year is the scenario being developed for? Where can we get information about the specific year in question? What are the major factors that must be considered within the total framework of the scenario?

The questions came from within the group, and the decisions relative to scenario building were those of the group. The following facts emerged which were the basic foundations upon which the entire scenario building process was to be based.

The scenario was to be developed for the year 2000. The three major factors which must be considered relative to industrial arts education in the year 2000 are: Society in the Future, Technology in the Future, and Education in the Future. Each major factor was to be fully developed in a seminar lasting approximately two hours. All participants were to spend sufficient time reading to secure an adequate background to develop ideas relative to each major topic. A seminar outline was to be developed by the group one week prior to the actual seminar. Upon completion of the seminars, the completed scenario was to be presented to the entire group.

The development of the scenario was not the completion of the study activity, but rather the beginning of the most important activity relating to the study of the future of industrial arts. The scenario was as realistic as can be expected from three weeks of reading on a topical area. The sources of input for the students ranged from noted authors to laymen writing or speaking through a multitude of media. The seminars were conducted by individuals within the study group at the end of the third, sixth, and ninth weeks. Each seminar concentrated on one of the specific major topics. The conclusion

Student emphasizing a point during the seminar on education in the future.

of the seminars allowed the group to project how they felt society, technology, and education would fit together in a relatively believable scenario.

DEVELOPMENT OF INDUSTRIAL ARTS PROGRAMS

The organization of study groups to develop programs of industrial arts for the year 2000 was again the responsibility of the individuals who had developed the scenario. The decision-making process was concluded with the formation of four individual study groups, each consisting of four members. The study groups were to report back to the total group upon completion of an industrial arts program for the year 2000. The presentations were to be developed around an outline consisting of the following. Philosophy of the Program, Methodology of the Program, Content of the Program, Facilities of the Program, and Relationship to other Programs.

The presentation of the study group's program for the year 2000 was to be in accordance with the scenario which had been developed. The individual study groups were required to present and defend their programs before the entire group, as well as interested individuals who were invited to attend.

PROGRAMS OF INDUSTRIAL ARTS

The following two presentations are sketches of programs which were presented to the entire group.

PROGRAM NAME. General Technological Mechanical Learning Curriculum (GTMLC)

HISTORICAL DEVELOPMENT. The timetable between 1973 and 2000 was not an educational void, but rather filled with significant developments which gave birth to GTMLC. The developments are graphically represented on the next page.

RATIONALE. The changing role of education within the society has caused educators to focus their efforts upon the individual within the educational system rather than the curriculum. The GTMLC has found its rationale in the following: A necessity to understand the changing society, the total development of the adolescent, the increased need for involvement during leisure time, the individual's need to explore and discover. the increased use of role-playing to aid in individual psychological development; the need for the schools to serve all age groups.

METHODOLOGY. The teaching methodology incorporated by the General Technological Mechanical Learning Curriculum is considered innovative in nature and has been made possible through the organization of the educational system. The following innovations are utilized by the GTMLC. learning centers, material transmission, teachers as coordinators, utilization of community as a school, and individualized instruction.

Seminar leader (center) summarizing previous discussion by the students.

EDUCATIONAL TIMELINE
1973 — 2000

1957	1970	1979	1980	1984	1986	2000
Sputnik	Innovative programs of industrial arts	Introduction of voucher system	Vocational education leaves public education	Beginning of non-compulsory education	Establishment of the National Council for the Revitalization of Industrial Arts	General technological mechanical learning curriculum

CONTENT. The basic content of the GTMLC is outlined as follows. Energy Technology, Transportation Technology, Communications Technology, Food and Drug Technology, and Ecology.

FACILITIES. The facilities of the GTMLC consist of a centrally located learning facility and the total community. The learning facility is utilized on a proportionally small basis in comparison to the use of the community as a learning environment.

PROGRAM NAME: Techno-Praxisology

RATIONALE. The program was developed based upon two precepts which were the avoidance of undesirable repercussions in the populace due to the increasing speed of technological advances, and to move the industrial arts program from a vocationally-oriented program to a technologically-oriented program.

METHODOLOGY. The basic methodology incorporated by the program is identified as follows. The use of individual computer learning complexes, Continued use of human teachers, The majority of learning activities are carried out within the community. The laboratory is used for guided learning experiences.

CONTENT. The basic content of Techno-Praxisology is organized as follows: Historical overview of the development of technology, The study of the effects of technology on education, government, research, and society; A study of careers.

FACILITIES. The facilities utilized by the Techno-Praxisology Program consist of a number of small learning centers and community facilities. The community facilities carry the majority of the learning activities.

IMPLICATIONS

The utilization of the scenario building technique to study the future of industrial arts was not intended to develop programs for the year 2000. The purpose of the exercise was to aid beginning teachers in considering alternatives to the existing structure of industrial arts. The programs previously presented are not intended as specific alternatives for the field of industrial arts to consider, but rather a representation of the type of thinking which can be accomplished by students preparing to teach industrial arts.

The study of the future of industrial arts through the scenario building technique allows one not only to consider alternatives for industrial arts, but also alternatives for the future of society, technology, and education. The individuals who should be considering future alternatives are beginning teachers, as they will continue to shape not only the field of industrial arts but the world in which we shall all live.

Dr. Gelina is an Associate Professor and the Coordinator of Graduate Studies at Iowa State University, Ames, Iowa.

Evaluating the Effectiveness of Scenario Building

Edward C. Pytlik

All newly-proposed teaching techniques or methodologies must be evaluated to discern their teaching effectiveness. Without such an evaluation, it is often difficult, if not impossible, to determine whether the proposed method actually is successful. The success of the methodology is determined by its ability to accomplish what is hypothesized, and most hypotheses center around one or a combination of three general statements:

1. The new method or technique will expose the student to a greater body of knowledge than he previously had been exposed to.
2. The new method or technique will allow the student to more readily absorb a larger amount of knowledge.
3. The new method or technique will stimulate or motivate the student to a greater degree than did the traditional method or technique.

The obvious implication of each of these statements is that the student will learn more when the new technique or method is implemented. Scenario building, when used successfully as an instrument to increase the amount of student learning, should incorporate all three of the general statements listed above.

The actual scenario that is completed by the students is only one of several steps in the over-all project, albeit the final step. Prior to this step, the topics and sub-topics under discussion must be researched, the data gathered must be discussed and evaluated, and regard must be given to complementary and contrary data found in interconnected topic areas. The research is usually accomplished through a review of literature, and the data gathered usually is discussed in a series of seminars. The key to evaluating the effectiveness of scenario building, then, is not only to assess the final step, the actual scenario built by the students, but to assess their preliminary steps of literature review and discussion as well. Thus, the evaluation will include assessments of student preparation and student participation, in addition to the final outcome.

When a review of literature is used in the preliminary step of scenario building, the preparedness of the students may be assessed by determining the depth of their research. This can be accomplished by requiring that the students submit selected quotes from their readings for each general topic that comes under discussion. These quotes and their sources may then be evaluated.

In assessing the quality of the submitted quotes, the following criteria might be included the applicability of the quote to the topic under discussion, the length of the quote, to determine if the full meaning of the author's comment has been retained by the student; the value or worth in quoting the excerpts.

In assessing the quality of the sources used in the acquisition of the submitted quotes, the following criteria might be included the professional prestige the author holds in the field of the subject under discussion, the extent to which the book or article was devoted to the study of the future, whether or not the book or article was listed in a bibliography supplied by the instructor.

This third criterion could either raise or lower the graded quality of a source. If, for example, the source was not listed on one of the bibliographies, yet the author was a recognized authority on the subject under discussion, the quality of the source would increase. Conversely, if the source were less than average and not on one of the bibliographies, the quality score of the source would be decreased.

When seminars are held as the second step in using scenario building to study the future of industrial arts, the participation of the students, both individually and collectively, may be assessed through unobtrusive observations of each seminar. Criteria that might be included in assessing student participation are. Did the small group of "non-talkers" in the class, under the positive influence of the seminar setting, make a greater contribution than they would have made during a "regular" class? Did an increased interest in and a general knowledge of the study of the future increase the number of contributions made by each individual student? Did the total number of comments increase from the first seminar to the last?

The third and final step when using scenario building in studying the future of industrial arts is the creation of the scenario depicting the future. In assessing the quality of this proposed future, the following criteria might be considered. the value of the topics and sub-topics included, the detail of the scenario, and the probability of the proposed future actually occurring.

A positive evaluation of the various steps of scenario building will indicate good student preparation and participation, signifying increased learning on the part of the students, the ultimate object of any newly-proposed teaching technique or methodology. It will also signify the effectiveness of using scenario building in studying the future of industrial arts.

Mr. Pytlik is a graduate assistant in the Department of Industrial Education at the University of Maryland, College Park, Maryland.

Humanism

Some Semantic Implications for a More Humane Technology

Marvin Poyzer

Some time ago, a student stopped by my office and found me reading the book, Science and Sanity, by Korzybski. "Whatcha doing, Doc?" asked the student.

"Trying to write a speech," I answered.

"What's it all about?" he asked.

So I tried to tell him, and I could see by the look on his face that he either didn't believe me or that he thought me a bit mad. So I tried again, and this is part of what evolved.

"Dennie," I said, "what if I told you that the brakes on your car are faulty? What would you do?"

He answered, "First, I wouldn't believe you could know so much about my car. Then I would go check them."

"And if you found them faulty — what would you do?" I asked.

He answered that he would get them fixed.

So I asked, "What would you do until then if you had to drive the car?"

He answered, "I'd drive awfully carefully."

Then I explained that this speech is based on the simple premise that the English language that we use is and has been "faulty." The premise is so simple that it may take me a couple of pages to try to explain why and what I mean, and I may repeat myself a couple of times — and then you may shake your head and give me the same look Dennie gave me.

So you think about it a minute and then suggest, "If I had a car like that I would junk it and get another — a safe one," and so would I. But you can't ask millions of people to "junk" their Mother tongue and get another one! Besides, you may claim that most of the cars on the road are safe to drive anyway — so what's all the fuss about? May I remind you of the millions of cars that have been called back to make corrective changes so that they may be a little safer. Besides, it's the nut behind the wheel that can make a car a whole lot more dangerous — just like the "nut" that uses English and doesn't realize the potential force he has.

Language and the ability to use it is a distinctly human attribute. We are surrounded with a barrage of words. Some of us even contribute to that barrage. Most of us use English or misuse it. If we use or even react to English in such a way that we are less frustrated, bored, hurt, or bewildered, then we may have contributed to a more humane technology — whatever that is. Going back to the "faulty" brakes on the student's car, my premise is simply that the English language, that we've tried so hard all of our lives to master, is faulty. It needs to be fixed — and our hard-working English teachers didn't even tell us about it. They sold us a bill of goods that doesn't match the cargo. It's even structurally unsound, like having the frame of your car broken or twisted so everything is out of alignment.

If we can't get millions of people to change their language and language patterns, perhaps we can alert them to some of the pitfalls and weaknesses, and suggest a few ways to make their language more humane.

One of my old professors used to hold up two fingers of each hand like quotation marks when he was using a word in a special way or sense, asking us as listeners to be alerted to the fact that he was doing so, and asking us to wait a minute to hear exactly how he was using it. The word "bank" has over a hundred meanings. Perhaps "technology" has, too. Korzybski gives us over twenty clues or BIC Ds that may be used to make some sense out of our old 16th century English. He claims that we are even programmed into some of our actions or reactions by the very structure of the language. By the way, if this is about a more humane technology, what is an "inhumane technology." Perhaps we should be using the phrase "a more humane use of technology." Olson had a grand time telling us about industrial arts and technology, but I don't remember him writing about a more humane use. By the way, we just fell into another trap. Technology doesn't have to be more humane or less inhumane — it may be just neutral.

So we come to another BIC D — that's "built-in crap-detector" — awareness that English promotes the either-or dichotomy, and the clue here is the use of the word "IS" in the sense that something is the same as another or identical. Consider the heartache that might have been saved if we had talked and written that industrial arts and trades and industry are complementary parts of an industrial education continuum, instead of splitting us into two camps. It is only recently that industrial arts has been included in Federal Vocational Acts, and we still have a great amount of articulating to do before we are accepted as equal partners in practice. We continue to teach drafting in one room, metals in another, and so on — and all the while we know that manufacturing encompasses them both. But the very fact that we think and write and talk in split terms leads us to continue the farce — or, in some instances, some language monsters. Many of these "monsters" need to be critically evaluated and either dropped from our professional vocabulary or recognized for the trouble they may breed in the darkness of our semantic orientation.

One device that can aid us in correcting this habitual splitting is the extended use of the common dash (—) between words to denote that we have corrected the situation a little and, until we have a new word or phrase that is more true to the territory, we beg the reader to think in a more comprehensive sense. Examples of this might be "designing-drafting, lecture-laboratory, psycho-physical."

My president at the University of North Dakota in 1959 was still calling me the Manual Training Department head, which brings us to another BICD — the practice of "dating" our thinking and writing. Industrial arts 1948 cannot be mistaken for industrial arts 1974, and if we date our propositions we won't be misled so easily. After all, we do it most of the time. We know a television set 1950 is not the same as a television set 1974; a lot of technological developments have been incorporated since 1950, and most of us now demand full transistorization. How much have we changed our language patterns since then? We need to update the language of industrial arts. Some examples come to mind of a few welcomed attempts in this direction. The IACP World of Manufacturing and World of Construction are good examples of a semantic revolution in the field. Industrial education and or career education also have great potential.

Sometimes we even make a more fatal mistake — we mistake a word as being the same as the object or situation — and then we are outraged when they aren't the same. No word is the same as the object it identifies, and we are a lot safer and sometimes a lot happier when we realize that the word is a symbol used to identify something. I am reminded of a newly married husband asking his wife to buy a "hammer" to be used around the house for some carpentry jobs and she came proudly home with a "ball pein" hammer. Hammer to her was hammer, and that was that. Korzybski used the phrase, "the map is not the territory." Are some of the maps we've been using out-dated and too restricted? Several innovative proposals, such as IACP, American Industries, Olson's Industrial Arts and Technology, etc., have been developed over the past ten years. The test of their effectiveness will be how well they can guide us through the territory of industrial education.

Try this small map: "Skill is seen as knowledge in action," and imagine the look on your administrator's face when you try to convince him that there can be some — quote — intellectual content in your courses.

Strangely enough, industrial arts has incorporated into its language one of the best BICDs in the business. We do a lot of indexing, and we train our students to do it, too — indexing in the sense of a descriptive language. We don't send our students for a "thing-a-ma-jig" or one of those delightfully spiraled shiny "you know whats." We send them for a No. 6 round head, 1 1/4-inch steel wood screw with a Phillips slot." Indexing helps us make sense out of many crazy situations. It makes us treat students as individuals. It makes us realize that no two things or people are alike and that we can adapt — be more humane — in situations.

So my thesis has been, simply, that buried in the very language we use are some pitfalls, some programmers, some traps, some downright lies that cause us and our programs to be less humane, and therefore our technology has some inhumane results. If we want to move toward a more humane technology, we had better look first at the humans that have produced it and then at our uniquely human but faulty language which has played a dominant role in either our successes or our failures.

BIBLIOGRAPHY

Chase, Stuart, Power of Words, Harcourt, Brace, 1954.
Hayakawa, S. I., Language in Thought and Action, Harcourt, Brace, 1949.
Korzybksi, Alfred, Science and Sanity, Pennsylvania, Science Press, 1948.

Lee, Irving J., The Language of Wisdom and Folly, Harper, 1949.
Olson, Delmar W., Industrial Arts and Technology, New Jersey, Prentice-Hall, 1963.
Svedsen, Ethan, Action and Thought in Industrial Arts Education, Illinois, McKnight and McKnight, 1963.

Dr. Poyzer is a Professor of Industrial Education, University of Hawaii, Honolulu, Hawaii.

Evaluating Humanistic Behavior as a Means of Obtaining a Humane Technology

Vincent J. Walencik

It is a unique individual who can "observe" his own behavior objectively. It is therefore necessary to develop observational instruments that can be used by coders to analyze specific behaviors. In an attempt to obtain a technology which reflects positive human interaction, an observational system must be designed which can measure humanistic behavior. Although many observational systems have been developed to analyze various behaviors, none has been primarily concerned with humanistic behavior. Such a system must be easily administered, cover a large portion of the population, exhibit high levels of reliability and validity, and demonstrate an ease in tabulation. If a humane technology is to be realized, teachers must be observed in the classroom, informed of their behavior, and alter that behavior where necessary. Only through positive attitudes on the part of educators toward humanism can a humane technology ever be realized.

Since the teacher's humanistic behavior is a most important aspect of the educational process, it becomes significant to analyze the means by which that behavior may be observed and modified. The teacher as a human being still has a human element as a unique quality of teaching, and most feedback or evaluation systems make no attempt to assess it (Tuckman, 1971). Roman C. Pucinski (1971), chairman of the General Subcommittee of Education in the United States House of Representatives, holds that a humanistic element of education based on warm supportive interaction of people is practically non-existent. Another advocate of humanizing education, Harold C. Lyon (1970), believes that teachers are conditioned "to deny feelings, and hence, have cut their students off from the rich vistas of learning feeling can open."

OBSERVING HUMANISTIC BEHAVIOR

The Tuckman Teacher Feedback Form (hereafter designated as the TTFF) is an experimental observational device designed to measure humanistic behavior. The TTFF contains fifty pairs of adjectives. Each adjective and its approximate opposite describe a human element of behavior, e.g., original-conventional, passionate-controlled, impertinent-polite, patient-impatient, cold-warm, initiating-deferrent. The observer rates the teacher on a semantic differential scale for each of the pairs of adjectives (Table 1). The adjective pairs are written in both directions—some have their "positive" end on the left, some on the right. This is desirable to minimize the effects of response set. The TTFF can be used for teacher-to-teacher observation (Tuckman, 1971) as well as for pupil-to-teacher observation (Walencik, 1973).

TABLE 1

TUCKMAN TEACHER FEEDBACK FORM

1. ORIGINAL	____:	____:	____:	____:	____:	____:	____:	CONVENTIONAL
2. PASSIONATE	____:	____:	____:	____:	____:	____:	____:	CONTROLLED
3. IMPERTINENT	____:	____:	____:	____:	____:	____:	____:	POLITE
4. PATIENT	____:	____:	____:	____:	____:	____:	____:	IMPATIENT

5. COLD	___: ___: ___: ___: ___: ___: ___:	WARM
6. INITIATING	___: ___: ___: ___: ___: ___: ___:	DEFERRENT
7. HOSTILE	___: ___: ___: ___: ___: ___: ___:	AMIABLE
8. LIKEABLE	___: ___: ___: ___: ___: ___: ___:	ALOOF
9. CREATIVE	___: ___: ___: ___: ___: ___: ___:	ROUTINIZED
10. INHIBITED	___: ___: ___: ___: ___: ___: ___:	UNINHIBITED
11. ICONOCLASTIC	___: ___: ___: ___: ___: ___: ___:	RITUALISTIC
12. GENTLE	___: ___: ___: ___: ___: ___: ___:	HARSH
13. UNFAIR	___: ___: ___: ___: ___: ___: ___:	FAIR
14. BOUYANT	___: ___: ___: ___: ___: ___: ___:	LETHARGIC
15. SHALLOW	___: ___: ___: ___: ___: ___: ___:	KNOWLEDGEABLE
16. CAPRICIOUS	___: ___: ___: ___: ___: ___: ___:	PURPOSEFUL
17. ENERGETIC	___: ___: ___: ___: ___: ___: ___:	LIFELESS
18. CAUTIOUS	___: ___: ___: ___: ___: ___: ___:	EXPERIMENTING
19. DISORGANIZED	___: ___: ___: ___: ___: ___: ___:	ORGANIZED
THOUGHTFUL	___: ___: ___: ___: ___: ___: ___:	INCONSIDERATE
21. UNFRIENDLY	___: ___: ___: ___: ___: ___: ___:	SOCIABLE
22. RESOURCEFUL	___: ___: ___: ___: ___: ___: ___:	UNCERTAIN
23. RESERVED	___: ___: ___: ___: ___: ___: ___:	OUTSPOKEN
24. IMAGINATIVE	___: ___: ___: ___: ___: ___: ___:	EXACTING
25. SUBTLE	___: ___: ___: ___: ___: ___: ___:	DIRECT
26. ERRATIC	___: ___: ___: ___: ___: ___: ___:	SYSTEMATIC
27. AGGRESSIVE	___: ___: ___: ___: ___: ___: ___:	PASSIVE
28. CONCEITED	___: ___: ___: ___: ___: ___: ___:	HUMBLE
29. ACCEPTING (people)	___: ___: ___: ___: ___: ___: ___:	CRITICAL
30. DETACHED	___: ___: ___: ___: ___: ___: ___:	EMPATHIC
31. QUIET	___: ___: ___: ___: ___: ___: ___:	BUBBLY
32. AUTOCRATIC	___: ___: ___: ___: ___: ___: ___:	DEMOCRATIC
33. CONTEMPLATIVE	___: ___: ___: ___: ___: ___: ___:	IMPULSIVE
34. OUTGOING	___: ___: ___: ___: ___: ___: ___:	WITHDRAWN
35. STUBBORN	___: ___: ___: ___: ___: ___: ___:	ACCOMMODATING
36. IN CONTROL	___: ___: ___: ___: ___: ___: ___:	ON THE RUN
37. FLIGHTY	___: ___: ___: ___: ___: ___: ___:	CONSCIENTIOUS
38. DOMINANT	___: ___: ___: ___: ___: ___: ___:	SUBMISSIVE
39. MOODY	___: ___: ___: ___: ___: ___: ___:	CHEERFUL
40. OBSERVANT	___: ___: ___: ___: ___: ___: ___:	PREOCCUPIED
41. EAGER	___: ___: ___: ___: ___: ___: ___:	DISDAINFUL
42. INTROVERTED	___: ___: ___: ___: ___: ___: ___:	EXTROVERTED
43. RELAXED	___: ___: ___: ___: ___: ___: ___:	NERVOUS
44. DOGMATIC	___: ___: ___: ___: ___: ___: ___:	FLEXIBLE
45. ASSERTIVE	___: ___: ___: ___: ___: ___: ___:	SOFT-SPOKEN

46. EASY GOING ___ : ___ : ___ : ___ : ___ : ___ : ___ : DEMANDING
47. TIMID ___ : ___ : ___ : ___ : ___ : ___ : ___ : ADVENTUROUS
48. ANGRY ___ : ___ : ___ : ___ : ___ : ___ : ___ : HAPPY
49. DOMINEERING ___ : ___ : ___ : ___ : ___ : ___ : ___ : PERMISSIVE
50. INDIFFERENT ___ : ___ : ___ : ___ : ___ : ___ : ___ : RESPONSIVE

TEACHER-TO-TEACHER OBSERVATION

Many observational instruments are designed to utilize a teacher or supervisor as the coder of teacher behavior. The TTFF enables the coder to analyze the teacher and easily record the behavior on the observation form. When the observation is completed, the coder prepares a behavioral profile of the teacher using the Feedback Summary Sheet (Table 2).

TABLE 2

FEEDBACK SUMMARY SHEET

Item Scoring

ORIGINAL 7 : 6 : 5 : 4 : 3 : 2 : 1 : CONVENTIONAL

COLD 7 : 6 : 5 : 4 : 3 : 2 : 1 : WARM

I. Creativity

Item Item Item Item - Item Item Item
(1 + 9 + 11 + 24) - (10 + 18 + 47) + 18
(___ + ___ + ___ + ___) - (___ + ___ + ___) + 18 = ___

II. Dynamism (dominance & energy)

Item Item Item Item - Item Item Item
(27 + 34 + 38 + 45) - (23 + 31 + 42) + 18
(___ + ___ + ___ + ___) - (___ + ___ + ___) + 18 = ___

III. Organized Demeanor (organization & control)

Item Item Item - Item Item Item Item
(22 + 36 + 40) - (16 + 19 + 26 + 37) + 26
(___ + ___ + ___) - (___ + ___ + ___ + ___) + 26 = ___

IV. Warmth and Acceptance

Item Item Item - Item Item Item Item
(4 + 12 + 29) - (5 + 7 + 13 + 21) + 26
(___ + ___ + ___) - (___ + ___ + ___ + ___) + 26 = ___

Profile

44 ___
40 ___
36 ___
32 ___
28 ___
24 ___
20 ___
16 ___
12 ___
8 ___
4 ___
0 ___

Creativity | Dynamism | Organized Demeanor | Warmth & Acceptance

The teacher-to-teacher observational system of the TTFF analyzes four factors of humanistic behavior: CREATIVITY, DYNAMISM, ORGANIZED DEMEANOR, and WARMTH AND ACCEPTANCE. CREATIVITY analyzes originality, creative abilities, use of free-thinking, and imagination of the teacher and the degree to which the teacher instills these qualities in his students. DYNAMISM analyzes aggressiveness and assertiveness of the teacher. ORGANIZED DEMEANOR analyzes resourcefulness of the teacher, degree of direct control utilized by the teacher in the classroom, observant nature of the instructor, and organization and systematic approach to cognitive materials. WARMTH AND ACCEPTANCE analyzes the areas of patience, gentleness, fairness, and friendliness.

The coder determines the humanistic behavior of the teacher on the four factors by giving a numerical value to the score obtained on the TTFF observational form as indicated on the Feedback Summary Sheet. Each factor has two separate scores which must be determined. As a result of the adjective pairs being written in both directions, the positive and negative items must be scored individually. Likewise, the possibility of obtaining negative scores is eliminated through the use of constants which are added to the factor scores. After calculating the individual factor scores, the coder prepares a humanistic behavioral profile for each factor.

PUPIL-TO-TEACHER OBSERVATION

In many instances the teacher wishes to obtain feedback concerning his behavior in the classroom. The most readily available observers are the pupils in his class. Many observational instruments are not designed to permit untrained coders to make valid judgments. An alternate form of the TTFF allows the instructor to utilize pupils in coding humanistic behavior (Walencik, 1973). The members of the class observe the teacher, using the original observation form of the TTFF. Likewise, an alternate form of the scoring system is necessary because high school pupils do not interpret the adjectives of the TTFF in the same factor structure as do their adult counterparts. The Student Feedback Summary Sheet (Table 3) is utilized for pupil-to-teacher feedback. Due to the difference in factor structures, seven areas of humanistic behavior are determined: AWARE INVOLVEMENT, WARMTH and ACCEPTANCE, FORCEFULNESS, POSITIVE MOOD, OPENNESS, INNOVATIONS, and RESPONSIVENESS. Due to the possibility of negative scores for each factor and the fact that different factors contain various numbers of items, all Student Feedback Summary Sheet totals are calculated into a percentage using the following formula:

$$\%\ \text{Score} = \frac{100}{X_{max} - X_{min}} (X_{max} - X)$$

Where:

X = score obtained from pupil observation on that factor

X_{max} = maximum score obtainable on the TTFF on that factor

X_{min} = minimum score obtainable on the TTFF on that factor

The percentage scores obtained from the observations by the pupils of the teacher can then be diagrammed on a humanistic behavioral profile.

HUMANISTIC BEHAVIOR FEEDBACK

Once humanistic behavior of a teacher has been determined, it is necessary to inform the teacher of his or her behavior. The purpose of the feedback is to allow the teacher to determine areas of deficient humanistic behavior and to analyze desirable levels of behavior, although standards of achievement can be used as a motivational mechanism for change. Experiments using the TTFF have been conducted with student teachers (Walencik, 1973) and in-service vocational educators (Spence, 1973) which indicated significant changes in behavior toward more positive humanistic behavior. These studies demonstrated significant change in behavior, especially in those teachers who were initially observed as having poor humanistic behavior in the classroom.

Use of the TTFF has also shown that changes in humanistic behavior can be accomplished in teachers through a relatively simple observational instrument using untrained

TABLE 3

STUDENT FEEDBACK SUMMARY SHEET

Item Scoring

ORIGINAL	7 :	6 :	5 :	4 :	3 :	2 :	1 :	CONVENTIONAL
COLD	7 :	6 :	5 :	4 :	3 :	2 :	1 :	WARM

I. Aware Involvement

Item Item Item Item Item Item

(22 + 34 + 36 + 40 + 41) - (47)

(___ + ___ + ___ + ___ + ___) - (_) = ___

II. Warmth & Acceptance

Item Item Item Item Item Item Item

(8 + 20 + 29) - (7 + 13 + 21 + 28)

(___ + ___ + ___) - (___ + ___ + ___ + ___) = ___

III. Forceful

Item Item Item Item

(38 + 45) -(16 + 46)

(___ + ___) -(___ + ___) = ___

IV. Positive Mood

Item Item Item Item Item Item

(31 + 43) - (30 + 35 + 39 + 48)

(___ + ___) - (___ + ___ + ___ + ___) = ___

V. Openness

Item Item Item

( ) - (3 + 5 + 32)

( ) - (___ + ___ + ___) = ___

VI. Innovative

Item Item Item

(2 + 6) - (18)

(___ + ___) - (_) = ___

VII. Responsiveness

Item Item Item

(33) - (44 + 50)

(___) - (___ + ___) = ___

coders (classroom teachers or pupils), whereas many systems designed to provide feedback require the use of trained observers and elaborate coding procedures. The supervisor of teachers and pre-service teachers can now obtain positive results in behavioral change through a technique which requires limited time to gather data from the observers while utilizing readily available coders.

If a humane technology is to become a reality, instructors must be cognizant of their behavior in the classroom. An educator who lacks positive humanistic traits cannot expect to instill a technological attitude within his students which stresses humane qualities. An observational system such as the Tuckman Teacher Feedback Form, although still in the neonate stage, is a first step in providing feedback in an area of behavior which is not specifically diagnosed by currently accepted observational instruments.

REFERENCES

Spence, M. A study to evaluate the impact of structured and unstructured feedback to teachers. Unpublished doctoral dissertation, Rutgers University, New Jersey, 1973.

Tuckman, B. W. Changing the behavior of teachers through feedback. An invitational

paper presented at the meeting of the National Association of Elementary School Principals, Cleveland, Ohio, 1971.
Walencik, V. J. An experimental study to determine the effectiveness of feedback as a means of changing student teachers' humanistic behavior. Unpublished doctoral dissertation, Rutgers University, New Jersey, 1973.

Dr. Walencik is a member of the faculty at Montclair State College, Upper Montclair, New Jersey.

Humanizing Elementary Education Through Industrial Arts

Robert W. Nannay

One of the most controversial issues being discussed in the educational arena today deals with the concept of "humanizing" education. Although this educational innovation is being directed at the entire spectrum of education, many of its supporters emphasize the importance and necessity of providing a humanistic environment at the early childhood and elementary grades. It is here that the important characteristics and concepts related to student peer group relationships, self-image, positive attitudes toward school, adults, work, and society, self-direction, motivation, responsibility, etc., are nurtured.

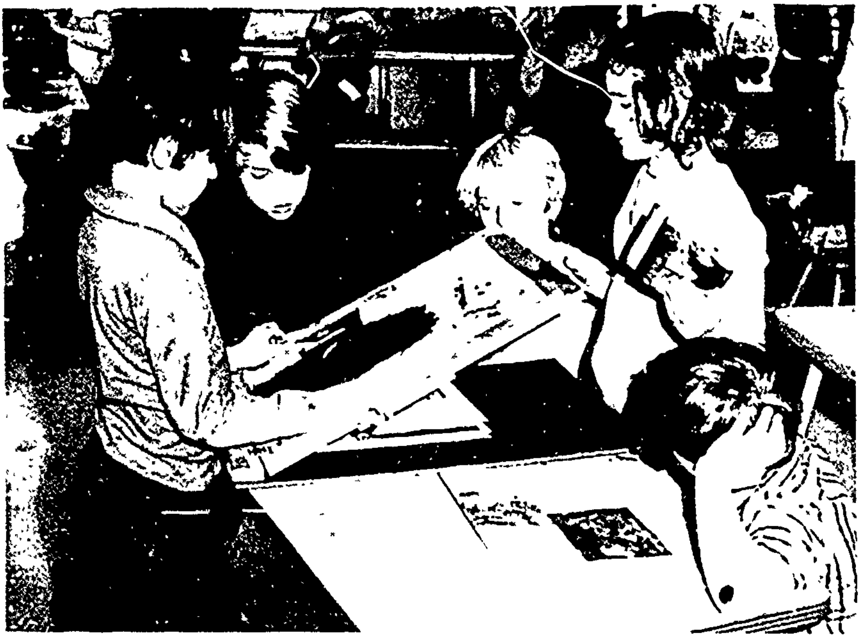
The humanistic movement originated to counter the criticism of U.S. schools which has surfaced during the past decade. Charges of dull and irrelevant education, stifling regulations, a minimum of curriculum options, strict procedures, rigid regimentation, teacher inhumaneness, emphasis placed on academic subjects, and failure to meet the developmental tasks and needs of today's youth constitute some of the prime areas of concern. As Glines, in his book, Creating Humane Schools, stresses:

> Schools are in need of drastic, immediate overhauling, otherwise, many students should not be required to attend. Schools have a negative effect on many — perhaps even on the majority. There are no accurate percentages available, but many educators now believe that the traditional school programs and the regulations which still exist in most school districts in the USA are the major cause of student unrest (Ref. #6, p. 22).

Such negativism expressed by students toward American schooling has been accentuated in the form of increased drug abuse, absenteeism, academic failure, vandalism, assaults on adults, and, of course, an alarming dropout rate. According to the U.S. Office of Education, approximately one million elementary and secondary students dropped out of school during the 1972-1973 year (Ref. #11, p. 4). This incredible situation greatly supports the immediate trend to alter our present system of education.

Professor Hugh Wood at the University of Oregon has developed a recipe for the present-day school dropout. Unfortunately, it reflects upon many existing school programs throughout the United States. He states:

> Take one poor American boy, give him as little love as possible, kick him around a bit at home, put him in an academic schoolroom with a subject-centered curriculum and a scholarly teacher who sees no hope for him. Foil him once or twice, never give him more than a "D," be critical, never praise him, treat him as a number rather than a person, and do not let him ever feel he belongs in school. Transfer him from one school to another occasionally, keep him out of school activities. Stir these difficulties well together, make him angry enough to play truant a few times, cook well in social class structure, burn to a crisp with sarcasm, and bake two or three years. This should produce something you can sweep outside or under the academic rug, but if you cannot get rid of him this way, tell him he has to take English with Miss Brown. If you want to frost this with a little juvenile delinquency, deny him a job the first 30 places he tries. If this recipe still produces a good American youth, try again (Ref. #6, p. 52).



THE NATURE OF THE HUMANE SCHOOL

Obviously, this statement is rather sarcastic and cynical. However, it does stress the need for those of us in education to consider alternatives to educating today's youth. One possible solution to solving our existing education problem is through a humanistic curricular approach. To understand the rationale behind this movement, one must be aware of the three educational domains and the emphasis placed on each in today's schools. Undoubtedly, the cognitive domain—knowledge, skill in subject matter areas—has received the greatest attention of the three. Ranked second in emphasis has been the psychomotor domain—physical maturity, fine and cross motor coordination and skills, strength, athletic ability. Finally, the affective domain—self-image, responsibility, self-direction, motivation, personal relationships—has been granted a minimum degree of attention. In creating humane schools, the three educational domains must be shifted so they are stressed in the following order. Affective, Psychomotor, Cognitive.

Rather than exposing students to and holding them accountable for the mastery of irrelevant knowledge and isolated facts, curricula should and must be designed to meet the psychological, physiological, and sociological needs of youth. Once the affective and psychomotor domains have been established, the cognitive domain will naturally become an important variable in the educational environment. Ideally speaking, a balance between the three domains would be the most desirable educational arrangement. However, it is the firm belief of the leading proponents of humanistic education that for this to occur, educators must first emphasize the affective domain (Ref. #6, p. 21, Ref. #8, p. 67).

Perhaps the most important variable in creating the humane school can be found in the student teacher relationship. Briefly stated, the personality of the student and the teacher must be in harmony. Another important factor deals with perception. The teacher's perception of the student must be positive. Furthermore, and very critical to affective domain development, the student must perceive that the teacher's perception of him is positive. According to Glines, "Positive motivation, self-image, daily success, and self-direction are more important than the study of subject matter in the development of humane education (Ref. #6, p. 7)."

Many educators surely will challenge the thought of placing the affective domain in a prominent position with regard to our educational priorities. However, one only has to become familiar with the concepts expressed in the following references to see the importance of the affective domain to our education programs as we rapidly approach the 21st century. Herman Kahn's The Year 2000, Alvin Toffler's Future Shock, William Ewald's Environment for Man, The Next 50 Years, Robert Bundy's Forecasting the Future, and Frederick Pohl's Space Merchants, to name a few, deal with various technological concepts which will greatly influence our lives in the foreseeable future. Specifically, these books are concerned with the utilization of drugs to control human behavior, increased affluence, psychological effects of leisure, changing attitudes toward work, increased alienation in society, megalopolis, 300 million people in the United States by the year 2000, and the ensuing impact on transportation, housing, pollution, and food shortages.

Educators must get away from the present commitment to memory learning and move to an educational offering based on the development of people — i.e., self-image, decision-making skills, communication skills, and personal relationships.

THE ROLE OF INDUSTRIAL ARTS IN THE HUMANE ELEMENTARY SCHOOL

The field of industrial arts, by its very nature and philosophy, has a tremendous role to play in designing and implementing humane curricula in the elementary school. Buffer has identified a list of experiences that children receive while engaged in industrial arts activities. They include:

1. Development of perceptual-motor behavior.
2. Development of multi and integrative sensory-motor skills.
3. Experiencing success in a school activity.
4. Freedom of movement in a laboratory.
5. Interact with peers to achieve common goals.
6. Experience leadership and followership activities.
7. Deal with concrete materials rather than sole dependence on abstract reasoning.
8. Participation in action-oriented activities with immediate goal satisfaction (Ref. #1, p. 23).

It is quite apparent from careful analysis of this list that the affective and psychomotor domains — the major elements of a humane environment — receive great attention in the field of industrial arts. Further support for offering industrial arts experiences in the elementary realm is provided by Mary-Margaret Scobey. She states,

> The term learning-by-doing in educational circles has been used so often that it has become trite. Yet we know that children will be more interested, learn more easily, and retain learning longer if they actively are engaged in constructing, manipulating, and experimenting. The manipulative concrete activities of industrial arts are especially appropriate for young children who have limited experience upon which to build abstractions (Ref. #10, p.11).

Other proponents of elementary industrial arts could be cited. Unfortunately, the fact remains that the field of industrial arts is relatively non-existent in the elementary schools throughout the United States. A recent study limited to 20 states indicated inconclusive evidence of industrial arts activity in elementary schools. The reporting members were state industrial arts supervisors. However, the report did indicate a "growing interest in some type of elementary program and that growth potential looked bright even though progress was bound to be slow (Ref. #11, p. 10)."

Presently, there are a number of highly successful elementary industrial arts programs in the United States. Some of the more prominent include: Project LOOM, Melburne, Florida, Elementary I.A. Project, Los Angeles, California, Project Occupational Versatility, Seattle, Washington, Technology for Children, Trenton, New Jersey, A Technological Exploratorium, K-6, Akron, Ohio, and Park Orchard Elementary Project, Kent, Washington, to identify a few. But again, our input at this level of education is minimal.

William Hoots, who is one of the leaders of the elementary industrial arts movement, feels that what is needed is proper leadership. This must come from "within the individual school, from the state department of public instruction, from national educational organizations, and from other educational associations." Hoots continues to identify some basic requirements for such effective leadership. Included here are.

1. An understanding of child behavior, needs and interests.
2. Familiarity with the elementary school curriculum.
3. Knowledge about trends and issues in elementary school industrial arts.
4. Knowledge about technology and its social influences.
5. Experience in industrial arts for children (Ref. #4, p. 12).

IMPLICATIONS FOR TEACHER TRAINING INSTITUTIONS

Another source of leadership for promoting industrial arts in the elementary school must originate in the teacher training institutions. At the AIAA annual conference in Las Vegas in 1969, Stephen Johnson of Fort Lauderdale, Florida, presented a paper entitled "Developing a National Curriculum in the Technologies for the Elementary Grades." One of his major recommendations called for the establishment of elementary industrial arts teacher preparation programs in colleges and universities where industrial arts has a major program (Ref. #8, pp. 111-112). More recent support in this area comes from a Master's thesis written by Geoffrey Nichols at the University of Alberta. Based on his study of elementary industrial arts programs in the United States, he strongly recommended that "curriculum development in elementary school industrial arts should be emphasized at the teacher education level so that new, innovative, and conventional programs can be compared (Ref. #10, p. 89)." A similar study undertaken by Douglas Holm at the University of North Dakota in 1973 concluded that "elementary majors should be required to take a course in elementary school industrial arts as a part of their undergraduate preparation (Ref. #7, p. 3)."

Despite this call for curriculum innovation in our field at the elementary level, our colleges of education continue to hesitate with regard to program implementation. One approach to solving this problem is to offer a minor in technology/industrial arts for future elementary teachers. A few colleges and universities have established such a minor. The following is an example of such a program for elementary majors.

MINOR IN TECHNOLOGY
FOR ELEMENTARY MAJORS

Career Education in the Elementary School	3 credits
Graphic Communication	3 credits
World of Technology (General Industrial Arts)	3 credits
Modern Industry	3 credits
Methods of Teaching Technology in the Elementary School	3 credits
Elective (select from the following broad areas)	3 credits
Manufacturing and Construction	
Energy and Transportation	
Graphic Communication	

(Developed by the Department of Industrial Education and Technology, University of Maine at Portland-Gorham.)

In summation, the humanistic movement in education appears to be gaining momentum. In light of the criticism of America's educational system expressed by students, parents, legislators, and progressive-thinking educators, the approach must at least be field-tested in our schools. Surely, we must place much more emphasis upon the affective and psychomotor domains in education. The field of industrial arts is one curricular area which is unique in this realm. Simply stated, industrial arts is the most humanistic discipline in education. Let us not throw away the great opportunity which is at our fingertips to become the leaders in the movement to create humane elementary schools.

REFERENCES

Buffer, James. "I.A. As Therapeutic Education for the Mentally Retarded." Where the Action Is. AIAA. Washington, D.C., 1969.

Coleman, James. "How Do the Young Become Adults?" Unpublished paper presented at the American Educational Research Association Annual Meeting. Chicago, Illinois. April 4, 1972.

Cross, Patricia. Beyond the Open Door. Washington, D.C.. Jossey-Boss, Inc., 1971.

Editor. "What Now for Elementary School Industrial Arts?" IAVE. February 1972.

Gardner, John. Excellence: Can We Be Equal and Excellent Too? New York: Harper and Row, 1961.

Glines, Don E. Creating Humane Schools. Mankato, Minnesota. Campus Publishers, Mankato State College, 1972.

Holm, Douglas. A Study to Ascertain the Need for Industrial Arts in the Elementary

Schools of Grand Forks. Unpublished Master's thesis. University of North Dakota, 1973.

Johnson, Stephen. "Developing a National Curriculum in the Technologies for the Elementary Grades." Where the Action Is. AIAA. Washington, D.C., 1969.

Kline, Lloyd W. Education and the Personal Quest. Columbus, Ohio: Charles E. Merrill Company, 1971.

Nichols, Geoffrey. Description of Selected Contemporary Programs in Elementary School Industrial Arts within the United States of America. Unpublished Master's thesis. University of Alberta, 1972.

Scobey, Mary-Margaret. Teaching Children About Technology. Bloomington, Minnesota. McKnight and McKnight, 1968.

U.S. Office of Education. Career Education. DHEW Publication No. (OE) 72-39.

Dr. Nannay is an Assistant Professor at the University of Maine at Portland-Gorham, Gorham, Maine.

Individualized Instruction

Software Design for Teachers

Clarence H. Preitz
Allen E. Morris

Many industrial arts teacher educators today look upon instruction sheets, particularly operation sheets and job sheets, as an early attempt by industrial arts teachers to redesign the components of the instructional process and to individualize instruction. In actual fact, the teachers who used instruction sheets were personalizing instruction and not individualizing it. Unknown to these teachers, they were moving toward a better balance between group and individual needs.

Personalized instruction was the first major attempt by industrial arts teachers to meet the needs of the individual student. It was the first step by these teachers to break away from traditional methods of teaching and from a lock-step curriculum in order to better adjust their teaching to meet the needs of the individual learner more successfully.

Furthermore, personalized instruction did not take into consideration many of the variables associated with the individualization of instruction. Although this type of instruction provided the student with learning activities, these activities were not specifically designed for the individual student from the results of diagnostic procedures.

Individualized Instruction Defined

There are as many various definitions for the term "individualized instruction" as there are writers on this subject. The majority of these definitions focus on instructional planning with and for each individual student before he is taught and then teaching him according to an established plan. Possibly the most accurate definition for individualized instruction is that of Southworth (1971) who wrote:

> Individualized instruction consists of planning and conducting with each pupil programs of study and day-to-day lessons that are tailor-made to suit his learning requirements and his characteristics as a learner (p.249).

Regardless of the definition chosen, the individualization of instruction contains five basic interrelated components: pacing, objective, instructional materials, the learner, and the teacher as a facilitator and manager of the learning environment. Pacing means that each student progresses through the learning sequence at a rate commensurate with his attitudes and abilities. Without the other four components, instruction cannot be individualized nor executed.

Task Analysis

An initial step in developing instruction sheets was for the teacher to carefully analyze an operation or a job in detail by performing a task analysis. A task analysis of an operation requires the detailing of an involved pattern of actions and judgments that must be identified and correctly sequenced if the operation is to be learned correctly. This preliminary step in designing instructional material has value because it frequently identifies tasks that need to be learned, and it also forces the teachers who are involved in the process to make certain decisions regarding tasks and subtasks which are selected for inclusion in the instructional material. In addition, teachers engaged in task analysis also develop competencies in organizing and sequencing instruction.

Planning Sheets

In industrial arts classes where individual differences have been given serious consideration, the general practice has been to use planning sheets as a means to personalize and not individualize instruction. Planning sheets do help to personalize instruction in that they force the student to analyze, examine, and sequence a series of operations to be followed in completing a job or project. In making his analysis of the operations to be followed, because the student lacked the necessary competencies, his analysis, in many instances, was not carefully performed. Despite this fact, planning sheets did serve and are still serving a useful purpose in industrial arts.

The use of planning sheets was the beginning of a redirection of one of the components of the instructional delivery system used by industrial arts teachers in their attempt to reach the individual learner more successfully. This instructional procedure was directly connected to the student's frame of reference as he planned the steps to be used in constructing the project. The planning sheet provided the student with the opportunity to work individually or as a member of a small group.

Small Group Instruction

Over the years much attention has been given by industrial arts teachers to small group instruction. In this teaching format, the attention of the teacher is focused on the needs of a particular group of students, with instructional procedures appropriate for the group being used. Critics of this teaching format point out that since individual students differ so widely, instructional materials should be tailored to the needs of the individual student and not of the group.

CURRICULUM CHANGE AGENTS

Until the advent of the 1960's, when research funds were made available, industrial arts content came from either the manufacturing industries or the craft trades. Since that time, many industrial arts teachers have been aggressively incorporating various technologies as a change agent for their programs. The inclusion of some of these technologies into industrial arts programs of studies has had an influence on the content of these programs, as well as on the instructional material used in the instructional delivery system.

Multiple Activity Laboratory

In the past decade and a half, another change agent in industrial arts in North America has been the wide acceptance of the multiple activity laboratory as an organizational pattern for the instructional environment for industrial arts classes. Where the multiple activity laboratory has replaced the traditional unit shop, the instructional delivery system has also been modified by being less teacher-centered and more learner-centered, with a role change for both teacher and learner. Both are part of curriculum change and incorporate the kind of change in instruction that has influenced facility design and instructional material design. Instructional materials in these laboratories are no longer designed around the needs of the teacher, but they are designed around the needs, interests, and capacities of individuals. Both print and non-print media can be one of several vehicles for the transmission of content in this learning environment.

Programmed Instruction

One of the major advances in instructional material design was the concepts of programmed instruction that were introduced by Dr. B. F. Skinner and his associates. Advocates of programmed instruction point to its advantages in the individualization of instruction. These proponents also point out that, with slight editorial changes, some programmed materials can be redesigned to meet the needs of a wide variety of learners. Industrial arts educators who support these instructional materials believe the greatest hindrance to their greater use is the lack of valid programmed materials for their programs and the difficulty of preparing these instructional materials at the local level.

More recently, Dr. Armond G. Hofer, in conducting a research investigation with grade seven metal shop students, combined the basic principles of linear programming and photography. The purpose of Hofer's study was to determine the effectiveness of programmed materials as compared to demonstrations to teach manipulative operations. In his findings, Hofer (1964) wrote. "It appears, then, that programmed materials are able to produce results at least as good as demonstrations, with far less time and energy on the part of the teacher" (p.50). Unfortunately, Hofer did not give his method of organizing instructional material a definitive title.

Pictorial Programmed Instruction

A more recent development in instructional material design for industrial arts is Pictorial Programmed Instruction (P.P.I.) developed at the Department of Industrial and Vocational Education of the University of Alberta, Edmonton, Alberta, Canada.

Pictorial programmed instruction developed from the work of Skinner and Hofer and is based upon the principles of operant conditioning. Pictorial Programmed Instruction is designed to be a 90/90 program. Obtaining this ability demanded a totally new design of how the material to be learned is to be organized and sequenced. Unlike a conventional program, extensive use is made of specific visuals to reinforce short descriptive state-

12

Remove both chuck shell and collet from shaft to determine if collet is properly inserted.

N B The longest taper on the collet should be inserted in motor shaft.

ments of not more than 20 words. When combined, these are referred to as a frame. A frame of P.P.I. consists of two interfacing pages. On the left page of each frame is a short, precise descriptive statement for a task or subtask of an operation or procedure that the student is to learn. On the right hand page of the frame is a supporting photograph. This photograph is a visual stimulus of its companion statement and illustrates the overt "hands-on" activity the student is to perform. Both the descriptive statement and the photograph are logically and sequentially organized in the text of the program. Cues, prompts, and other programming techniques are not an integral part of the programmed material.

P.P.I., like programmed instruction, uses a series of statements and responses in a sequential manner to achieve a prescribed set of instructional objectives written in performance terms. Teachers who write P.P.I. tend to use knowledge of results as reinforcement. The strengthening of the behavior that has been displayed by the learner after he replicates what he has read and seen in each frame of the program is reinforcing. The program is designed to maximize the probability of success for the student. What the student replicates is relevant and consequently reinforcing. This type of instructional material is designed to insure that each student is taken through the same instructional sequence with as few errors as possible.

P.P.I./Programmed Instruction

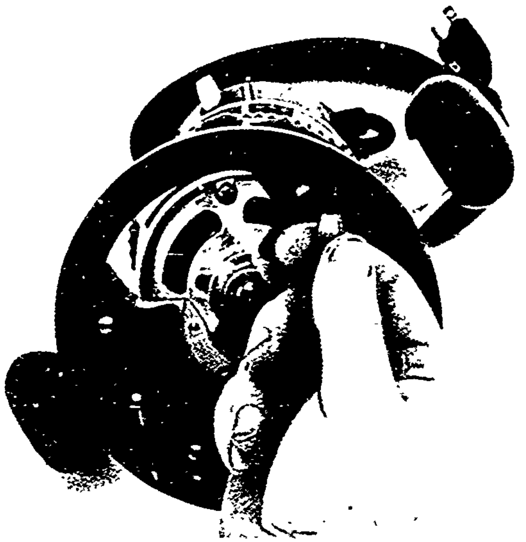
P.P.I. is a modified form of programmed instruction is used to give instruction, information, and advice to the individual learner. It has much in common with programmed instruction.

Pictorial Programmed Instruction has the following characteristics:

Capable of instructing effectively with minimal and in some cases no direct participation by the teacher

Rationale a short explanation as to the significance of the material to be learned and its relationship to the total instructional scheme

Precise definition of instructional objectives directed at student achievement that is measurable



Logical and sequential organization of the material to be learned

Material consistent and nothing omitted either by accident or design

Arrangement of tasks and subtasks in relatively small increments which are cumulative

Student an active participant throughout the learning experience by exhibiting either an overt or covert behavior

Student reinforcement after replication of stimuli — the presentation-response-reinforcement cycle of pictorial programmed instruction

Pictorial Programmed Instruction, like many other software items, is unidirectional. That is, the program cannot answer the students' questions. For this reason, the design of the program must be executed with extreme care in order to anticipate the questions and the problems that may arise for the student in the course of the learning experience.

DESIGNING P.P.I.

The responsibility of the teacher designing P.P.I. is to see that the tasks are accurately and clearly described and presented. To accomplish this, a task analysis is made to identify the task and subtasks of the operation or process that the teacher wants to include as content for the instructional material. This analysis is made using a three-column analysis sheet which includes TASK TO BE PERFORMED, PICTURE TO BE TAKEN, AND SAFETY PRECAUTIONS TO BE FOLLOWED. In the "task to be performed" column, the person making the analysis writes short, precise statements which describe the subtasks of the operation or process being analyzed. Unnecessary information and detail will only confuse or waste the efforts of the student and reduce the efficiency of both learner and instructional material and therefore are omitted.

Task Analysis/P.P.I.

The outline generated from the task analysis is a complete description of the component parts of the P.P.I., a blueprint upon which production is based. The tasks identified on the task analysis sheet can also be used as a content outline for additional items of software such as a slide-tape presentation, a film strip, or a single-concept film.

The introductory pages of the program include a list of the essential tools and materials that the student will use as he learns the process or operation that is programmed. Frames which describe a material to be used in making or finishing a project should include a sample of that material if the material is a solid. This procedure is followed to assist the student in learning to identify the various materials he will use in making his project.

Arrows, lines, circles, or indicating fingers are used to lead the eye of the learner to the part that the designer wants to emphasize and have the learner look at. Nothing is left to chance, since the explicit purpose of the P.P.I. is to teach.

This supplemental teaching method has several important advantages. One of its most important advantages is its feature of self-administration and self-pacing. For example, the learner is actively involved in the learning process and is given considerable latitude in independent regulation of his preferred rate of learning.

Validation of P.P.I.

Part of the value of the P.P.I. stems from the fact that this type of instructional material can be prepared by experts in their field — industrial arts teachers at the local level. To enhance the value of this software item requires considerable writing, rewriting, and validating before the designed text becomes reality. Validation requires that the P.P.I. be piloted with a minimum of three groups of students who are unfamiliar with the programmed material. This is done to identify areas of difficulty or ambiguity that need to be refined.

Learner Characteristics

Before beginning to design software, the teacher needs to determine the precise purpose of the material for the programs by establishing both a rationale and performance objectives for the instructional material. Careful consideration should be given to the characteristics of the learners who will be the ultimate consumers of the instructional material. These characteristics include age of the learner, educational maturity of the learner, the learner's vocabulary, the learner's reading ability, the learner's previous experience. Another consideration that the teacher needs to give attention to is the amount of repetition that will be needed to make the instructional material effective.

Slide-Tape, Film-Strip/Task Analysis

As previously indicated, the tasks identified on the task analysis form can be used to design other items of software. The narrative portion of this outline can be used to identify cue words to establish pulsing cues and a time basis for each visual of the slide-tape or film-strip presentation. The accurate positioning of the pulse can make or break the effectiveness of both of these audio-visual presentations. A major use of information from the task analysis form is that it can be used to plan the picture to be taken for both the slide-set and the film-strip.

The preparation of a slide-tape presentation includes three major steps after the task analysis has been made. These steps are taking the picture of the subtasks to be presented on each slide, preparing them in mounts, and coordinating them with the commentary on the tape recording. The slides are taken according to the pictures identified on the task analysis form.

To make a slide-series, a reversal color film is used and after exposure is sent to a local film processing laboratory for processing. When returned, the slides are mounted in cardboard mounts and edited using a light box.

Graphics Preparation

Graphics for the slide-tape are prepared from the outline of the task analysis. First the graphic is prepared using pressure-sensitive lettering which is then copied on 35-millimeter ortho film, keeping size of the graphic and its position on the slide in mind. The result of this process is a 35mm negative of the graphic.

This negative is then placed in an etching bath which removes the exposed or black areas of the film, leaving an intaglio surface with the small areas of clear or unexposed emulsion supported by the plastic base of the film.

The etched slide is dyed with a Q-tip which has been soaked in a transparent watercolor. Since the plastic base of the film is non-absorptive, only the remaining clear gelatin emulsion is dyed. In order to achieve a two-color effect, the whole negative is bath-dyed and then surface-dyed with a Q-tip. The second color soaks into the very thin gelatin layer on the back of the film.

To create a slide with a graphic notation, the slide and the graphic are sandwiched together and mounted in an ordinary 35mm cardboard slide mount.

Film-Strip Preparation

This combination can now be used as is or may be reserved as a master so that copies of the slide set or a film-strip may be prepared. The film-strip is prepared by using the set of slides from the slide tape package, with additions or deletions to accommodate the film-strip format. These slides are then duplicated, using a special sliding easel on a repronar or other slide duplicating apparatus. Another alternative is to send the slide set to a commercial processor who will produce a film-strip from the set.

Commentary for both the slide-tape presentation and the film-strip is generated from the tasks to be performed column of the task analysis form. The taped content refers the student to the subtask that is illustrated in a slide or in a film-strip frame and that he is to perform on the item illustrated.

One of the major advantages of both the slide-tape and the film-strip is the step-by-step sequential order of the slides and frames, another is the relatively low cost of producing these items of software. With both these software items, the teacher has a ready-made, efficient, and convenient teaching tool.

Slides have the advantage of being easily arranged or rearranged in whatever sequence is appropriate. The rate of presentation can be controlled by the learner as he sets his pace of learning.

University Students and Software Design

Because many industrial arts teacher education institutions have curricula that are heavily weighted toward the students acquiring psychomotor skills, students in these programs have little opportunity to take courses directed at the design and development of instructional materials.

A part of the industrial arts teacher education program at the University of Alberta requires that the students develop a P.P.I. text or other item of software for a process or operation of their choice. Much of the acquisition of psychomotor skills by these students is taught with the use of P.P.I. text, which is considered a supplemental method of teaching.

Graduates of the program have not only been taught by this method, they have been required to design instructional materials. The purpose of this requirement is to have the student develop the competencies that he will use in designing and preparing instructional materials for his students.

ARTICULATED INSTRUCTIONAL DEVELOPMENT BOOKLETS

The industrial arts program offered at the junior high school level in Alberta is in most cases based on the multiple activity organizational pattern. The grade seven material technologies program is centered on a study of metals, woods, plastics, and other materials (concrete, glass, leather, rubber). One bay of the laboratory is equipped for each material area in a physical configuration that will accommodate from four to six students. In turn, each bay is provided with sufficient tools and equipment to permit six different activities to be pursued simultaneously by the students in that bay.

The grade eight graphic and power technologies program is organized by content and physical arrangement in a similar manner. At the grade nine level, students electing the program are encouraged to contract the type and depth of activities they wish to pursue.

Use of AID's

Theory and related information is presented at a concept level during the large group (total class) sessions. During the individual activity sessions, students apply these concepts within the particular area they are working. It is at this point, when the students enter the activity section of the program and work in a bay, that the need for independent learning resource materials is realized. To meet this need, Articulated Instructional Development Booklets (AID's) were designed by selected industrial arts teachers to individualize instruction. These booklets, although using some of the principles of pictorial programmed instruction, differ slightly in that a product or a process is used for instructional content.

The basic element of these booklets is to "show and tell" the "what and how" to a junior high school student as he proceeds to perform a process or fabricate a product.

After four years of developmental work, the AID project was approved for funding by the Department of Education, the Calgary Board of Education, and the Industrial Education

Council of The Alberta Teachers' Association. This made possible the final editing and publication of 500 AID packages. Included in each package are 40 booklets for both material technology and graphic/power technology, as well as a teacher's data guide.

Organization of the Booklet

nother result of the approval of the AID project was the standardization of:

FORMAT
- 5-1 2 x 8-1 4-inch page size
- one picture per page
- maximum of four lines of script per page
- printed both sides of paper (maximum of 79 pages)
- arrow identification of motion

CONTENT
- product or process base
- reading level controlled (what followed by how)
- script in complete sentences

CONTROL
- Production Control Activity Record (PCAR) in each booklet
- Procedure Check Points – give non-manipulative directions
- Quality Check Points – require teacher inspection and approval to continue
- Power Equipment Check Points – require teacher approval and possibly demonstration prior to continuation
- End of AID Check Points – requires teacher's initials
- AID booklets are color and number coded in accordance with an open-ended classification system

Yearbook Additions

The package of 80 booklets developed by the AID Project (1973) is considered as the base from which industrial arts teachers in the province will now work. Funds have been arranged whereby additional booklets will be developed each year in the form of a "yearbook" addition. It is hoped that this form of continual up-dating of these instructional materials will provide the avenue to keep the junior high school industrial arts program in the province current with technological advancement.

REFERENCES

Hofer, G., "Teaching Manipulative Operations with Programed Materials." Industrial Arts and Vocational Education, Volume 53, No. 8, October 1964.

Preitz, C. H. "Pictorial Programmed Instruction: Its Development and Utilization." Industrial Arts and Vocational Education, Technical Education, Volume 57, No. 10, December 1968.

Southworth, H. C., "A Model of Teacher Training for Individualization of Instruction," in Weisgerber, R. A., Perspectives in Individualized Learning. Itasca, Illinois: F. E. Peacock Publishers, Inc., 1971.

Wittich, W. A., and Schuller, C. F. Instructional Technology Its Nature and Use. New York: Harper & Row, Publishers, 1973.

Dr. Preitz is a member of the Department of Industrial and Vocational Education, Faculty of Education, The University of Alberta, Edmonton, Alberta, Canada.

Dr. Morris is Supervisor of Industrial Arts for the Calgary Public School Board, Calgary, Alberta, Canada.

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Interdisciplinary Studies

Merging the Concepts of Technology and Home Economics

Julia E. Summers

Change is a constant, and we in the field of education are charged with the responsibility of preparing the next generations for a world we do not know and cannot predict exactly. However, there are a few things which are known or are predictable. We know we can no longer "train" students to perform procedures which have become obsolete. We know that sex roles are less rigid. We know that the American perception of authority as represented by business and government resembles the days of King George. We know that the family is no longer as stable or as large as in our generation. The question remains: How do we incorporate this knowledge into an educational pattern which will contain enough stability for functioning today and enough freedom to proceed into tomorrow?

Obviously, we will not be able to move abruptly to another system of education. Nor can we create new components for this emerging educational system from whole cloth. Instead, we must view the education of today and select from it those components which are of value, discard those which are of lesser value, and increase the mixture with concepts and generalizations essential for the future.

Industrial arts instructors and home economists have a background unlike that of other public school teachers. In college, other instructors are provided one or maybe two courses which prepare them to communicate procedure. As we prepared the assigned designs and products, we were constantly showing, describing, and conferring with professors as well as other students. We know how to teach, but do we know what to teach? Are we complacently insisting that our students produce meaningless objects to take home, or are we bending our ingenuity to discover projects which embody concepts applicable to other endeavors and other subjects?

Home economics and industrial arts must be responsible for analysis of content concepts. But there are many concepts which can and should be shared by these areas for the benefit of students.

There are two fundamental reasons why this cooperative pooling of concepts has not taken place. First, to receive a certificate in either home economics or industrial arts, the teacher candidate had no college time to pursue the other. Second, the internal concepts are not formed well enough on paper to indicate that they can be taught cooperatively. At this time, the concepts of industrial arts are much better spelled out than those of home economics.

As content changes are made, we can modify the class day in favor of the student. Industrial arts and home economics were two of the first "frills" added after the Boston School curriculum was developed. A danger is that we become protective and demand our 45-minute segment of the class day forever. Modular scheduling has become a reality in most contemporary schools and will be accepted by others as they develop their change procedures.

We will have to change our content to fit within the reduced exposure time when we have students. To do this, we need to make our subjects student-centered and delete those activities which are time-wasters and do not support valid content.

Change, as described here, will take administrative action and support. Before approaching administrators, there are things which you can do to improve your class functioning. I would suggest that instead of asking permission of your principal or curriculum coordinator, you meet with your staff home economist and develop a plan which will be functional for you and present the what and how as a working solution.

Is this request reasonable? Most certainly not if you do not have any idea of the content of home economics and therefore can see no reason or way to merge the two.

Here is a comparison of the two curriculum areas. You may have already moved your instruction into another categorical breakdown, but not all instructors have. If your curriculum does not contain all of these components, this will help you see how it can.

INDUSTRIAL ARTS	HOME ECONOMICS
	Areas of Instruction
1. woods	1. foods and nutrition
2. metals	2. clothing and textiles
3. graphics	3. child care (human growth and development)
4. textiles	4. home care of the sick
5. ceramics	5. home decoration
6. plastics	6. household management

OBJECTIVES IN COMMON:

* Prepare students to produce and consume
* Efficient use of time and motion
* Proper use of human and financial resources

The similarities are obvious. We are presenting tactile experiences with material substances. We rely on the use of communication and computation skills, knowledge and use of the scientific method, and the necessary socialization of the human in contact with other humans gained from other segments of the curriculum.

However, the emphasis is entirely different. Industrial arts/technology is directing students into those concerns which can be characterized as PUBLIC. Activities are presented which are associated with the home only so far as the structure of the dwelling and its equipment and furnishings. The emphasis does not include the people with whom we work, live, or produce. This curriculum is overwhelmingly thing-oriented. Social aspects of technology are rarely examined as components of the technology itself.

The curriculum of home economics is almost exactly opposite. Students are encouraged to investigate their feelings and observe the maturing process as individuals. Students are directed through activities associated with the domestic relationships of people. For this component, let's use the term PRIVATE.

A general outline of the curriculum of home economics provides information which substantiates the need for men to participate in home economics.

FOOD AND NUTRITION

- Purchase
- Preparation
- Preservation
- Properties
  - Chemical
  - Physical
- Serving
  - Family
  - Commercial

HOME CARE OF THE SICK

- Emergency care
- Preventive care
  - Immunization
  - Hygiene
- Chronically ill
  - Genetic
  - Communicable
  - Injuries
- Aging
- Convalescent

CLOTHING AND TEXTILES

- Fiber
  - Sources
  - Processing
  - Fabrication
  - Finishing
- Apparel
  - Construction
  - Purchase
  - Care

HOME DECORATION

- Elements of design
- Purchase and care of:
  - Equipment
  - Furnishings

CHILD CARE
(Human Growth and Development)

Prenatal	
Infant	
Toddler	
Preschooler	physically
Elementary	mentally
Adolescence	socially
Adulthood	
Aging	

HOUSEHOLD MANAGEMENT

- Consumerism
- Time
- Resources
  - Financial
  - Human

From this outline you can further see the reason for the word association, PUBLIC/PRIVATE. You can see how we are contributing to the development of one-sided individuals: boys prepared to leave home, girls prepared to stay home. Viewing the realities of the work, home associations of the individuals, you will recognize that men are in contact with other humans and need information and experiences to assist them in handling these associations. Women, in turn, are directly associated with technology as they decide which appliances to purchase and how best to use them.

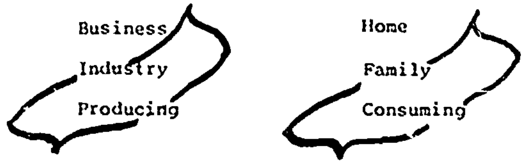
This association implies that all people will eventually become part of a family. This is not true. Remember that single men and women are responsible for the activities otherwise contributed by the opposite sex in a family relationship. As more of our students choose to remain single, this increased basis of information becomes even more essential.

The following diagrams depict a change from the current arrangement of instruction to a modified curriculum.

CURRENT APPROACH

INDUSTRIAL ARTS HOME ECONOMICS

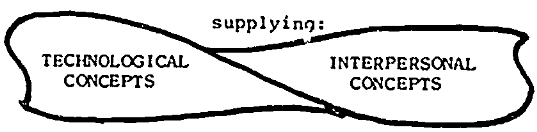
prepares students for:



If the two facets were merged, we could produce an individual who has at least two approaches to decision-making.

NEEDED APPROACH

INDUSTRIAL ARTS HOME ECONOMICS

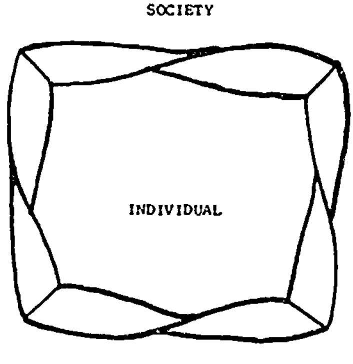


As this composite is applied to the facets of human contact, we will be able to turn the appropriate perception to the situation and to relate technologically and interpersonally with peers, family, society, and work.

FUNCTIONAL OUTCOME

SOCIETY

PEERS



WORK

FAMILY

This description has been directed at why we need to work toward providing more than obsolete, one-sided information to the emerging generation. As classroom teachers, we are always faced with the how and what. On the following pages are brief ideas, one from each area of home economics and industrial arts, which suggest concepts these areas hold in common. Try them and construct others yourself. At first your home economist will feel as you may now. "Why tamper?" "I have lived without these ideas, why should I provide them to my students?" Remind her that tomorrow will be different, and we can no longer teach for the past. Without an expanded information base, decisions about technological happenings will continue to be made in ignorance. Decisions affecting us all have been made by individuals unaware of the effects of technology or by technologists who disregard human values and needs. Through education we have an alternative. Can we affort to ignore it?

SUBJECT AREA: Textiles
CONCEPT: Extrusion
GENERALIZATION: Forming of fiber strands from synthetic substances increases the types and characteristics of the fiber group.
ACTIVITIES TO DEVELOP CONCEPT:

A. Investigate forming by using:
   1. tire pump
   2. cookie press
   3. grease gun
   4. cake decorator
   5. caulking gun
   6. toothpaste tube
B. Construct a jig using a vise, and by tightening slowly extrude substances which don't normally retain an unsupported shape.
C. Visit an industry where extrusion is a basic process.
D. Investigate fluid state vs. retaining new shape.

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

Select an industry which uses extrusion and investigate their problems and how they have turned them into successes.

Steel fabricating
Textiles
Tire
Plastics

SUBJECT AREA: Ceramics
CONCEPT: Heat resistance
GENERALIZATION: Transfer of heat between objects or substances can be reduced by ceramic insulation.
ACTIVITIES TO DEVELOP CONCEPT:

A. Experiment and describe the temperature/time/volume relationships of water drawn at 65^{o} Celsius:
   1. plastic tub
   2. metal tub
   3. crock
   4. kitchen sink
B. Compare anodizing to ceramic coating.
C. Construct an historical exhibit showing the knob and tube system of house wiring.
D. Investigate the industries which have used ceramic coating processes.

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

A. How are the electric and electronic industries associated with the ceramics industry?
B. Investigate the craft industry based upon ceramics.

SUBJECT AREA: Metal
CONCEPT: Fastening
GENERALIZATION: Combining materials increases their use.
ACTIVITIES TO DEVELOP CONCEPT:

A. Select hard and soft materials and fasten them in various ways.

Materials	Fasteners
1. wood	1. hooks
2. metal	2. nails
3. fabric	3. screws
4. ceramic	4. glue
5. plastic	5. stitching

B. Attach metal foil to a hard material.
C. Attach metal foil to a soft material.
D. Attach metal to a soft material in a loose (movable) connection.
E. Attach metal to a hard material in a loose (movable) connection.

STUDENT SPECIAL INTEREST RESEARCH TOPICS:
A. What effect does carbon have on the uses of iron?
B. Experiment with forming hot and cold metals.
C. Experiment with laminating as a form of fastening.

SUBJECT AREA: Graphics
CONCEPT: Symbols
GENERALIZATION: Common acceptance of visual representation enhances communication.

ACTIVITIES TO DEVELOP CONCEPT:
A. Convey meaning to others in class by visual representation.
B. Modify a sign to use an international symbol.
C. Explore communication without symbols.
D. Explore visual symbols in:
1. music
2. Braille
3. dance
4. sign language
5. print
6. photographs
7. sketches
8. literature
E. Explore the use of symbols in:
1. broadcasting (public/private)
2. transportation
3. geography (cartography)
4. meteorology
5. industrial safety

STUDENT SPECIAL INTEREST RESEARCH TOPICS:
A. Investigate principles of sound transfer.
B. Investigate communication with the handicapped.
C. Investigate the responsibilities of the FCC (Federal Communication Commission).
D. Explore the development of international symbols.

SUBJECT AREA: Plastics
CONCEPT: Plasticity
GENERALIZATION: Malleability, plasticity, is a characteristic essential to the selection of forming processes.

ACTIVITIES TO DEVELOP CONCEPT:
A. Record the amount of force accepted before the following materials break:
1. wire
2. dowel rod
3. cotton fabric
4. metal foil
5. cookie
6. jello
7. soap bubbles
B. Determine ways to return material in "A" to its original state.
C. Experiment with forming processes not commonly used for that material.
D. Construct a forming press for laminated wood.

STUDENT SPECIAL INTEREST RESEARCH TOPICS:
A. Investigate the process for making re-curve bows for archery.

B. Chart the melting and kindling temperatures of selected materials.
C. Identify the break characteristics of selected materials.

SUBJECT AREA: Wood
CONCEPT: Composite
GENERALIZATION: Physical and chemical combinations of cellulose has increased the need for wood.
ACTIVITIES TO DEVELOP CONCEPT:
A. Soak wood chips in:
1. alcohol
2. vinegar
3. bleach
Dry and examine the residue. Note the characteristics.
B. Make paper from tissue.
C. Examine, note characteristics, and determine the processing steps of making composition board.
D. Construct a model showing the processes in making plywood.
STUDENT SPECIAL INTEREST RESEARCH TOPICS:
A. Investigate a paper products company.
B. Investigate a forest products industry.
C. Investigate the use of cellulose in the textile industry.

SUBJECT AREA: Clothing and Textiles
CONCEPT: Image transfer
GENERALIZATION: Application of image is essential to the fabric printing industry.
ACTIVITIES TO DEVELOP CONCEPT:
A. Construct a roller drum to apply:
1. ink
2. textile paint
3. bleach
4. enamel
5. latex
B. Construct silk screen which is registered for pattern repeat.
C. Construct transfer technique for three-color printing.
D. Experiment with substance acceptance of:
1. silk
2. nylon
3. cotton
4. wool
5. acrylan
6. dacron
STUDENT SPECIAL INTEREST RESEARCH TOPICS:
A. Investigate the photographic industry.
B. Investigate image transfer used by plastics fabricators.
C. Investigate processes used by manufacturers of fine china.

SUBJECT AREA: Home Care of the Sick
CONCEPT: Heat transfer
GENERALIZATION: Temperature maintenance depends upon a continued source.
ACTIVITIES TO DEVELOP CONCEPT:
A. Develop a gauge for identifying a heat source.
B. Apply heat to selected sources and analyze their retention qualities.
1. glass (pyrex)
2. metal rod
3. asbestos
4. paper
5. plastic (thermoplastic and thermosetting)
C. Construct an iceless refrigerator and calculate the temperature you can attain. (For exact specifications see: Homemaking Around the World, Peace Corps, Washington, D.C., 1965)
D. Collect the supplies to regulate temperature for someone with:
1. measles

2. abdominal cramps
3. sprain

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

A. How does a microwave oven cook food?
B. How does a refrigerant work?
C. Calculate the melting time of a given volume of ice under various conditions.

SUBJECT AREA: Child Care
CONCEPT: Structure
GENERALIZATION: Vehicles are designed to carry specific maximum weights.

ACTIVITIES TO DEVELOP CONCEPT:

A. Place weights in various spots on wheeled toys. Observe the amount of energy needed to make the toys move.
B. Develop a weight/load ratio.
C. Sketch interiors for passenger/freight vehicles and indicate the load-bearing areas.
D. Compare weight-bearing capacity of pull, riding, power-driven, and hand-driven vehicles for children.

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

A. Investigate axle/weight restrictions in your state.
B. How big is the children's toy business?
C. Are there restrictions on materials used in children's toys?
D. Analyze the problems created for long-haul truckers by speed reduction.
E. What structural changes are used in front-loaders and backhoes when compared to passenger and load-carrying vehicles?

SUBJECT AREA: Food and Nutrition
CONCEPT: Toxicity
GENERALIZATION: Substances to be ingested must be prevented from developing chemical reactions with containers.

ACTIVITIES TO DEVELOP CONCEPT:

A. Use weak acid/base on:
   1. commercial can
   2. aluminum
   3. silver plate
   4. glass
   5. ring and lid for home canning
B. Use stronger acid/base on the same materials.
C. Research assay procedure of metal canning equipment.
D. Use litmus paper to classify the acidity and/or alkalinity of selected foods:
   1. meat
   2. poultry
   3. fruit
      a. fresh
      b. cooked
   4. vegetables
      a. fresh
      b. cooked

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

A. Investigate the development of canning implements.
B. Investigate the regulations on the commercial canning industry.
C. What procedures are used to prevent bacterial growth in canned food?

SUBJECT AREA: Home Decoration
CONCEPT: Coating
GENERALIZATION: Condition, material, and use of a surface indicates appropriate coating treatment.

ACTIVITIES TO DEVELOP CONCEPT:

A. Paint (latex and enamel), varnish, wax (paste and liquid):
   1. pine, oak, poplar
   2. plywood
   3. formica

4. metal
5. concrete
6. plaster
7. plastic

B. Clean the surfaces thus treated with:
1. water
2. water and detergent
3. wax
4. turpentine
5. alcohol

C. Apply the coating preparations in "A" by using:
1. brush
2. roller
3. cloth
4. stick
5. trowel

D. Remove the coating substances from surfaces in "A".

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

A. Investigate the pigments in various coating substances.
B. How big is the 'paint' industry?
C. What are the restrictions by the Food and Drug Administration on the ingredients in paints used in the home?

SUBJECT AREA: Household Management
CONCEPT: Observing
GENERALIZATION: Identifying causal factors is related to the amount of information available.

ACTIVITIES TO DEVELOP CONCEPT:

A. Identify ways to record information.
B. Complete a time motion study of common tasks.
1. making single bed
2. making double bed
3. making a 2-layer cake
4. changing a tire
5. vacuuming plush carpet
6. vacuuming shag carpet

Determine factors which cause time motion variables.

C. Produce a light film of common task.
D. Communicate findings and draw implications from time motion study.

STUDENT SPECIAL INTEREST RESEARCH TOPICS:

A. Create a dramatic presentation which contains non-causal factors. Present the drama to the class with evaluation instrument to see if they can identify the causal factors.
B. Investigate the work of Frederick W. Taylor.
C. Identify restrictions to efficiency in a common task and determine the changes needed to correct them.

SUGGESTED READINGS

The following readings may help you to develop a philosophy conducive to beginning to merge your curriculum with home economics. There are no articles specifically written with the ideas as expressed here. You wouldn't go to a physician who doesn't read current medical literature. Can you expect parents to be pleased to send their children to educators who are behind in their professional reading?

FUTURE

Case, Charles W., and Robert I. Larson, "Preparing Educators for the Future." The Futurist December 1972. (253-255)
Vital description of seminar design which educators have prepared to create a new future for public education.

Davids, Leo. "North American Marriage: 1990." The Futurist. October 1971. (190-194)

Probable legal and attitudinal changes in the institution of marriage. Valuable reading for teachers whose students are between 10 and 20 years of age.

Decker, F. Walker. "Educational Policy is Flapping in the Wind." The Center for the Study of Democratic Institutions. February 1974. (21, 25)
Concerned analysis of the stagnation confronting educators, parents, and students.

Eldridge, H. Wentworth. "Teaching the Future in North American Universities." The Futurist. December 1972. (250-252)
See the types of class offerings your future teaching colleagues will be taking.

Mendelson, Drew. "Future Fare." The Futurist. December 1973. (270-271)
Description of an imaginative look at the future by public school students.

Shane, Harold G. "Education for Tomorrow's World." The Futurist. June 1973. (103-106)
Analysis of problems as stated by educators and solutions suggested to prepare students for the future.

Shostak, Arthur B. "Tomorrow's Reform Agenda." The Futurist. June 1973. (104-110)
With the shift in population growth, we are forced to recognize that consuming of all products will alter.

The Futurist. August 1970.
SPECIAL ISSUE: "The Future of Religion." Where does religion fit in the culture being built for America's future?

HEALTH

Fried, John J. "Biofeedback—Teaching Your Body to Heal Itself." Family Health. February 1974. (18-21, 38)
Internal communication can make the pain go away. The technology of how it works.

McCleary, Elliott H., "New Miracles of Childbirth." Family Health. February 1974. (26, 40-42)
Excerpts from book. Electronic monitoring contributes to healthy deliveries and babies.

U.S. Departments of Agriculture and Health, Education, and Welfare in Cooperation with the Grocery Manufacturers of American and the Advertising Council. "Food is more than just something to eat." Family Health. April 1974. (16-page center section)
This section will be enough to convince you that the technology of food and the implication of the health of the human race demands that you recommend this periodical to your school librarian. Plan to use the technological information with your students.

HOME ECONOMICS

Agan, Tessie. "People and Their Housing." American Home Economics Association Journal. October 1972, (15-19)
Excellent resource for joint unit of urban planning.

Boyd, Jacque. "Food Labeling and the Marketing of Nutrition." AHEA Journal. May 1973. (20-24)
New FDA (Food and Drug Administration) regulations offer opportunities to experiment with graphic layouts. Have students use international signs for food labels.

Compton, Norma H. "The Focus Is on the Environment." AHEA Journal. January 1973.
Environment is used to describe space in which we live. Surprisingly similar to Industrial Arts/Technology attitude.

Darden, Ellington. "Olympic Athletes View Vitamins and Victories." AHEA Journal, February 1973. (8-11)
Male Olympians reveal knowledge of nutritional values. Their commentary is a nutrition lesson.

Falsetti, Joseph. "Renaissance on the Missouri Campus." AHEA Journal. December 1972. (13-17)
Pictorial evidence of Art and Design in Home Economics.

Hodge, Eileen. "Spinning a Traditional Yarn." AHEA Journal 1973. (23-24)
"How to do it" textile project. Cast spinning to wheel.

"Home Economics, A Vital Force." AHEA Journal. January 1973. (28-31)
Short descriptions of contributions and responsibilities of home economics to the individual and society.

Johnson, Moira. "What Will Happen to the Gray Flannel Suit?" AHEA Journal. November 1972. (5-12)
Brief history of fashion. Shows trends in society.

GENERAL EDUCATION

"Alternative Forms of Schooling." (Theme of Issue) Educational Leadership. February 1972.
This issue investigates several alternatives to currently prevalent schooling patterns.

Henson, Kenneth T. "Future Education. A Systematic Approach." Educational Leadership. April 1973. (652-655)
Synopsis of factors pointing to the need for a systematic approach to education for the future.

Meister, Richard A. "What about 'Unified Arts' in the Middle School?" Educational Leadership. December 1973. (233-235)
Brief descriptions which answer questions of planning, program, student outcomes, implementation, evaluation, and staffing.

Scobey, Mary-Margaret. "Coping in a Technological Culture." Educational Leadership. December 1972. (229-232)
A precise explanation of what technology should be to the students in elementary, middle schools.

INDUSTRIAL ARTS/TECHNOLOGY

DuVall, Barry. "A Time for Curricular Synthesis—Reflections on the Re-Birth of a Curriculum." Man Society Technology. January 1974. (89-90)
Investigates a continuum of curriculum emphasis. Encourages individual teacher development of curriculum.

Good, Mary G. "Where Have All the Young Girls Gone?" Man, Society, Technology. January 1974. (100)
Editorial giving statistics to help administrators comprehend why they should invite girls to become technologically literate.

Kozak, Mike R. "Jiminy, The Future of Education." Man Society, Technology. January 1974. (113-116) Exciting, although a little frightening. Please share with your teaching home economists.

Moomey, Richard L. "...AM 'Ain't No Lady Yet'." Man Society Technology. November 1973. (49-51)
Captivating description of how interdisciplinary teaming can be accomplished. Entire issue devoted to interdisciplinary approach.

Ms. Summers is a doctoral student at West Virginia University in the Program for the Study of Technology Education.

A Motivational Method in Industrial Arts for the Improvement of Reading

Herbert Siegel

The problem facing most concerned educators today is—"Can Johnny and Jennie learn to read?"

In New York City, the Bureau of Industrial Arts, believing that children can learn to read once they see the need to read, developed an experiential module called the Elementary School Publishing Activity Center.

This program helps to motivate learning and establish in the minds of the children reasons for reading, writing, and performing all the related functions required to publish their own creative writing and art work. It provides children with an opportunity to apply

The "Duplicating Section" rolls up its sleeves for action.

academic learnings and make them meaningful. The interdisciplinary involvements with science, language arts, social studies, mathematics, art, and other subject areas are unlimited.

This industrial arts module consists of a typewriter, electronic stencil maker, electric mimeograph, sign maker, plastic binder, and other equipment. These pieces of equipment are located in schools in such areas as part of a classroom, an office or storeroom, or in any area with access to several electric outlets.

In 1970, two school districts supported N.D.E.A. Title III proposals prepared by the staff of the Bureau of Industrial Arts. These pilot programs were demonstrated at local and city-wide exhibits where children also displayed their newspapers, magazines, books, pamphlets, posters, and other products.

The basic industrial arts graphic arts concepts, practices, learning skills, and understandings are explored. These include preparing the copy, editing, proofreading, layout, typesetting on the signmaker, printing, making stencils, mimeographi g, folding, binding, stapling, and other publ. shing activities.

The classroom teacher motivates the class prior to the "hands-on" activities. A variety of topics may be included in the discussion, emphasizing an interdisciplinary approach to motivate reading. Consumer education, career awareness, current events, short stories, poems, space exploration, mathematical puzzles, and other topics are areas for pupil involvement.

The class engages in research and gathering of material for its publication, using newspapers, magazines, and other resources. Pictures, unique lettering, symbols, captions, and paragraph heads may be cut out, saved, and used for copy paste-up. The teacher reviews the written work, correcting spelling, grammar, punctuation, and other pertinent matters.

In the Publishing Activity Center, pupils select large type for printing on the sign make , which may serve as a headline or title to the publication. This piece of equipment may be used to make signs and posters as well. Pupils ink the type which has been set, adjusted, spaced, and locked up in the press. They proofread the printed copy, make the necessary corrections and strive to improve the quality of the printing. Pupils prepare the art work to be included in the product. This may involve drawings and other materials from boys and girls in many classes. In some cases, a photo-electric copy machine may be used for creating additional headlines. However, the sign-maker's versatility is valuable in the total program. The IBM selectric typewriter is used to prepare the copy. A variety of elements are provided in order to provide a range of type fonts.

Pupils prepare the paste-up by arranging the copy, drawings, headlines, and other

The excitement of producing and binding the magazine was evident on the faces of the students.

materials in accordance with the format they select for the publication. These techniques, similar to those employed in the production of professional publications, are supervised by the teacher.

The copy, placed in the electronic stencil maker, is soon ready for the duplicating machine. Pupils place the stencil on the duplicator and then run the machine. The automatic counter on the machine, set by the operator, controls the number of copies being produced. The pages are then collated, either by hand or by machine, if one is in the center. The squad of workers then punch and bind the materials in the combo binder.

This simulation of the world of work develops an awareness of the many careers involved in and interrelated with this communication media. Evaluations of participating groups compared with control groups as well as with their own anticipated growth and actual growth have shown that this program has had an impact on upgrading pupil achievement.

These modules have now increased in number to 84 on-going units, with a projection of approximately 70 or more additional centers in September of 1974. We have received requests for information from many other interested school systems and State Education Departments.

It seems to me that children, like adults, can learn anything they want when they see the need or are strongly motivated. The Publishing Activity Center Module has been most effective in doing just that.

Mr. Siegel is the Director of the Bureau of Industrial Arts of the Board of Education of the City of New York.

The USMES Project—An Approach to Humanizing Education

Donald J. Betando

I wonder if we might consider a problem that one would pose to a group of students concerning the acceleration and braking of a vehicle. Students would no doubt tell you that the speeding of a vehicle is dependent upon one stepping on the accelerator pedal.

and the slowing of a vehicle is accomplished by stepping on the brake. If you concur with these conclusions and are presenting such facts to be true, it is possible that an injustice in education is occurring. Let us consider a space vehicle in orbit around the earth. As you operate the accelerator, the vehicle travels into a larger orbit, decreasing its speed. As you brake the vehicle, the orbit becomes smaller, increasing the speed. Is it possible that technology has advanced at such a rapid pace that concepts change?

The increasing abundance of facts in our advanced technology tells us that a program that deals in only abstract knowledge and dry facts would not prepare our students to take a meaningful place in our rapidly changing society.

In the late 50's, with the advent of Sputnik, a great emphasis in education was put on modern science and new math. Although this proved beneficial to some students, the majority did not gain by this reform. There was an increase in the level of abstraction. The teacher was asked to be an expert, and specialization was emphasized.

One of the hindrances to learning is the absence of motivation, because most of the material presented lacks relevancy to the student. He is in an educational atmosphere where he is asked to repeat facts which have been presented to him. So, often, he is asking the reason why he should learn certain facts or skills, and the teacher attempts to assure the student that some day he will find the subject matter relevant. Another reason for indifference by the student is a feeling of isolation and powerlessness in the adult world.

In 1967, a group of educators met under the auspices of the Cambridge Conference to discuss the correlation of science and mathematics in the schools. They recommended that science, math, and social science should be unified in the classroom by the presentation of real and practical problems — just like those met in our daily living.

One of the participants of this conference was Dr. Earle Lomon, a professor of physics at M.I.T. Dr. Lomon subsequently submitted for and received funding from the National Science Foundation to carry forth the recommendations of the Cambridge Conference. The interdisciplinary program which was developed for the purpose of real problem solving is known as the Unified Science and Mathematics for Elementary Schools project (USMES).

The USMES approach of interdisciplinary learning through real student challenges is relevant and void of student isolation. Students work with practical problems which they must solve and which actually have an effect on the world around them. They do not work on hypothetical problems such as, "If Mr. Jones flies 400 miles an hour, how long will it take for him to fly 2000 miles?"

Through these real activities, the students are learning facts and skills. The skills are being practiced and the facts understood. But probably the most human and lasting knowledge a teacher can impart to his student is the art of identifying a problem, deciding on a course of action, and following through.

There are a variety of challenging units used in the USMES approach to teaching. Some are Burglar Alarm, Lunch Lines, Dice Design, Soft Drink Design, Consumer Research—Product Testing, Play Area Design, Pedestrian Crossings, and Designing for Human Proportions.

In the unit called Burglar Alarm, the students might be discussing in their classroom the increasing cases of theft in our society. They might know of cases in their neighborhood where residences have been broken into and thefts have occurred, possibly even their own school and classroom. Needless to say, the interest is there. Throughout the discussion, the teacher plays an important role in raising issues and questions. He does not have to be an expert on the subject because of the students' working on their own, but is one who guides the students in learning the processes of problem solving. This is not to say that he need not be competent in the subject matter. Within a guided period of time, the teacher focuses on a specific challenge, i.e., build a burglar alarm that will give adequate warning in their classroom. The children are encouraged to try out their ideas for alarms after they become familiar with simple electric circuits. The range of activities can be broad, since the students are encouraged to handle the design problem on their own. Throughout, the students learn the utilization of tools and materials to construct the simplest to the most complicated alarms. Most of the construction activity takes place in a school design lab. The USMES design lab is a general purpose facility housing materials and tools, where a student can design and construct those items which pertain to his challenge, whether it be a burglar alarm, a scale model, an astrolabe, or a bird feeder. One might say that the design lab is a general shop. The student could utilize tools and materials in his classroom and have no need for a separate design lab.

The project's dissemination has been widespread. Many school districts are implementing pilot programs, and in Lansing, Michigan, and Chicago, Illinois, district-wide programs are being carried out.

Teams of teachers and administrators are introduced to USMES units at national resource team workshops. Here, in addition to becoming familiar with the USMES approach, they also study different strategies for teacher training and implementation. Many of these teams, upon returning to their districts, provide in-service training for other teachers. Another source for training has been through in-service and pre-service courses at such universities as Boston, Michigan State, Colorado, Illinois, California State at Bakersfield, and San Jose State University. Most of these schools will continue to offer courses this coming year.

As the USMES program further develops, many teachers discover a need to enhance their abilities in order to better carry out this interdisciplinary approach. One area is the ability to use materials and tools effectively. To satisfy this need, the Industrial Studies Department at San Jose State University will offer a design lab workshop this coming summer.

Over the years industrial arts has made considerable contributions at the elementary level. I am delighted to say that through the USMES Project, industrial arts continues to play an even more important role in developing student motivation and increasing the understanding of subject matter for grades K-8.

Dr. Betando is a Professor of Industrial Studies at San Jose State University, San Jose, California.

Manufacturing

Action Program

Robert C. Stewart
Roger Jessup

Scattered throughout the state, many small industries are being operated by students in Georgia schools. Each company is owned and managed by boys and girls in grades six through twelve. The program is called the ACTION program (Applied Career Training In Occupational Needs). The purpose of the program is to teach young people the concepts of industry in our free enterprise system. The course is suitable for boys and girls of any achievement or ability level. The program has met tremendous success and is educational, enjoyable, and profitable for the students. Software, including student workbooks and company records, is published by Community Resources Limited, of Tulsa, Oklahoma.

COMPANY CAPITALIZATION

Each local company is capitalized through the sale of stock. Students sell preferred stock to parents, teachers, and townspeople. The class members purchase common stock through a payroll deduction plan. Stock sells for one dollar per share, and the value fluctuates throughout the quarter.

COMPANY ORGANIZATION

All students serve on the board of directors. Each common stock share carries one vote. Students fill out job applications indicating which job they would like to have, as well as what experience or skills they possess. The following officers are elected by the directors: President, Vice President of Sales, Vice President of Production, Secretary, and Treasurer. The officers appoint department heads in areas such as research and development, public relations, sales promotion, purchasing, and safety. When production begins, officers receive an established salary and production workers receive an hourly wage. Everyone who sells company products receives a sales commission. Money making, although the backbone of the free enterprise system, is a by-product of the study of manufacturing in this course.

BOARD OF DIRECTORS MEETINGS

Every two weeks the class holds a directors meeting to discuss company finance, product selection, sales, or company policy. All meetings are run by company officers according to parliamentary procedure.

PRODUCTION

Students spend much of their class time producing products. Production workers have the opportunity to learn the use of a variety of hand and machine tools. Products can be made from any material, depending on the equipment available. Metals, woods, and plastics are most commonly used. Students find the hands-on activities of production an enjoyable break in the traditional routine of school.

SALES

The first activity in sales is to survey the market and forecast sales. Every student is involved in sales and sales promotion. The importance of sales in industry is easily illustrated. A sales commission of ten per cent is offered as incentive. Products range in price from twenty five cents to fifty dollars.

RECORD KEEPING

Records are kept by all officers. This would include the areas of personnel, sales, finance, purchasing, production, control, and safety. Every four weeks a financial report is made, indicating the status of the company.

LIQUIDATION

At the end of each term, the company is liquidated. A report is sent to each stockholder along with a check. As in the business world, not all companies operate with a profit. The course is intended to be a learning process, and students can learn just as much in a company which loses money as in one which profits greatly.

Although all ACTION Programs are operated within the same guidelines, no two companies are alike. The range of activities and achievement of any program can be limitless. Each company is limited only by their resourcefulness, imagination, and desire to succeed. Students learn to keep records, to read and work from working drawings, to work safely, to manage, to direct, to organize, to sell, and to get along with others. Good work habits are developed. They also learn that all work, regardless of level, is important and has dignity.

ROLE OF THE ADVISOR

Most companies have two advisors. The industrial arts teacher serves the company in the areas related to production. A local businessman is recruited to advise the company in record keeping. The over-all responsibility of the program belongs to the industrial arts teacher. Teacher training is available in Georgia to prepare advisors to implement the program.

Two successful ACTION Programs are being operated in Norcross, Georgia. One is located at Summerour Middle School and the other at Norcross High School. Both companies operate under the name of Norcross-Summerour Industries. At the middle school, eighth graders who are taking industrial arts for the first time participate in the program. The company, now in its second year, has produced a wide range of products, including book racks, towel holders, decoupage plaques, trivets, games, candle holders, jewelry boxes, picnic tables, and many more. The Norcross High School company employs ninth graders. Both companies have managed to stay in the black. They are in the process of merging and getting into the catalog sales market.

The ACTION Program is more than a manufacturing simulation, it is industry. This innovative approach is highly motivational. All students have the opportunity to be successful. This program can be a tremendous addition to any industrial arts program.

Mr. Stewart teaches industrial arts at Summerour Middle School, Norcross, Georgia. Mr. Jessup teaches industrial arts at Norcross High School, Norcross, Georgia.

Task Force Production

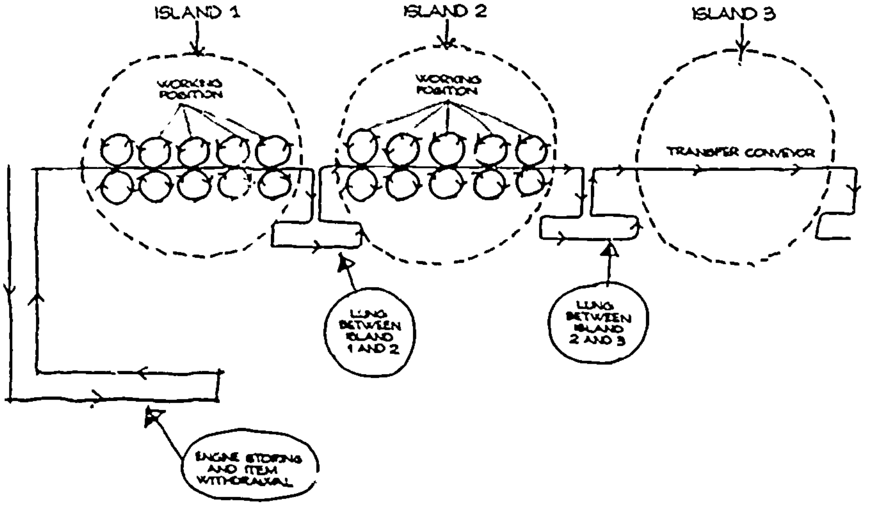
Merrill M. Oaks

Small group production is one of the newest and most promising techniques used in industry today. Rather than the traditional line assembly, where workers have been notoriously bored and dissatisfied, the team approach emphasizes small groups, each with significant production responsibility. The result has been increased job satisfaction and pride in workmanship.

SMALL GROUP PRODUCTION IN INDUSTRY

Mass production has been used in American industry since early in the nineteenth century when Eli Whitney developed interchangeable musket parts. This method has enabled industry to fabricate products in quantity with excellent quality control and at a reasonable cost. For laborers working on the line in mass production, however, the method is often uninteresting, unfulfilling and dehumanizing. In Work in America, a special report to the Secretary of Health, Education and Welfare, several maladies of the blue collar worker were implied, including physical and mental health complications resulting from job dissatisfaction.

PLAN OF ISLAND ASSEMBLY SYSTEM
(STATIONARY ENGINE)



Island assembly system plan for engines

In each working position, the worker at Fiat's Termoli engine assembly plant will perform the entire cycle of the operation done at his island.

To realize the advantages of mass production and still meet the various individual needs of the workers, major world auto manufacturers have recently developed a revolutionary team production method, essentially a modified form of mass production. Instead of individual workers, each with a small contribution to the product, teams or groups of workers are given complete responsibility for completion of a major component, perhaps assembly of the engine, or upholstery of the automobile interior. This team effort is the basis of small group production. The result is individual and group pride in workmanship and a feeling of significant contribution to the final product. European auto manufacturers including Saab, Volvo and Fiat have converted to small group production and have reported significant decreases in absenteeism and job turnover. There has also been a noticeable increase in product quality.

SMALL GROUP (TASK FORCE) PRODUCTION IN INDUSTRIAL ARTS

At Washington State University, the use of small group production in industrial arts is known as "task force production." This terminology denotes the consolidation of technical, managerial, and social roles. There is emphasis on the development of the student as well as the development of the product.

Using task force production allows students to experience the latest in industrial methodology. But the advantages don't stop there. To the student, the method offers a variety of valuable hands-on and social experiences. To the teacher, it offers an alternative means of managing large classes.

Students are motivated by ideas relating to their interests. One of the first activities in establishing task force production is to split the class into small groups of 3-5 students each, according to interest. The individuals in each group, united by this bond of common interest, work together to design and fabricate their product.

An important feature of task force methodology is that each individual in the group participates in every aspect of management, planning, and production. Each group member contributes to design, procurement of materials, the safety program, and is responsible for fabricating a significant part of each product.

A competitive spirit among the groups is a natural result and helps further develop motivation. In a friendly nature, each group tries to outdo the others in product design, quality, and over-all impressiveness.

Group interaction and social development is another positive feature of task force methodology. Since all decisions are made by the group and input from each member is solicited at each production stage, the group members necessarily learn to cooperate and work as a team. Members are encouraged to help one another with ideas, technical advice and or physical assistance as needed. Working closely together results in closer personal friendships and a spirit of esprit de corp for the entire group. This development of interpersonal relationships and social awareness is important for students of any age.

The methodology of task force production is a humanistic approach to teaching. By using small groups and stressing individual participation at every stage of production, the method becomes student-oriented as well as product-oriented.

From the student's point of view, task force production provides the opportunity to produce a quality project and develop closer personal relationships with others in the class. By being involved with all aspects of development, each student experiences pride and a feeling of satisfaction with the finished product.

From the instructor's viewpoint, task force production has several appealing features. Large classes are a burden often shared by industrial arts teachers a every level. Coordinating large numbers of students with limited facilities and limited equipment can be a formidable task. By dividing a large class into small task forces of 3-5 students, the instructor can substantially reduce many problems. Once the class members have a clear concept of task force production, the groups work with relative independence, using the instructor as a resource. Thus the teacher has a manageable number of groups with which he can meet for discussion and advice as needed.

Instructors frequently find fewer discipline problems when running the task force production method. Students are generally well motivated and imbued with a competitive spirit, a combination which keeps them productively involved. Also, because the project is a group effort, there is considerable peer pressure to meet responsibilities and function as a productive member of the team.

The task force method is equally effective in any medium — metal woods, plastics, electronics, etc. It is also adaptable to multi-media production and is particularly suited to a general shop situation.

IMPLEMENTATION OF THE METHOD

The following chronological steps give a summary of the consecutive phases of the task force production method. (See Figure 1)

1. Introduction to the Concept

Students are given a brief overview of the principles of mass production and task force production in a technological society. The organization of industry and the roles of management and labor are defined and discussed.

2. Development of Consumer Product Ideas

A survey of the consumer market is made by class members. The need and appeal of products within the community, at home, and among school personnel is assessed. The consumer population can be determined by the class members — products may be produced for group members only, for a select population, or for general distribution.

3. Product Selection

Product ideas are suggested and analyzed by class members, resulting in a list of acceptable items. Each student then makes his product choice, based on interest. Finally, groups of 3-5 students each are formed to complete the product selected.

Experience has indicated that including more than 5 students results in an unwieldy group. Less than 3 students involves too much responsibility for each student.

4. Assignment of Roles Within the Group

Management roles are shared by each group member. Students are assigned to one or more of the following functions: production supervisor, design engineer, procurement officer, construction foreman, safety director, and quality control officer.

5. Designing of Product

Students are not given a stock set of plans for any product, but rather are encouraged to use exploration and creativity in developing ideas. If an idea is acquired from another source, it must be improved in design, materials, versatility, and or consumer attractiveness.

Figure 1

CONSTRUCTION PHASE SEQUENCE OF ACTIVITIES

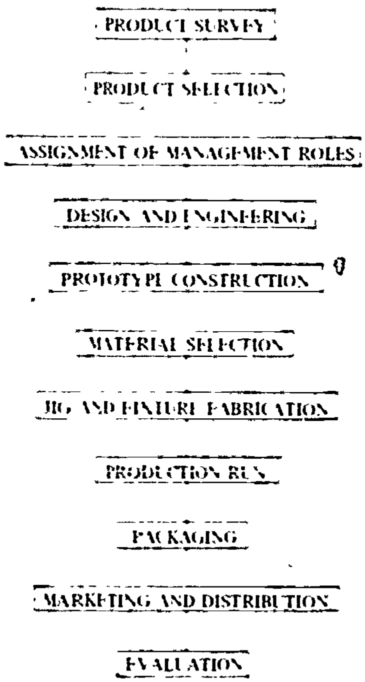
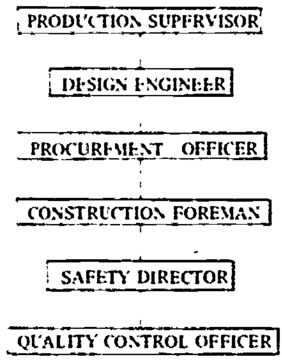


Figure 2

MANAGEMENT FUNCTIONS



6. Building of Prototype
Using lightweight, easy-to-use materials, a prototype is constructed to scale. Redesigning is done at this time.

7. Selection of Materials
Criteria for material selection includes ease of fabrication, cost, availability, finishing properties, and aesthetic appeal.

8. Construction of Jigs and Fixtures
High quality control is insured with the use of proper jigs and fixtures. Students discover their usefulness in significantly increasing the speed of fabrication of the product.

9. Production Run
A minimum of one product per team member is produced. If desired, production can be extended for as many products as desired.

10. Packaging of Product
The package should be designed to be shippable, attractive, and space-saving.

11. Marketing and Distribution
An exploration into the system of marketing can be discussed on a continuum throughout the class. Students must know where and how to sell and to whom. Marketing research, including a study of the stock market and use of stocks, may be incorporated.

12. Final Evaluation

Each group reports on their product to the entire class. Discussion is held to consider improvements at all phases of production, the importance of personal interactions as experienced in the task force, and evaluation of the roles of management and labor.

CONCLUSION

The industrial arts curriculum should offer more to students than psychomotor skill acquisition. Innovative methods can offer knowledge of contemporary industry, including production methods and roles of personnel. Learning industrial arts skills should not exclude factors in the affective domain, such as the development of social skills, group dynamics, social interaction, decision-making skills, and the ability to accept change.

SELECTED BIBLIOGRAPHY

1. Fendell, Bob. Will New Volvo Plant Alter U.S. Methods?, Automotive News, October 15, 1973.
2. Hindle, Brooke. Technology in Early America. The University of North Carolina Press, Chapel Hill, North Carolina, 1966, pp. 48-49.
3. Volvo, AB Public Relations Release, 40508, Goteborg, Sweden, January 1974.
4. Scott, David. Meet the Makers: SAAB Motor International, 1974, 2, pp. 101-103.
5. Work in America. Subcommittee Report on Employment, Manpower, and Poverty of the Committee on Labor and Public Welfare, United States Senate, February 1973. GPO 89-1930.

Dr. Oaks is an assistant professor in the Department of Education at Washington State University, Pullman, Washington.

Metals

New Metalcasting Process—for a Humane Technology

John M. Svoboda

The foundry industry, or to use the more modern term, the metalcasting industry, is one of the oldest and largest industries in the world today. In the United States, it is the sixth largest industry in terms of value added, providing countless employment opportunities and a strong contribution to the gross national product. Today the metalcasting industry has become one of the more modernized industries in the country. Yet most career or industrial education programs expose the student to processes developed at the turn of the century.

Let us look back to see where we came from, and then look ahead to see where we are going. The oldest known casting in existence was discovered in Mesopotamia and dates back to 3200 B.C. Since that time, Man's lifestyle has been greatly influenced by metal castings. Early castings were weapons, agricultural implements, tools, cooking utensils, and ornaments and jewelry.

Foundries in the Dark Ages produced church bells, cannons, cannon balls, and pipe. Some cast iron pipe still in use in France was made in 1664 during the reign of Louis XIV. The first known castings produced in this country were cast iron pots made at the Saugus Iron Works, near Boston, in 1642.

As we entered the period of the Industrial Revolution, foundries began to provide castings for looms, steam engines, pumps, and other machinery-related items.

Today castings are involved in practically everything we encounter in our daily lives. The automobile is made possible by the casting process. The same is true for modern jet aircraft, ba[illegible], trucks, and ships. Agricultural equipment and food processing equipment depend on castings. Construction equipment, machine tools, mining equipment, and power generation equipment all rely on castings... the list is endless. Even artificial heart valves and surgical implants are castings.

The success of the U.S. space program was dependent on castings, and examples still remain on the moon in the Lunar Excursion Module (LEM). In 1973, castings were successfully made for the first time in the weightless vacuum of outer space as part of the Skylab Program, thus opening new frontiers of metal processing technology.

We can trace the metalcasting process from 3200 B.C. to Skylab and beyond. To keep pace with this rapid technological growth, the metalcasting industry has introduced countless new processes and innovations to produce castings with higher quality at a lower cost to the consumer while providing environmental control and a pleasant work place for the employees.

However, the majority of career and industrial education programs do not even mention these newer processes, much less "teach" them. Most programs make "trinket" casting, such as ash trays using an oil-bonded sand. Melting of aluminum is done in gas-fired crucible furnaces. Lack of adequate funds, lack of space, lack of knowledge and interest all contribute to the problem. The student is simply not exposed to the methods and processes he will encounter when he faces the real industrial environment.

It is the intent of this paper to discuss these processes, their place in industry, and ways in which they may be included in career and industrial education curricula.

The first process to be considered is high-density molding and flaskless molding. The bulk of casting production is still made in "green sand," that is, silica sand bonded with clay and water. This type of bonding mechanism requires that energy be applied to develop adequate bonding strength. This may be realized by hand ramming, pneumatic ramming, jolting, squeezing, or combined jolting plus squeezing. As casting quality demands increased, so did the demands for highly stable molds which required more energy input.

The solution to this requirement was to use sophisticated machines which apply pressure to the sand using hydraulic cylinders. These machines also have become highly automated, producing hundreds of molds per hour, and therefore are normally found in high-production foundries such as those of automotive and farm implement producers. Frequently automated pouring equipment is used in conjunction with these systems.

With certain types of equipment, the flasks used to contain the sand are eliminated since the mold is stable and rigid enough to contain the metal. These systems are also characteristically high-volume systems.

Because of the sophistication and expense of the equipment involved, this type of molding cannot, of course, be demonstrated in a school shop. However, since this is the most common system that the student will encounter in industry, the author feels that the instructor should discuss this process in lecture, preferably with the use of audiovisual aids. Plant visitations may also be arranged. Sources of help for the instructor are listed at the end of the paper.

Another approach used by industry to achieve mold stability is the use of chemically bonded molding sands. These are often called self-setting, air-setting, or no-bake systems. There are many different chemical systems available such as furan resins, urethanes, alkyd oils, sodium silicate, and others. All of the systems, however, work in a similar manner. Sand, binder, and catalyst are all blended in a mixer. A muller, such as is required for green sand molding, is not necessary. The system will have a finite set-up time, or "bench-life", during which molding must be completed. The mold will then "cure" itself with the pattern still in place, which gives excellent dimensional accuracy. Bench-life and curing time may be adjusted to suit your needs by adjusting the type or amount of catalyst.

These binder systems offer several advantages to the school laboratory: they are relatively inexpensive, they give more consistent casting quality, they are clean; little or no smoke or fume are generated, and they require no expensive equipment.

It is highly recommended that instructors incorporate these new materials into their program. Although these binders are not available from the usual "school" supply houses, they may be obtained at any foundry supply house in your area . . . at lower costs.

Another new foundry process which is particularly applicable to school shops is the full mold process. This process combines an expendable polystyrene pattern with conventional sand technology. A pattern is prepared from expanded polystyrene, the material used for Christmas decorations. This may be hand carved and finished, or made in special injection molds for high-production industrial applications. The pattern incorporates the gating and risering system as well.

The pattern is next surrounded by molding sand. Although green sand or oil bonded sand may be used, more acceptable molding media are the self-setting systems described above. Since they require no ramming energy to develop strength, there is no chance for damage to the pattern. The expendable pattern remains in the mold, therefore, extreme overhangs and undercuts are permissible, which makes this process ideal for one-off art castings.

Once the binder has cured, the mold is ready for pouring. The heat from the molten metal vaporizes the polystyrene pattern and allows the metal to fill every detail of the mold cavity. The pattern may be coated with several coats of silica or zircon wash before molding to improve surface finish. If three or four substantial coats of wash are used, the back-up sand does not require any binder at all. A 12-mesh sand, compacted by vibration, will do an excellent job.

The extreme latitude in pattern design for this process makes it ideal for sculpture work. Special textures may be obtained by coating the polystyrene with a thin coat of wax and molding the desired texture in this layer of wax. The wax will vaporize along with the polystyrene pattern giving the desired results.

Note: Due to the high volatility and combustibility of the polystyrene pattern, open risers should never be used and adequate ventilation must be provided.

A recent (1973) innovation in molding technology is the Japanese V-Process (vacuum process). This innovative process is particularly suited to the casting of flat plate-like castings such as plaques, screens, wall ornaments, etc. The process may best be explained by describing the production of one half of the mold.

A thin plastic sheet is heated and placed over a pattern which has ports and connections to allow a vacuum to be drawn at the pattern surface. The vacuum is applied to the pattern and the plastic sheet conforms exactly to the pattern contour, similar to the vacuum packaging seen in most hardware and grocery stores. A flask is placed over the pattern and filled with loose, unbonded, dry silica sand. Next a second plastic sheet is placed over the top of the flask, and a vacuum is drawn on the volume between the two plastic sheets. The vacuum provides a rigid mold half between the two plastic sheets. Because the sand is unbonded, a small amount of flexibility is obtained at the pattern surface, which allows for minor undercuts and back-draft.

When both the cope and drag halves of the mold are completed, they are closed and poured. The vacuum must be maintained to keep the mold rigid until solidification is complete. Casting surface quality is excellent and easily reproducible.

While this molding system may sound complicated for the average school shop, it actually is not and provides an excellent challenge for the innovative instructor. Old vacuum pumps, long retired from the Chemi ry Department, will provide an adequate vacuum for this process. Flasks may be rather simple, since they support no load. Pattern design and porting requires ingenuity, but little expense.

This molding system is relatively new, and the technology of the plastic films is far from perfected. However, for the metalcasting instructor who wants a challenge, the V-Process offers an excellent vehicle for casting school plaques, wall ornaments, and similar castings with superb detail.

The last process to be discussed is not new, but a very old process. Although the investment casting process dates back to about 3000 B.C., it is still relatively new to school shops. Also known as the "lost wax" process, this casting process offers the metalcasting instructor an inexpensive method to produce precision casting. Industrial applications of this process range from jewelry to outboard motor props to jet turbine blades.

A wax pattern is prepared by hand carving or fabrication, or injection molding to the exact casting shape. Care must be taken because every detail of the pattern will be reproduced in the casting — including knicks, gouges, and scratches. A sprue is attached, and the pattern is thoroughly cleaned to remove dirt and grease from handling.

Next a slurry of investment material (usually silica) is prepared and poured into a flask to surround the pattern. This is allowed to set in a manner similar to plaster of paris. Once the investment is set, it is placed in a gas or electric burn-out furnace to dry the investment and remove the pattern. The mold is slowly brought up to a temperature of approximately 1000°F which cures the mold and burns out the wax pattern, leaving the mold cavity.

After burn-out, the metal is cast using centrifugal, pressure, or vacuum techniques. As soon as solidification is complete, the mold is quenched in water, which causes the investment to disintegrate. This frees the rough casting, which then is cleaned and finished using conventional techniques.

Multiple castings may be made at one time by attaching several patterns to a common sprue forming a "tree". The only limitation is the size of the equipment and capacity to melt metal. The metal is melted by torch, common alloys used are jewelers bronze, silicon bronze, silver, and gold.

The required equipment is relatively simple. a gas or electric burn-out furnace, a casting machine, and a melting torch. A basic system consisting of a small electric burn-out furnace, a simple vacuum casting machine, a propane melting torch, and all supplies including investment power, flask, gasket, wax patterns, sprue wax, and miscellaneous items may be obtained for around $110. This is about an absolute minimum system. A heavier duty system could consist of a larger electric burn-out furnace, a centrifugal casting machine, and an oxy-gas or oxy-acetylene torch. Larger castings may also be cast by this process using conventional crucible melting.

Although a finished pattern may be purchased, the hand crafting of wax patterns for this process is a fascinating aspect. Wax may be obtained in many different hardnesses and shapes for carving, molding, and shaping. Natural objects such as flowers, insects, and twigs may be used as patterns, although burn-out time is longer. A classic example is an investment cast thistle.

There are numerous other new processes such as the ceramic molding process, which uses a ceramic slurry similar to investment casting but with a conventional, reusable pattern, hybrid binder systems, and fluid sand process where surface active materials cause a low-moisture sand mix to flow like a slurry. Detailed descriptions of these processes are beyond the scope of this paper, however, information may be obtained from library of the American Foundrymen's Society.

The Cast Metals Institute, American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Il 60016, stands ready to assist teachers who have cast metals in their labs or are considering adding this important subject. Assistance can be obtained directly from the above address or through any of the 50 local Chapters located throughout the U.S., Canada, and Mexico.

Technical assistance may include:

Metalcasting career guidance booklets and free loan of color/sound filmstrip package.

Publications list, including textbook recommendations, i.e., Metalcasting Instructors Guide.

Consultation with teachers and administrators regarding layout plans, equipment, and safety aspects.

Technical talks and assistance for industrial education conferences, seminars, and workshops by CMI staff personnel.

Metalcasting instructors seminars, held every year in June. This is a four-day technical program for qualified instructors and supervisors involved with cast metals programs in secondary schools, technical institutes, and teacher training institutions. Write or call CMI for a colorful brochure and registration form.

Assistance with free-loan AFS and other supplier films. Contact AFS Film Librarian for free film catalog.

AFS members in local chapters provide unlimited help and give the teacher a chance to communicate better with local foundrymen.

The main objective of this paper was to introduce several of the new foundry processes which produce better casting at lower costs while maintaining a humane working environment. The author hopes that some of the readers will be stimulated and challenged to incorporate the processes into their metalcasting programs.

Dr. Svoboda is Associate Director of Technology of the Cast Metals Institute, a foundation of the American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, IL 60016.

Plastics

Plastics as a Future Technology for the Industrial Arts Classroom

Claude E. Hill

Acrylic crystal ball gazers indicate that we are witnessing the emergence of a new era: The Age of Plastics and Polymer Materials. Projections reveal that by the mid-1980's more man-made products will be produced from synthetic polymers than from any other class of materials. And by the year 2000, the production and consumption of plastics is expected to be more than 10 times the present levels of utilization.

The phenomenal expansion of the plastics industry, which has occurred largely within the past 30 years, has seen plastics emerge as an indispensible part of nearly every area of manufacturing and merchandising. We have seen expanded and ever-increasing uses of plastics in the home and in household products, furniture, and appliances, in containers and packaging, on the farm and at the construction site, throughout electronics and communications systems, and in automotive, marine and aircraft applications. Very sophisticated uses of plastics also continue to emerge in such fields as electronics, aerospace, bio-engineering, and in medical applications for the human body. These spectacular achievements and dynamic growth trends in plastics are dependent, of course, on the constant input of chemists and materials scientists who, in the past two decades, have introduced dozens of primary types of plastics, with hundreds of variations and modification possibilities. Of equal significance is the vigorous research and development efforts which pervade the plastics industry, bringing constant improvements in product design, material analysis and selection, development of new machinery and tooling, economical production, and quality control, as well as exploration and resolution of problems involving ecology and resource management.

Plastics have come a long way since their principal role was that of low-cost substitutes for some other material. Plastics have grown to maturity, and the technological, social, and educational impact of this phenomenon is a reality for which we should be preparing today.

Considerable progress has been made in recent years in convincing educators of the need for including plastics as a vital part of the industrial arts curriculum. Concern must still be expressed, however, regarding the extent to which current offerings in industrial arts reflect the comprehensiveness, potential, and future scope of the plastics industry. Are young people given opportunities, for example, to investigate and understand the unique properties and characteristics of synthetic polymer structures, to exercise their imagination in exploring the design potential of plastics, to experience the multiplicity and versatility of plastics processing? Are there also opportunities to gain objective consumer knowledge of the vast market applications of plastics? And, in the important area of career education, are youngsters aware of the expanding opportunities and need for trained personnel throughout the plastics industry and related fields?

For plastics to be adequately represented as a viable technology of the future, it is essential that the following areas of content, adapted to the specific grade level and local resources, be included in the industrial arts curriculum.

REALIZATION OF THE PHENOMENAL GROWTH AND IMPACT OF PLASTICS ON CONTEMPORARY SOCIETY

The increased uses of plastics, all within a relatively short span of time, have created many profound changes in terms of our technological capabilities, production practices, economic and marketing trends, utilization of resources, and alteration of aesthetic values. These are but a few of the changes created, at least in part, by the emerging role of plastics in contemporary society, which young people need to confront.

UNDERSTANDING OF THE UNIQUE PROPERTIES AND CHARACTERISTICS OF POLYMER STRUCTURES

Students need opportunities to explore the unique and intriguing realm of plastics — which are more precisely known as polymers. Polymers are orderly arrangements of hydrocarbon molecules in long chain-like structures, chemically bred to create precise properties required for processing and for the intended end use of the material. With dozens of different types of polymers and numerous possibilities for variation of each, the range of properties is extensive. Polymers can be rigid or flexible, transparent or opaque, tough or brittle, resistant to heat or to cryogenic temperatures, resistant to weathering or to solvents, in a variety of forms such as sheets, rods, fibers, films, powders, and liquids, foamed to decrease weight, reinforced to increase strength and rigidity, or filled to improve a variety of other properties. While the wide range of properties, even in a single resin system, may appear confusing at first, the student comes to realize that herein lies much of the intrigue and versatility of polymer materials.

EXPERIENCE WITH THE UNIQUE DESIGN POTENTIAL IN PLASTICS

The opportunities for creative expression and imaginative designing with plastics are unlimited. The versatility and workability of plastics allow for exploration and implementation of design ideas that are virtually not possible with other materials. Through the design process, the student may also experience the decisions affecting the proper selection of a plastics material for desired functional and esthetic qualities, tooling for production processing, and control of manufacturing techniques to achieve optimum and economical results.

PRACTICAL INVOLVEMENT WITH THE MULTIPLICITY OF PLASTICS PROCESSES

Any comprehensive approach to plastics would most definitely include involvement with a wide variety of plastics processes. The essential molding processes include injection, extrusion, blow molding, rotational molding, thermoforming, calandering, high and low pressure laminating, and compression molding. Reinforced molding processes should include experiences in hand and spray layup, matched die and bag molding processes, and filament winding. Other important areas for student involvement include foam molding, casting, liquid and powder fusion coating, machining, and work with various bonding, fabricating, finishing, and decorating techniques. Concepts of mold making and development of tooling should also be included whenever possible with these processes. While the depth of involvement with these processes will obviously vary with the level of instruction and available machinery, the essential principles and concepts, such as process variables and material behavior, can often be taught very effectively on reasonably priced lab-size equipment.

CONSUMER KNOWLEDGE PERTAINING TO THE VAST MARKET APPLICATIONS OF PLASTICS

A vital and traditional objective of industrial arts is consumer education. With the enormous growth and expansion of plastics into virtually every major market area comes the obvious need for voluminous information concerning quality in design and manufacturing, knowledge of the plastics materials and their properties, maintenance and care of the product, as well as short- and long-term economic values.

The realm of consumer knowledge is no longer limited merely to product selection. It is likely that the consumer will also be required to make decisions about disposability or reuse of most products in the future. And, as world demand and competition for materials becomes increasingly critical, choices and decisions about resource utilization will also demand the consumers' thoughtful attention. Consider, for example, the worth of a liter of petroleum consumed directly as a fuel versus the worth of using the same liter of petroleum as a plastics product and perhaps even recycling it four or five times into other plastics products, then finally consuming these products for their fuel value. Such are the nature of decisions which may be at the heart of our future well-being, and which deserve exploration in the industrial arts classroom.

CAREER AWARENESS OF THE VOCATIONAL OPPORTUNITIES IN PLASTICS AND RELATED FIELDS

The career opportunities and personnel needs of the plastics industry were clearly established in a comprehensive industry survey in 1968, and the need continues into the foreseeable future for large numbers of entry-level employees in semi-skilled, skilled, technician, and engineering occupations.

In summary, the plastics industry has stated. While the usage of plastics in industry is increasing at remarkable rates, the availability of trained plastics engineers, technicians, and skilled workers is decreasing at an alarming rate, and a formal source of supply is practically non-existent. Since plastics is becoming more deeply involved in all types of manufacturing, job requirements and personnel requirements are changing. A knowledge of plastics is essential, since it is quickly replacing the old standard materials and processing methods. It is effecting major changes in the manufacturing processes used in every industry — automotive, aircraft, electronics, packaging, and construction. We must prepare now to meet this challenge and have the engineering talents and the trained work force available to work with this new manufacturing medium. This can only be accomplished through educational programs designed to train skilled technical and engineering personnel on all aspects of this relatively new science. This national survey has revealed that a critical shortage of trained personnel exists at all levels, and this shortage is growing more acute each year. Educators, parents, students at all grade levels must be made aware of this tremendous industry need and that the opportunities in plastics will be far greater than in any other industry."*

RESOURCES TO IMPLEMENT PLASTICS EDUCATION PROGRAMS

Industrial resource materials such as education and curriculum guides, bibliographic materials, audiovisual lists, equipment and supply information, industrial-trade literature, and vocational guidance resources are available from the Plastics Education Foundation. Maurice Keroack, Director, Four Lorna Lane, Loudonville, New York 12211.

BIBLIOGRAPHY

Glauz, R. L., et al., The Plastics Industry in the Year 2000. Stanford Research Institute. Menlo Park, California, 1973.

Masson, D., Ed., The Story of The Plastics Industry. The Society of the Plastics Industry. New York, 1970.

Modern Plastics Encyclopedia. McGraw-Hill: New York, 1974.

Plastics Education Guide. Plastics Education Foundation. Greenwich, Connecticut, 1970.

"Plastics in the 1980's — A 15-Year Outlook." Modern Plastics, November 1968, pp. 120-138.

Ullery, Robert J., Ed., The Need for Plastics Education. The Society of the Plastics Industry: New York, 1968.

Mr. Hill is an Associate Professor of Plastics Technology at Western Washington State College, Bellingham, Washington.

Mold Making with RTV Silicone Rubber

Dale L. Nish

A quality R.T.V. silicone rubber mold will reproduce every detail in the pattern. The reproduction from the mold can be no better than the pattern. Good judgment would dictate that the pattern be of high quality, with distinctiveness and character worthy of the capability of the R.T.V. silicone rubber.

The pattern must be free from dirt, oils, resins, and other foreign matter which may react with the R.T.V. silicone rubber or cause other defects in the mold and later in the reproductions.

Construct the mold frame from a piece of stock 3/16 to 1/4 inch thicker than the pattern. The stock should be approximately 4 inches wider and 4 inches longer than the pattern to allow for a frame 1 1/2 to 2 inches around the pattern. Lay out a cutting line around the pattern, leaving 3/16 to 1/4 inch clearance. Tilt the jigsaw table to an angle of 5 to 7 degrees. Use the cutting line as a guide and cut out the interior (waste) part of the frame.

Place the pattern inside the frame and check the clearance. If necessary, make adjustments.

Turn the frame over and cut a rabbet on the back side of the frame. The rabbet should be at least 1/8 inch deep and 3/8 to 1/2 inch wide. Also, cut a registration mark off the rabbet, to ensure accurate alignment of the mold and frame when the mold is replaced in the frame for casting reproductions. This rabbet will form a gasket around the mold, helping the mold to better contain the materials used in casting the reproductions. The gasket also greatly strengthens the walls of the mold, therefore, the mold walls can be thinner and use less materials.

Select a piece of plywood for the back of the mold. For convenience, the plywood should be the same size as the frame.

Select another piece of plywood for the top of the frame. Lay out the opening of the frame on the plywood. Drill 1/8 to 3/16 inch holes inside the opening, spacing the holes 3/4 to 1 inch apart.

Seal all parts of the frame with a recommended sealer. The sealer required will be determined by the R.T.V. silicone rubber used. Different R.T.V. silicone rubber formulations may require different sealers. Check the data sheet for sealer specifications. Sealing is critical, particularly on softwoods in which the resins react with the R.T.V. silicone rubber and cause soft spots in the surface of the mold.

Spray a light coat of sealer on the pattern. Do not leave a heavy glossy coat, as the glossy surface will produce a shiny mold, which in most cases is undesirable.

After the sealer is thoroughly dry, fasten the mold frame to the back piece. Fasten the pattern to the back piece, leaving the necessary clearance around the pattern.

Estimate the volume of the R.T.V. silicone rubber required to fill the mold. One cubic inch silicone rubber weighs approximately 20 grams. Determine the amount of silicone rubber required. For example: estimated volume of mold is

22 cubic inches; multiply by
x 20 grams per cubic inch
440 grams.

According to the G.E. 664 data sheet, the silicone rubber is mixed at the ratio of 10 parts silicone rubber to 1 part catalyst. Therefore divide 440 by 11 = 40. Thus the mixture would be 400 grams silicone rubber

+40 grams catalyst
440 grams total mixture.

Select a paper or plastic container at least 3 times larger than the amount of silicone rubber required. During the vacuum process, the silicone rubber will expand 3 to 4 times its volume. Measure out the required amount of silicone rubber by weight. Add the required amount of catalyst.

Mix the silicone rubber and catalyst thoroughly. The catalyst will be a different color than the silicone rubber. When completely mixed, the mixture will be free from streaks and uniform in color.

Clean the walls and bottom of the container several times during the mixing process. It is common to find unmixed materials in these areas.

Place the container of silicone rubber into a vacuum chamber. Close the lid and vacuum for 5 minutes or, if you can see into the chamber, until the mixture has expanded to its maximum height, then collapsed back into the bottom of the container. Shut off the vacuum and remove the container.

Start at one edge of the pattern and slowly pour the silicone rubber over the pattern. Let the silicone rubber flow across the pattern, forcing air out from indentations in the pattern and from around the mold frame. Try not to trap air as you pour the silicone rubber into the mold.

When the mold is filled, place it on a vibrating table. This step is added insurance against trapped air at the face of the pattern. If a vibrating table is not available, clamp the mold to a machine table, such as a circular saw, and let the machine run. Most machines have enough vibration to force trapped air to the surface of the mold.

When air bubbles cease to appear on the surface of the mold, shut the machine off. Fasten the top piece to the mold frame with screws or clamps. Excess rubber will be forced out the holes, as well as any trapped air. Set the mold aside on a flat, level place and let cure for 24 hours at a minimum of 70 degrees F. When the mold has cured, remove the mold and pattern from the frame. Gently peel the mold from the pattern. Use firm, even pressure, and do not hurry. Haste may ruin a perfectly good mold.

Dr. Nish teaches in the Department of Industrial Education, Brigham Young University, Provo, Utah.

Teacher Education

Innovations in Teacher Training: A Consortium Approach

Clifton P. Campbell
John I. Matthews
Thomas W. Inter
G. Timothy Kavel

Delaware, the first state in the nation, was very nearly the last to implement a bachelors degree program for preparing industrial arts (IA) and trade and industrial (T&I) teachers. While a late starter, the program this paper seeks to describe is innovative and may serve as a model for future delivery systems in established teacher education programs.

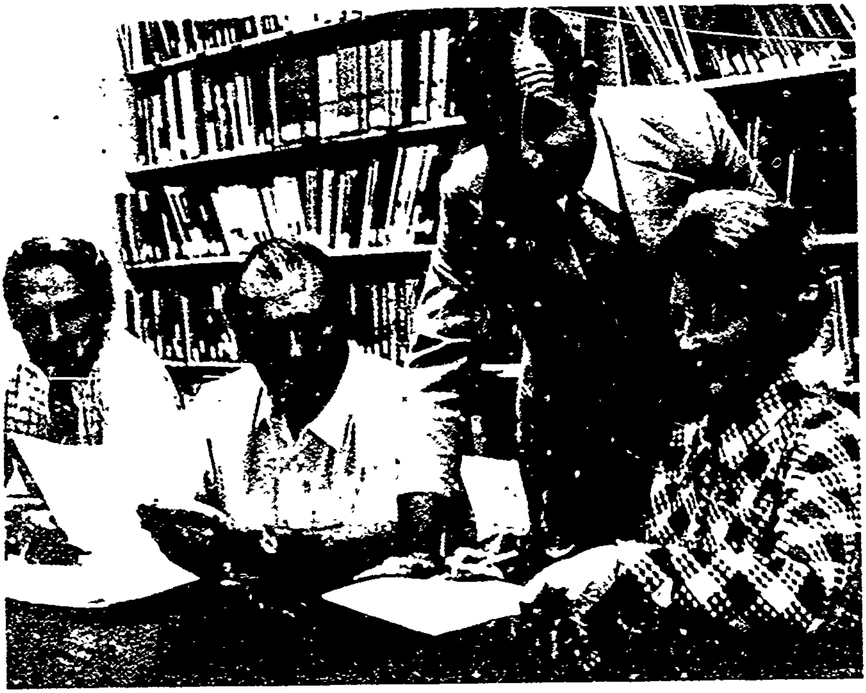
DEVELOPMENT OF THE CONSORTIUM APPROACH

Based on an authenticated need and the recommendations of several committees, a task force was organized to study occupational teacher education and to recommend guidelines for the proposal and implementation of a degree program in Delaware. In order to avoid a major capital expenditure and extensive duplication of technical facilities and equipment, a consortium effort was suggested. In July 1972, a consortium director began the tasks of planning and developing a competency-based cooperative multi-campus degree program. The resulting Delaware Occupational Teacher Education Consortium, which became operational this academic year, by design involved facilities and faculties of the University of Delaware, Delaware State College, and Delaware Technical and Community College. This represents a consolidated effort to provide improved IA and T&I teacher training.

ADVANTAGES AND EFFICIENCIES

Collaboration between consortium members has promoted a more efficient and a greatly strengthened teacher preparation and certification program. The student population being served consists of those working in industry who aspire to a teaching career, in-service teachers without certification and/or a degree, and recent graduates of high school or two-year technical college programs. Rewards which accompanied this unique partnership include:

- a more logical allocation of available resources
- elimination of needless duplication, through the integrated use of existing facilities and equipment
- collaborative planning and more efficient methods of program operation
- a conceptual scientific-technological foundation for general studies and technical specializations
- a climate of cooperation between competent faculty members with a common interest representing different institutions
- a core program of studies and provisions for individualizing each student's curriculum
- opportunity for students who desire admission to the program, but do not initially qualify for acceptance to either degree-granting institution, to make up deficiencies at the two-year college
- sufficient instructional breadth and depth, coupled with both occupational and teaching experience, so that graduates can be equipped for careers as teachers or in industry
- availability of courses in various locations
- competency-based grading in technical courses
- increased availability of counseling for students by guidance specialists and two advisors, one an advisor for the technical specialization and the other an advisor for general and professional studies
- flexible scheduling patterns for in-service and pre-service students in both a part- and full-time status at various campuses
- a professional basis upon which graduates may continue their education through advanced degrees.



Professional studies where the resources are.

PROGRAM OPERATION

Operationally, students in the program obtain their general and professional education at the state university or state college and technical specialization at any of the campuses of the state technical and community college system.

Technical component. Five technical specialization options are presently available for prospective IA teachers: Construction, Electricity/Electronics, Energy Conversion and Power Mechanics, Graphic Communications, and Materials and Manufacturing Processes. Other options are planned and will be developed as the program matures. Students select a major and supporting area of specialization from these general options. This attempts to establish a firm basis of competency and provide teachers with a thorough scientific and support-oriented technical background. A majority of the technical courses are scheduled at Delaware Technical and Community College campuses. However, certain other offerings are available at both senior-level institutions.

Further opportunities to develop technical competency are facilitated through an "Occupational Practicum," consisting of supervised on-the-job work experiences in the major area of specialization. Students begin the practicum no later than the summer of the second full year of course work. The logistics of this college/industry association are complex, and program advisement becomes an important factor in placement and evaluation. A waiver of the occupational practicum requirement is possible for those students who, with appropriate work experience, pass the written and performance sections of the National Occupational Competency Exam in their major field of technical specialization. The student's advisor for a technical specialization and/or his advisor for professional studies can be of assistance in the process of receiving credit by examination.

Professional component. While technical competency is a prerequisite for IA teaching, it does not guarantee a successful and satisfying career. For this reason, a quality assurance measure consisting of various professional studies is provided for early in a pre-service student's program. Elements of the professional studies component provide for pedagogical development through a continuing clinical emphasis. Under this plan, participants spend time observing and/or aiding students in selected shops at the middle, senior high or, when applicable, post-secondary level. Participants in these experiences can apply and evaluate learning theories and educational practices. They also gain a better understanding of "what teaching is like." Such insight is valuable for decision-making on teaching as a career. If compatible, considerations of grade level and technical specialization can be managed.

A culminating clinical experience, student teaching, is part of the program during the final year. For the in-service teacher, a supervised classroom practicum may be substituted. In this way, new approaches or innovations may be developed in one's own shop without the personal financial loss associated with the policies surrounding traditional student teaching practices.

General studies component. The general studies component, which is intended to enrich personal growth and professional development, is integrated operationally with the Technical and Professional Components. Each student's curriculum planning includes efforts to spread, over the entire undergraduate program, elements of each component. In this way students can explore teaching as a career early in their studies, relate academic skills to their programs, and continue to be exposed to technological developments until graduation. This strategy may mean that a full-time consortium student is concurrently taking classes at either senior institution and one of the technical and community college campuses.

PROGRAM FLEXIBILITY

Delaware's Occupational Teacher Education Consortium is now operational to meet the state's needs for competent teachers without expensive duplication of facilities and services. This state-wide program permits both pre-service and in-service industrial arts teachers to pursue their educational development at various campuses, often within reasonable commuting distance of home or job. Operationally, personalized arrangements are made for students to realistically mesh technical, general, and professional preparation, as well as practicum experiences, over the full undergraduate program. Elements such as concurrent registration in two institutions, with an advisor at each; occupational and classroom teaching practicums, clinical experiences, and a provision for credit by examination are combined in an innovative approach to Occupational Teacher Education designed to do a better job and make education a rewarding experience.

Admittedly, a program such as this is somewhat more difficult to administer than the traditional approach. However, it was developed for times such as these — when the nature and quality of the programs we offer teachers and prospective teachers are critical to our present and future success as teacher trainers.

Dr. Campbell is a Teacher Trainer at the University of Delaware, Newark, Delaware. Dr. Matthews is Director of the Delaware Occupational Teacher Education Consortium, with offices in Newark, Delaware. Mr. Inter is a Teacher Trainer at Delaware State College, Dover, Delaware. Mr. Kovel is Campus Co-ordinator for Delaware Technical and Community College, with offices in Dover, Delaware.

Supervising Student Teachers

Charles H. Wontz

Perhaps one of the more profound experiences in a teacher preparation program is student teaching, sometimes referred to as internship or practice teaching. Beginning with the placement notification, several steps are usually followed before that first day in the classroom. The supervising teacher begins to prepare to assimilate an entirely different personality into his classroom. The student teacher begins making pre-student teaching contacts with hesitancy, uncertainty, and perhaps real fear.

So that proper guidance may be provided, the supervising teacher is supplied with information about the student teacher which includes his age, physical condition and limitations, educational background, work experience, interests and hobbies, military experience, and marital status. Usually this information is provided by the student's own resume which is forwarded to the school where the student will be student teaching. If this resume has not been provided, the university should be requested to make such information available.

Some authors differ in their opinion about how much conditioning is necessary in preparation for a student teacher to come into a class. From one author's experience, it seems to make little difference whether or not the class is told in advance about their new student teacher. Some classes which had student teachers at the beginning of the school year never fully realized that the student teacher was not part of the regular faculty.

One authority believes that positive preparation is absolutely necessary. This belief is supported by numerous smoothly-operating situations in which positive rather than negative or no preparation was administered.

Ideally, the student teacher will visit the school for orientation and observation purposes prior to the internship period. On the first visit to the school, the student teacher should be given the following information and/or material:

1. A set of textbooks (teachers' editions)
2. Other instructional materials (curriculum guides, workbooks, audiovisual catalogs, supply requisition procedures, etc.)
3. Faculty and student handbooks
4. All other useful information on:
   a. School policy (handbook if available)
   b. County policy (handbook if available)
   c. School hours
   d. Dress code (for both students and teachers)
   e. Hall, bus, and cafeteria duties, extra-curricular activities of the supervising teacher; and duties of the student teacher.
5. Class composition
   a. Socio-economic
   b. Racial
   c. Sex distribution
   d. Achievement levels
   e. Specific reading levels and problem areas
   f. Ability levels (I.Q. ranges and age ranges)
6. Anything else which would be helpful during student teaching.

There are special people at the school who will be able to assist the student teacher in his first encounter with the teaching profession. These people should help the student teacher to feel that he is a part of the total academic life of the school. He should be introduced to the total school staff: administration, library, secretarial, lunchroom, and custodial personnel. He should meet all departmental chairmen and members of his own department. At his first faculty meeting, he should be introduced to the total faculty. A luncheon or dinner with the intern and the immediate departmental members could be arranged so that professional ideas and philosophies can be exchanged and discussed.

The supervising teacher should remember that his student teacher is placed with him to observe and learn from his teaching. He should give the student teacher an orientation in his personal methods of classroom management, his policies on homework, and his rules pertaining to student absences and tardiness. He should attempt to create prestige when introducing the student teacher as a qualified teacher who will be conducting the class in a few weeks. The term "practice teacher" should be avoided. By way of introduction to the class, the supervising teacher could point out that the student teacher is currently a senior at the university, any honors or recognition the student teacher has received, and any special interests or hobbies. This will aid in the students' acceptance and identification with the new teacher in their classroom.

The student teacher should be permitted to perform as many small tasks as possible before taking over a class. These tasks may include calling the roll, checking homework and test papers and returning them individually, perhaps with mini-conferences, signing absentee slips, tutoring individuals, working with small groups, giving demonstrations, and dismissing class. He should be permitted to take over the homeroom responsibilities as soon as possible.

A constructive climate must be created and maintained during the student teaching experience. Since the supervising teacher will eventually face the necessity of having to offer criticism to the student teacher, a tension-free environment must exist. The quality of the entire relationship is dependent upon the initial establishment of a comfortable yet professional rapport between the supervising teacher and the student teacher. The supervising teacher should avoid criticizing the student teacher in the presence of others. He should avoid being hypercritical, should encourage professional development instead of discouraging the student teacher in his early attempts at teaching. The supervising teacher should avoid preaching or being too dictatorial. Since a good relationship is developed when the supervising teacher encourages, accepts, and implements the student teacher's ideas whenever possible, constant criticism seems out of place in the evaluation program.

There are certain thoughts continually passing through the mind of the student teacher relative to graduation, applying for a job, living conditions in a particular county, and other ideas which the supervising teacher may remember from his own student teaching days. The supervising teacher should discuss these subjects with his student teacher and attempt to "tell it like it is."

As a student, the student teacher perhaps did not participate in a professional organization. His supervising teacher should explain to him the advantages of being a member of his national, state, and local professional associations, both general and specialized. He should be encouraged to attend local and area meetings if possible.

When parents visit the school for a teacher conference, the student teacher should be included. The supervising teacher should stress the importance of confidentiality when working with parents and students and familiarize the student teacher with the professional code of ethics.

The teacher dress code should be explained to the student teacher, and he should be encouraged to dress appropriately so that he will not be inadvertently embarrassed.

It is revealing to note the emotional stress on the student teacher during this phase of his education. Sharp depicts the emotional cycle of a typical eight-week student teaching experience in terms of elation "high" and depression "low." This cycle may be explained by observing the chart shown in Figure 1.[1]

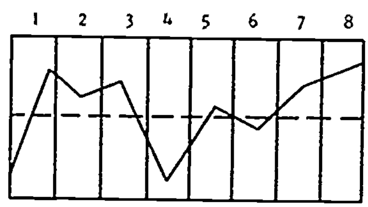


Figure 1

Week number one finds the student teacher insecure and fearful. As he is received and welcomed by the staff and as he discovers that pupils are really not monsters, he loses his initial misgivings. He soon peaks as far as enthusiasm is concerned. Sometime around the third or fourth week, depression sets in. This may be the result of a first test, supervising teacher criticism, a dispute with a student, or a conference with unhappy parents. From this depression "low," optimism and satisfactory progress enable the student teacher to raise his confidence to an all-time elation "high."[2]

Research shows that the most serious problems resulting during the student teaching experience stem from personality conflicts.

Participation in classroom activities by the student teacher should begin almost immediately after his arrival at the cooperating school. A number of activities have been suggested by various authors and are listed below. Many of these activities can and should be completed during the first few days of student teaching.

1. Observing other teachers
2. Taking roll
3. Preparing seating charts
4. Making assignments

5. Regulating lights, heat, and other physical conditions related to the classroom
6. Assisting with records
7. Managing lunch money
8. Working with pupils on a one-to-one basis or in small groups
9. Using reproducing machines for preparing teaching material
10. Helping supervise playground activities
11. Participating in faculty, PTA, and other meetings
12. Attending conferences with supervising teacher and parents
13. Preparing, administering, and scoring a test
14. Assisting with field trips
15. Preparing supply requisitions
16. Preparing reference material
17. Giving a demonstration
18. Reading the daily announcements
19. Supervising laboratory work
20. Performing maintenance on equipment
21. Examining textbooks
22. Collecting and returning written work
23. Preparing unit and daily lesson plans
24. Preparing bulletin boards

What should a supervising teacher do if he encounters a student teacher who has a personality which seems impossible to deal with? This could happen, and a brief discussion is relevant as to what steps would be appropriate.

The first step is for the supervising teacher to attempt to solve any existing problem on a one-to-one basis. If a reprimand is necessary, he should be firm and in a professional manner explain that he is there to help — not hinder — the learning process of the student teacher.

When necessary, as an alternative, he should make an appointment with the university coordinator and discuss the problem with him. If these actions fail and the situation does not improve, he may have to request release from any obligation to the university and to the student teacher in question.

In contrast to a certified contracted teacher's status, which is defined by law, the legal status of the student teacher (except in a very few states) is not defined. Although litigation rarely occurs, the legal status of the student teacher has become a topic of much discussion due to the penchant of parents to threaten suit.

If a student teacher is guaranteed the same legal protection as a regular teacher, then in the eyes of Mr. John Q. Public, he is just as liable as the teacher. In the event that a student is injured while under the direct supervision of a student teacher, again Mr. Public may say, "My son was under your supervision. I'll sue you." Of course, it would be more profitable to sue the regular teacher.

Henry and Beasley[3] suggest the following questions in clarification of the legal role of the student teacher:

1. What is the legal status of student teachers in the state?
2. What kind of legal protection is provided for the student teacher in the particular school?
3. Who is responsible for the class if the student teacher is alone with the group?
4. In what situations may the student teacher legally and ethically be used as a substitute teacher?
5. What is the role of the student teacher in the event of a teacher strike or a day of professional protest?
6. Are there responsibilities a certified teacher cannot delegate to a student teacher?
7. Can a student teacher administer corporal punishment?

Finally, Henry and Beasley conclude "...the supervising teacher should remember that his classes are his moral and legal responsibility and not the responsibility of the student teacher."

The question arises: should a student teacher begin teaching immediately upon arrival at the school? Since it is necessary for the student teacher to know what has been taught prior to his coming and what is to be taught while he is there, it is doubtful that he can begin teaching the first few days.

An interesting case study is presented by Henry and Beasley[4] in the following:

Cindy is a most enthusiastic beginning student teacher. She says that she is really excited about student teaching and wants to get started immediately. She asks if she can teach her entire teaching schedule on the second day so she will "know what it's like." You believe that no beginner can successfully assume that much responsibility with only two days of contact with the school. However, she is persistent, and you do not want to crush her enthusiasm, so you are in a real dilemma concerning this request. What action would you take?

Possible solutions to this dilemma are set forth by the authors. Which would you choose?

1. Let Cindy have as much responsibility as she desires, but observe her closely for any resulting problems.
2. Suggest to her that she assume only limited responsibility until she seems capable of handling greater amounts.
3. State that the policy is to have a beginning student teacher observe for a number of days before assuming a regular teaching schedule.

How should the student teacher be evaluated? "You're doing OK," is not an effective evaluation. This remark provides very little if any direction for improvement. Effective evaluation involves the frame of reference called "good teaching." Included in this frame of reference is an awareness of what changes should take place in order to attain "good teaching," as well as the methods necessary to effect such changes.

The following principles are taken from various authors concerning the evaluation of student teachers:

1. The fundamental purpose of evaluation is to promote growth.
2. Evaluation involves appraisal of agreed-upon values and goals.
3. Evaluation is an integral and important part of the learning process and should be continuous.
4. Evaluation should be based on both quantitative and qualitative evidence and employ a variety of techniques for recording and interpreting behavior.
5. Evaluation is a cooperative process in which the learner and all those concerned with his growth should participate.
6. Evaluation takes into account both the ability of the learner and the standards and competence generally required in the situations in which the individual will be engaged.

Suggestions for improvement should be offered as soon after the experience as possible. Such suggestions should be positive and should focus on the activity rather than on the person.

A variety of procedures and techniques should be used in the evaluation process. For instance, the following constitute several techniques for evaluating student teachers at the University of West Florida:

1. Coordinator Observation Reports (at least four are required.)
2. Mid-Term Evaluation (a cooperative report completed by the supervising teacher and the student teacher.)
3. Final evaluation by the supervising teacher.
4. Final Report and Recommendation by the university coordinator.

Perhaps the information offered here will encourage a future supervising teacher to provide for his student teacher an experience that is most meaningful. For teachers who are presently serving in the capacity of a supervising teacher, perhaps some factors have been mentioned that will help you affect the student teachers' professional development in a positive way.

Remember that if the student teaching experience is to be worthwhile, it must be well planned, organized, executed, and evaluated.

BIBLIOGRAPHY

Association for Student Teaching. The Supervising Teacher — Standards for Selection and Function. Commission on Standards for Supervising Teachers and College Supervisors of the Association for Student Teaching. Dubuque, Iowa: Wm. C. Brown Co., Inc., 1966.

Bennie, William A. Cooperation for Better Student Teaching. Minneapolis, Minn.: Burgess Publishing Co., 1966.

Lade, Gordon, Stoutamire, Barney, Yarling, James, and Wentz, Pat. Handbook for Supervising Teachers. Pensacola, Fla.: University of West Florida Printing Office, 1973.
3,4Henry, Marvin A., and Beasley, W. Wayne. Supervising Student Teachers the Professional Way. Terre Haute, Indiana: Sycamore Press, 1972.
1,2Sharpe, Donald M. A Brief Guide to Secondary Student Teaching. Terre Haute, Indiana: Indiana State University Press, 1970.
Stratemeyer, Florence B., and Lindsey, Margaret. Working With Student Teachers. Columbia University, New York: Teachers College Press, 1958.
Tanruther, Edgar M. Clinical Experiences in Teaching for the Student Teacher or Intern. New York: Dodd, Mead & Company, 1968.

Dr. Wentz is an associate professor in the Department of Vocational Technical Education at the University of West Florida, Pensacola, Florida.

Project TEAM

James N. Yadon
Lowell T. Hudson

The time and space alloted here will be sufficient to tell the faults and shortcomings of TEAM (Teacher Education for Auxiliary Members of the Staff), but there is most certainly not enough time or space to describe the attributes and successes of this rather amazing teacher education program. A positive presentation, however, will require a short paragraph or two on the shortcomings and the remainder of the presentation on the positive aspects.

The program did not provide the students with sufficient time on campus and away from their duties to either instigate, participate, or for that matter even observe some of the latest college fads such as streaking. No, they were too busy giving instruction to five classes each day and going to school three or four nights each week. I dare say there was little energy left to streak. There was no opportunity to develop the prominent educational idealistic cloud nine utopian philosophy which often pervades colleges of education far, far removed from the present educational climate. The program members were there every day, all day, in the heat of the battle. Idealism and theoretical solutions for problems were tested at once, in the real-life setting of school situations common to today's complex public school system.

The students did not have the opportunity to learn from scholarly professors who many times haven't been in an inner city school for ten years, or perhaps never. They had to rely on master teachers working in the classroom every day to provide most of the educational information they needed. They could readily see if the techniques and methods were working.

Students in this program did not have the same opportunity to observe a dozen or so classes before interning or student teaching. No! They observe hundreds of classes before the program is completed. In fact, they did not even have the same type of student teaching experience. They did not start out teaching one or two classes and end up teaching four or five classes for a few weeks. They started out teaching five classes and sometimes six, not just for a few weeks, but sometimes for three or four years! This was not a program where the members could get their feet wet, it was a deep-water program where they experienced a complete inundation in the educational process.

Now that we have had a look at the negative points, we must look at the positive points.

The program provided for the very best instruction in industrial arts college course work. Seventy five percent was by an outstanding teacher and educator, the presenter. The other 25% was divided between several capable professors and adjunct instructors. The lack of exposure to a variety of instructors in their formal industrial arts courses is perhaps the single greatest handicap. It is simply not possible for one professor to teach such a wide variety of courses needed for this program with a high degree of competency. The use of the supervising master teacher who unselfishly gave of his time and energy to provide the skills and methods development of the students provided a most satisfactory solution to this difficult problem.

The students were given ample opportunity to develop skills and conduct classes in outstanding laboratory schools. Sometimes the students were given laboratories which had not been in operation for years, with the expectation that they would not only conduct classes but put the labs into tip top shape. In all cases, they have done an outstanding job. The laboratories are as clean, well kept, and operational as any in the system.

The skunk oil and rose water has now been distributed, but it is only fair to conclude by pointing out the debt owed to everyone involved in this program. First, the students themselves demonstrated maturity, motivation, and cooperation in working to complete the program. Second, the teachers, principals, and administrators in the several schools who gave help and direction to the students. Third, the Career Opportunity Program, better known as COP program, supervisors, and personnel who worked closely with the students, county, and university in overcoming many problems. Fourth, the vocational and industrial arts supervisors are to be commended for their tremendous effort to coordinate the program and students to achieve the best situation for professional growth of the students. Fifth, the university is to be recognized for the tremendous effort in coordinating the courses from the industrial arts department through the division of continuing education to provide the many and varied courses needed by the students to complete their certification and bachelors degree.

Dr. Yadon is an Instructor in the Industrial Arts Department, Florida State University, Tallahassee, Fla.
Mr. Hudson is an Industrial Arts Supervisor in Jacksonville, Fla.

Designing Educational Facilities for the Future

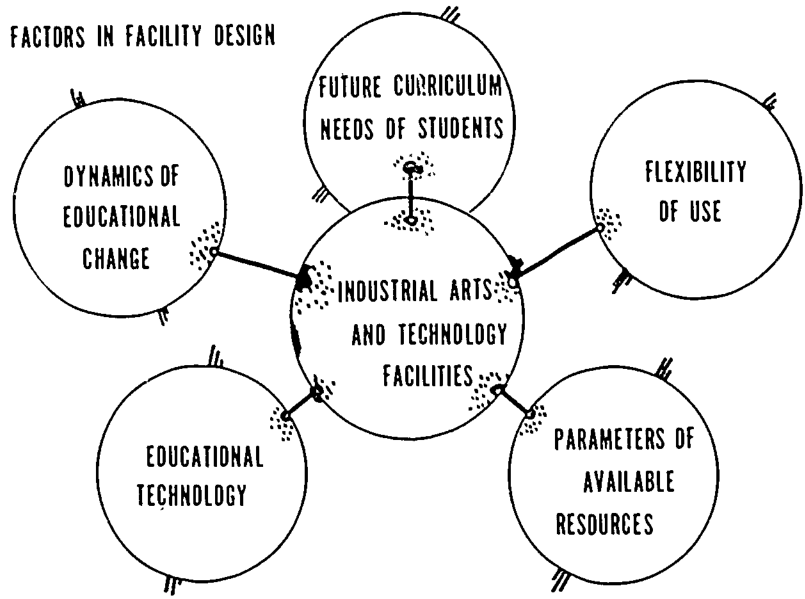
Ronald D. Bro
Alvin E. Rudisill

The design of industrial arts laboratories and buildings has too often been premised on present and past circumstances, with only a casual look to the future (Anderson, 1973). In an era of rapid curriculum change, such as is presently being experienced in industrial education, this procedure can result in facility obsolescence before construction is completed. Educators and architects need to work together to design facilities which will be functional in fulfilling the needs of students in the future. The design of today's facilities should be geared to emerging curricular programs and new instructional approaches in industrial education.

There have been a wide variety of curricular innovations in industrial education during the past decade, but most of them have common identifiable elements (Cochran, 1970). In general, the trend has been away from classification of content under such terms as metalworking, woodworking, and the like toward broader classifications such as production, energy systems, and communications. The impact of career education has also fostered broader-based content organizers under industrial-technological or occupational clusters. Accompanying the trend in broad-based programs is the expanding role of new instructional technology, individualized instruction, and industrial enterprise simulation. Unfortunately, many of our existing industrial arts facilities were not designed to properly implement the new and expanding programs and instructional approaches (Stallsmith, 1973). They were generally well designed for process-oriented technology specialization, but less well suited for broad-based cluster exploration and multi-media approaches.

In a survey of 65 industrial teacher education departments, a majority of the respondents indicated that new programs are needed to acquaint teachers with the total organizational structure and operations of industry. They also indicated that teacher education departments should "get on" with preparing teachers in the common elements of the major curriculum innovations of the past decade (Bro, 1971). Unless teacher education takes the lead in implementing these new programs, it can hardly be expected that its graduates will promote the implementation of them in the secondary schools.

In the fall of 1972, a curriculum committee of faculty in the Industrial Arts and Technology Department at the University of Northern Iowa began work on the development of a broad-based curriculum core for all of its majors. In the spring of 1973, legislative



approval was obtained on a long-sought-after new industrial arts and technology building to house the department. Since then the faculty has been actively involved in both curriculum and facility design. The facility planning committee has been working closely with the curriculum committee in planning a facility that would support and enhance the future curriculum of the department. As work on the committees proceeded, it became apparent that curricular trends and new instructional approaches in industrial education had major implications for design of the building. (See Figure 1.)

LABORATORIES

In a broad-based core course, it is highly desirable for students to be able to move freely throughout the cluster area without the restriction of permanent walls. They should be able to experience the wholeness of a technological cluster rather than isolated portions segmented by types of materials to be processed. Separation of laboratories by permanent walls, when necessary, should be based upon broad industrial-technological or occupational clusters and upon principles of efficient and effective instructional management.

Separate laboratories which can be opened up to form a large single laboratory for a comprehensive experience in industrial enterprise and can be closed for in-depth specialization in certain fields would be ideal. (See Figure 2.)

VERSATILITY AND FLEXIBILITY

The facility should be capable of serving many functions, readily adaptable for curricular changes, and economically expandable for future growth or development. It should lend itself to rearrangement of machines, services, furniture, and other equipment. In order for the curriculum to adjust to future technologies and occupations which do not presently exist and which we cannot presently describe, it is essential that the facility be designed to permit change to take place with a minimum of effort and expense.

NEW INSTRUCTIONAL TECHNOLOGY AND APPROACHES

Provisions should be made for utilization of a wide variety of teaching methods. Students should be able to work effectively in groups or on an individual basis. The implications here include provision for seminar rooms, multi-media presentations, closed-circuit television, auto-tutorial systems, a learning resource center, study carrels, and

LABORATORY DESIGN IMPLICATIONS

— COMPREHENSIVE STUDY OF INDUSTRY

— TECHNOLOGY SPECIALIZATION

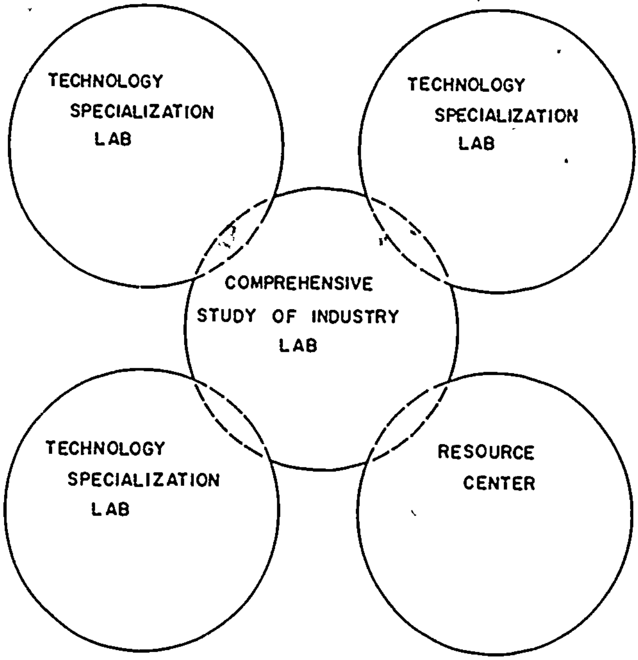


Figure 2

the like. Provisions should be made for large-group instruction augmented with the effectiveness of small-group and individualized instruction. The facility should lend itself to the use of instructional approaches such as team teaching, para-professionals, and inter-disciplinary instruction. Provisions should also be made for students to participate in simulated industrial enterprise experiences, including product research and development, mass production, and distribution.

How some of these implications were incorporated into the design of the future industrial arts and technology building at UNI is described in the remainder of this article. The facility being discussed will serve programs in both industrial arts and technology, with specializations available for careers in education and industry.

SPATIAL DESIGN

Current and predicted curriculum options in the department seemed to dictate that space be made available for a broad comprehensive conceptual approach for industrial arts majors, as well as space for highly specialized technical laboratories for in-depth study in technical areas for trade and industrial education and technology majors. A review of the project budget indicated that it was simply not adequate to provide for both types of spaces.

After a thorough evaluation of the advantages and limitations of both types of spaces, a compromise solution was reached which seemed to be satisfactory to proponents of

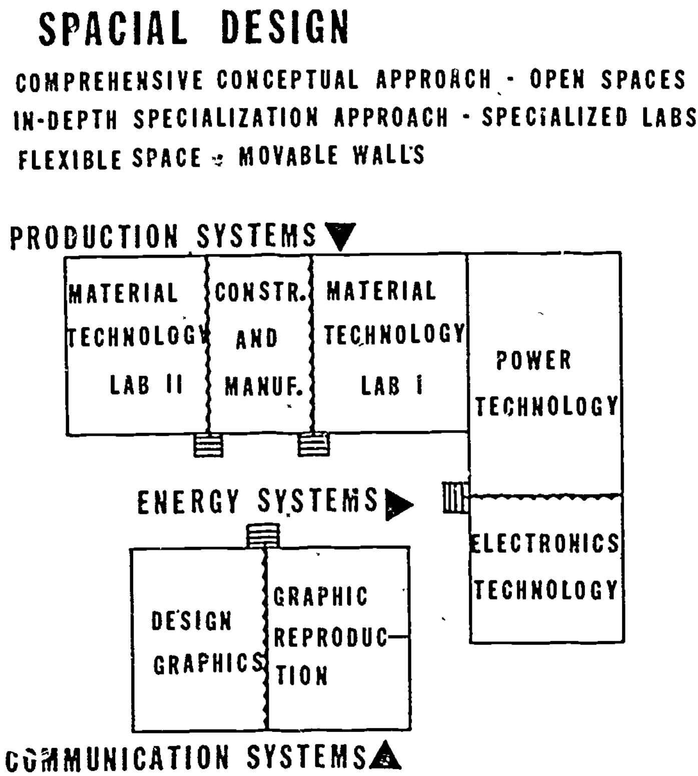


Figure 3

both open-space and specialized-area laboratories. The solution was to provide large open-space laboratories in each of the broad conceptual areas of production systems, energy systems, and communication systems and to provide power-operated movable walls which could be used to divide these large open spaces into specialized technical areas. Figure 3 shows the general spatial relationships of the final design adopted by the planning committee.

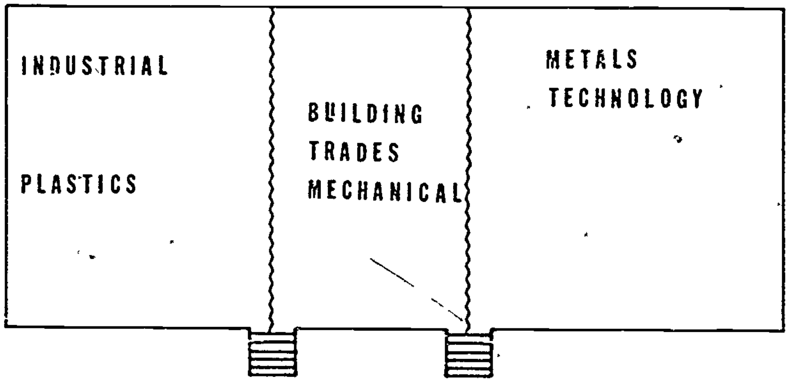
Figures 4, 5, and 6 show some of the programming options available with the movable walls in the open-space production systems laboratory. Figure 4 shows both walls moved into position, which allows for three separate and distinct in-depth technical courses to be offered at the same time by three different instructors. Figure 5 shows both walls in a retracted position, allowing a broad conceptual core course to be offered in product design and manufacturing with plastics, woods, and metals processing equipment moved into the central area for actual line production of products. Figure 6 shows one of the walls in a retracted position for a broad construction course to be taught in two areas plus the outdoor work area.

Obviously, this type of programming flexibility would not be possible without a considerable degree of flexibility in locating equipment within the open-space laboratory. This type of flexibility is provided by a unique utility grid system which provides for almost unlimited movement of equipment throughout the entire production systems laboratory. Figure 7 shows the trench system which will provide for electrical power, air, and exhaust utilities located on a 10 x 10-ft. grid pattern. In actual practice, these utilities can be made available in any pattern along the horizontal trenches.

Utility connections between the trench and equipment will be possible through a utility post design which seems to have the potential for revolutionizing laboratory design in

PROGRAMMING FLEXIBILITY:

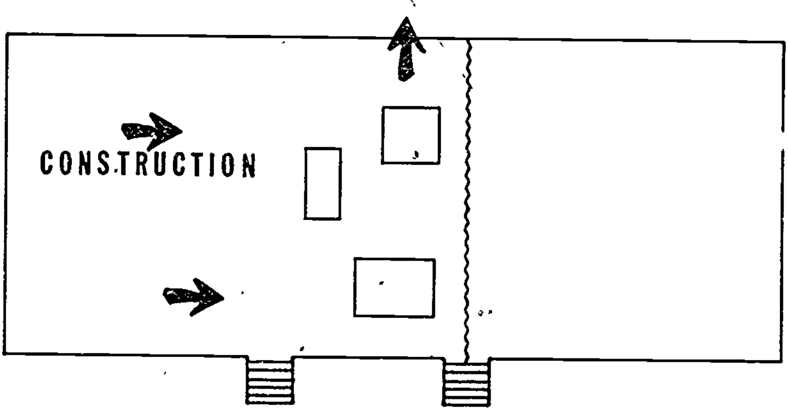
PROGRAMMING FOR UNRELATED COURSES



PRODUCTION SYSTEMS LABORATORY

PROGRAMMING FLEXIBILITY:

PROGRAMMING FOR CONSTRUCTION

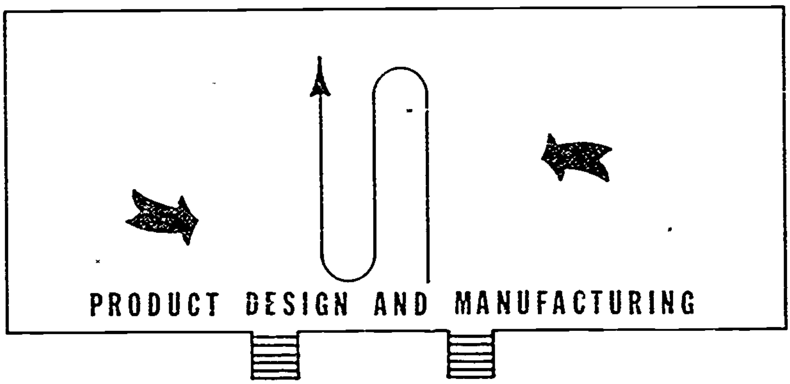


PRODUCTION SYSTEMS LABORATORY

industrial education. The post may be placed in position on the trench in about five minutes by simply removing a cover plate held on by four screws, "plugging in" the power, exhaust, and air outlets, tipping the post up into position, and fastening it in place with the same four screws used for the cover plate. See Figure 8 for details of the utility post design.

PROGRAMMING FLEXIBILITY:

PROGRAMMING FOR MANUFACTURING

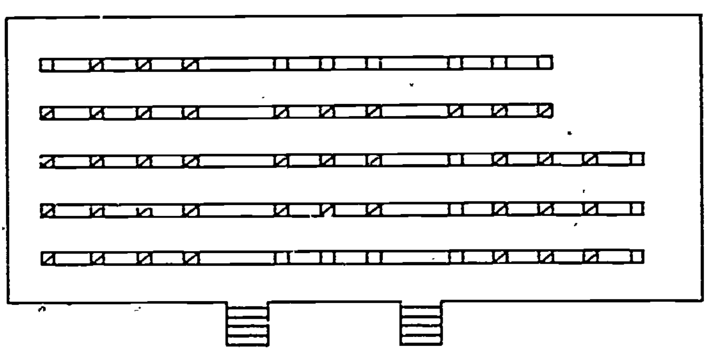


PRODUCTION SYSTEMS LABORATORY

UTILITY GRID SYSTEM

ELECTRICAL POWER AND AIR OUTLETS ☐

EXHAUST SYSTEM ☒

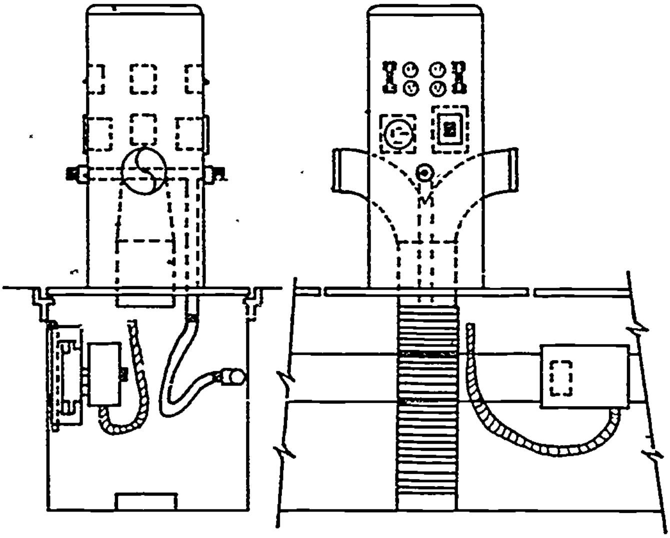


PRODUCTION SYSTEMS LABORATORY

This same type of flexibility is available in certain areas of the communications and energy systems laboratories. Covered outlets in these areas are provided flush with the floor surface for electrical power connections on two-foot centers along horizontal grids.

UTILITY POST DESIGN

ELECTRICAL POWER
EXHAUST SYSTEM
AIR OUTLETS



INSTRUCTIONAL INNOVATIONS

The majority of departmental faculty favored designing the new facility for competency-based individualized instruction, but there was considerable hesitancy on the part of some faculty to make a total commitment to this approach at the complete exclusion of more traditional methods. A complete analysis of new instructional approaches and faculty preferences seemed to indicate that although the department would continue to move toward individualized competency-based instruction, some courses and competencies would always be taught by large-group lectures or small-group interaction sessions.

The planning committee attempted to design the facility so that large-group, small-group, individualized instruction, or a combination of these methods of instruction could be used for any course options or competency-based activities. An example of this flexibility is illustrated in Figure 9, which shows the components of the closed circuit television system for the various types of instruction. All of the open-space laboratories or sub-labs have individualized study carrels equipped with television monitors in addition to wall or ceiling monitors for use when teaching to small groups. A lecture bowl for up to 120 students, a classroom for 40 students, and two seminar rooms for 20 students are equipped with TV monitors for large-group instruction via the closed circuit television system.

CCTV programming will originate in the resource center which is equipped with twelve video-color cassette record and playback units. Communication within the system is made possible with a two-way intercom system with terminals located in each laboratory near the study carrels and at the resource center.

CLOSED CIRCUIT TELEVISION:

LARGE GROUP INSTRUCTION ⊗

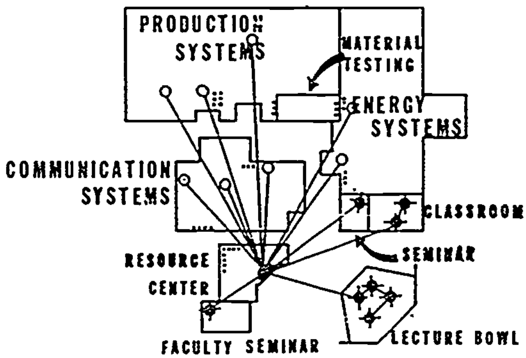
LECTURE BOWL - 120
CLASSROOM - 40
SEMINAR ROOM - 20

SMALL GROUP INSTRUCTION ⊙

8 WALL OR CEILING MONITORS

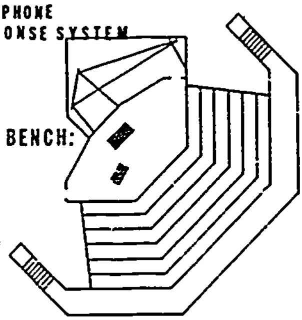
INDIVIDUALIZED INSTRUCTION

43 INDIVIDUAL MONITORS

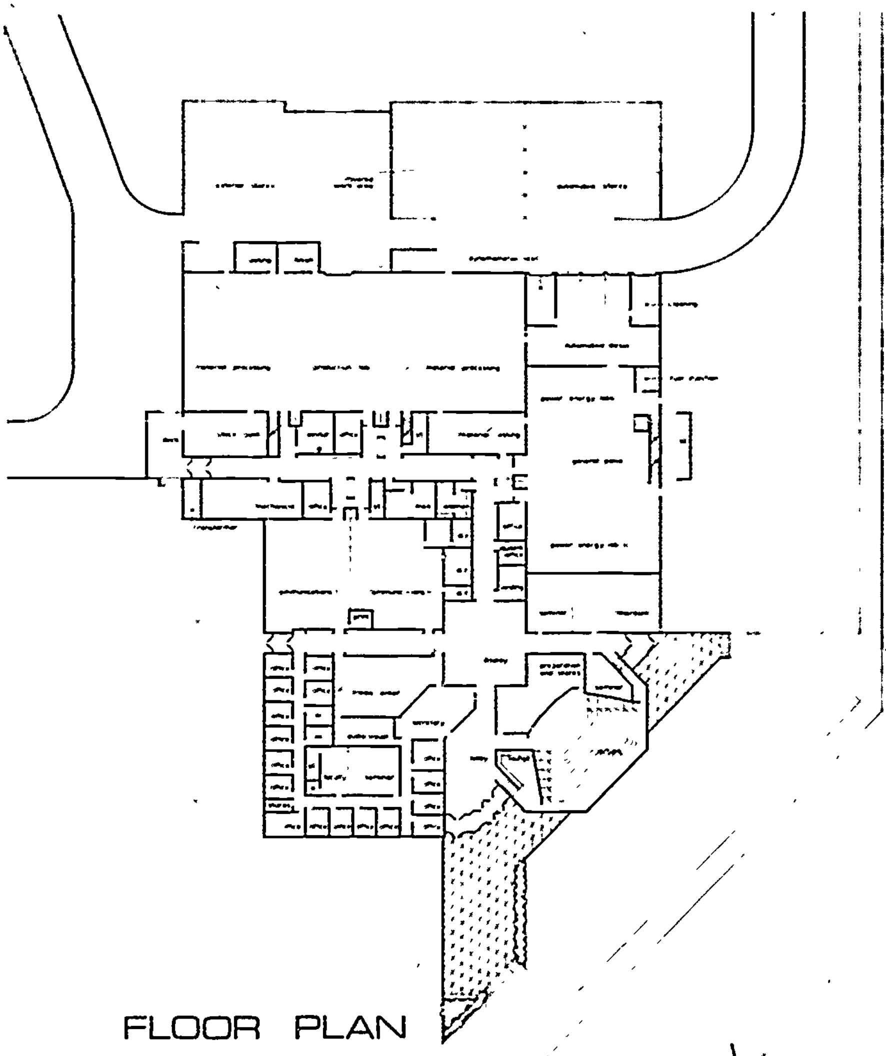


LARGE GROUP INSTRUCTION

LECTURN:
- LIGHT CONTROL
- OVERHEAD PROJECTOR
- 35 MM SLIDES
- FILMSTRIP
- 16MM FILM
- CASSETTE AUDIO TAPE
- MICROPHONE
- RECORD PLAYER
- CCTV
- AMPLIFIED TELEPHONE
- STUDENT RESPONSE SYSTEM



DEMONSTRATION BENCH:
- SINK
- POWER OUTLETS
- BUNSEN BURNER
- CCTV MONITORING



FLOOR PLAN

Large-group instruction will be enhanced with the well-equipped lecture bowl. Figure 10 shows the general arrangement of the rear-screen projection system incorporated in the lecture bowl design. The lectern is the "control center" and provides for complete control of lecture bowl lighting, including dimming capabilities, remote control of 35mm slide, filmstrip, and 16mm film projectors located in the rear projection room, control of an audio-tape recorder and a record player located in the lectern base, control of four CCTV monitors in lecture bowl and a remote intercom station with communication capability to resource center, and an amplified telephone system located in the base of the lectern. An overhead projector will be permanently located on the lectern.

Also located in the lectern will be a control panel for a student response system with response units located at each of the 120 seats in the lecture bowl. This system will provide the instructor with immediate feedback on questions posed to the class, including individual monitoring of student responses and the percentage of responses received for each response option.

The lecture bowl also contains a demonstration bench with a sink, power outlets, and Bunsen burner for demonstrations. A portable TV camera will be used to provide "close-in" monitoring of demonstrations via the four ceiling-mounted TV monitors. Ample space and power is available for moving in large power equipment for demonstrations.

Differentiated staffing techniques will be utilized in the new facility to provide for continuous supervision and evaluation of student progress in the open-space laboratories. Each teaching team will consist of faculty members, full-time instructional assistants who will provide for continuous laboratory supervision, graduate assistants, and undergraduate student assistants. A large office is provided in each cluster laboratory for all members of the differentiated staffing team except for faculty. Faculty offices are located in a separate administrative area.

Other innovations in the facility include centralized stock room, materials testing laboratory, office for officers of student clubs, display center, graduate student lounge, and a resource center which will be the central depository for all the competency-based individualized instruction modules.

The general layout of the building is shown in Figure 11. Further information about any phase of the design procedure or more details about any of the innovations may be obtained by writing to Dr. Bro or Dr. Rudisill.

LITERATURE CITED

Anderson, Lowell D., "Trends in Laboratory Design for the Middle School," Man, Society, Technology, 32:239, March 1973.

Bro, Ronald D. "A Comparison of Conventional and Transitional Industrial Teacher Education Departments with Respect to Selected Factors Deemed to Affect Innovativeness." Unpublished Doctor's Dissertation, University of Nebraska, 1971.

Cochran, Leslie H., Innovative Programs in Industrial Education (Bloomington, Ill., McKnight and McKnight), pp. 110-111, 1970.

Stallsmith, Douglas D., "Industrial Education Facilities," Man, Society, Technology, 32:234, March 1973.

Dr. Bro is Associate Professor of Industrial Arts and Technology at the University of Northern Iowa, Cedar Falls, Iowa. Dr. Rudisill is Professor and Head of the Industrial Arts and Technology Department at the University of Northern Iowa, Cedar Falls, Iowa.

Preparing Industrial Arts Teachers: A Student's Perspective

Richard A. Peterson

I would like to express my views in two areas. I think that a large department should take pride in being large, and that a large department can offer its students greater opportunity in a number of areas.

It appears logical to me that a department grows because students are attracted to the program because of quality teachers, quality programs, and opportunity. A large metropolitan area provides a number of educational alternatives, thus, a department would have to have an outstanding program to attract students. I feel that if a department does not meet the needs of the students in today's competitive educational market, it will cease to grow and could even decline in enrollment. I am sure everyone has observed one professor with an overload and another without. Large size does not occur by accident!

I personnally am not aware of a small school which would not take the opportunity to grow in order to offer the students a better and broader curriculum.

I have appreciated being able to choose an advisor with personal interests very similar to my own. This may not be possible with a smaller institution, which may have only one advisor. At a large school, the students may have an opportunity to make use of more elaborate engineering and technology facilities. I can see in a large school a keener sense of competitiveness among students as well as faculty. A large department can afford to offer special-interest classes, such as ecology and energy studies, which are a growing part of today's high school curriculum. A faculty member of a large department with a single subject area assignment can dedicate more research and study to his specific area, offering more depth to the students.

My high school industrial arts experience indicated the importance of studying under individuals who were abreast with the industrial trends. I feel that the larger school would have a more versatile faculty and could afford to hire part-time people from industry.

I am student teaching this quarter, and another advantage of a large college has become quite apparent to me: the effort a full-time student teaching supervisor can spend in finding the right assignment to meet my personal needs. In contrast to this situation, a smaller college may have to have their student teaching supervised by a faculty member from outside the department who might not be aware of the unique characteristics of both the subject matter being presented and the student teacher presenting the material.

I am presently on the job market, and from people I have talked with, I am convinced that I made the right decision in going to a school with a large industrial arts department.

Mr. Peterson is a student at Western Washington State College, Bellingham, Washington.

Teaching Aids

Simulation and Gaming: Theory, Practice, and Implications

Michael Dyrenfurth

The purpose of this presentation is to counteract the swelling, somewhat casual, tide of enthusiasm for the technique of simulation. A recent review of our five main periodicals, American Vocational Journal, Man Society Technology, Journal of Industrial Teacher Education, Industrial Education, and School Shop, suggests strongly that, in our field at least, we are still in the "acceptance on faith" stage as described by Boocock and Schild (1968). We have not yet reached the stage of critical analysis or even that of cautious optimism. It is possible that uncritical adoption of the technique will lead to a backlash that will severely hamper its future development. Evidence of this can be found in that little research has been reported on the following problems of simulation as identified by Stewart (1961). The seriousness of this problem can be determined by the fact that a full 13 years have elapsed since their first publication.

a) Simulations may provide misleading representations of the world.
b) Simulations may discourage originality.
c) Simulations may ignore qualitative factors in scoring.
d) Simulations may omit the human element.
e) Simulations may enhance the danger of literal transfer.

In order to analyze the state of the art, remembering that we are dealing in an applied field, a consistent terminology and overview must be available. Fletcher (1970) clearly pointed out the difficulty resulting from this lack:

> There's no agreement about which of the many differences are the important ones and which are superficial. Before game research can advance rapidly, there must be some stipulation of a set of variables that are important and ought to be investigated. Furthermore, terminology is inconsistent from game to game. Until terminology is consistent across games, findings of one game cannot be applied adequately or accurately to another (p.219).

Since this consistent interpretation is necessary to analysis, a second purpose of this presentation will be to introduce a system model of simulation and some of its pertinent definitions.

Finally, to do justice to the title and to the audience, since most of you are more likely to be developers and consumers of simulations (rather than researchers of the technique), a third purpose of this presentation is to identify some areas for implementation and development.

THE STATE OF THE ART

Systematic views of simulation

Approximately five years of periodicals in our field were reviewed, as were the AIAA conference proceedings from 1969 to the present. By scanning these articles, it became clear that consistent terminology did not exist. The articles dealt with techniques ranging from simulators of mechanical systems, such as an ignition system simulator, to inbasket activity for educational administrators. Some articles dealt with games, involving many rules and a high element of chance, while many others focused on mass production activities. The observed inconsistency is not necessary because models and systems overviews do exist.

The first major distinctions that we must recognize are those between games and simulations. Twelker (1969) uses the criterion of reality base vs. abstract base to differentiate between games and simulations. Figure 1 provides graphic illustration of Twelker's dichotomy. According to his definition, simulations must use a model drawn from reality, while games are not so restricted. The distinction is further clarified in a recent Phi Delta Kappan article by Thiagarajan (1974). In this article, the author developed a game (called Gamegame II) that teaches one to differentiate between simulations, games, and instructional material. Figure 2 will illustrate the main decision rules.

Focusing on simulation now allows us to present a paradigm of the technique and thus classify findings and variables in a consistent manner. The systems view of simu-

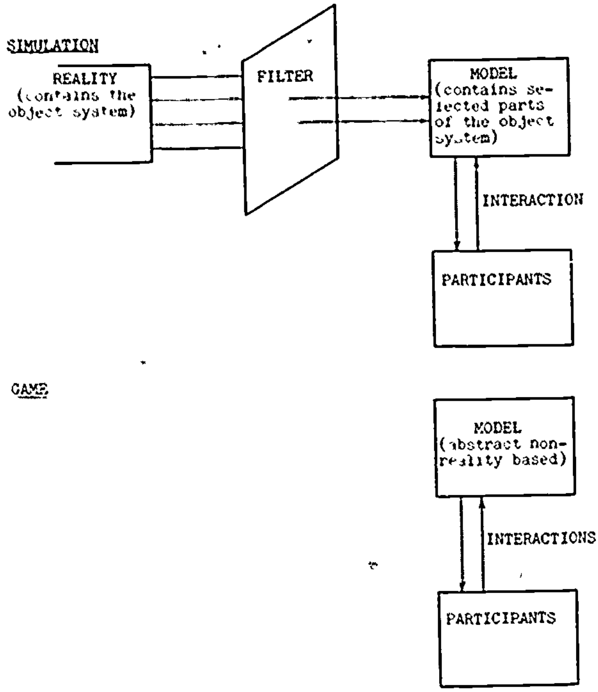
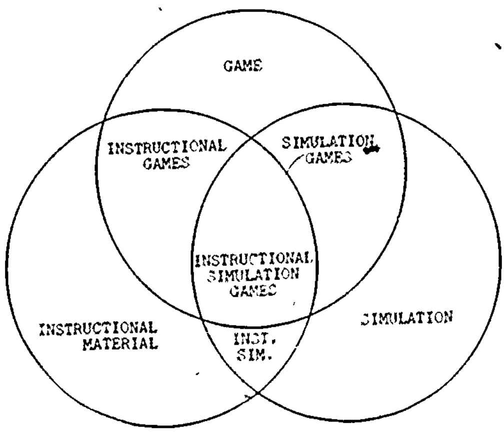


Figure 1. Simulation and Games, as adapted from Twelker (1969)



INSTRUCTIONAL MATERIAL	SIMULATION	GAME
Designed to help pupil learn something	Representation of an object system (reality)	A rule-governed activity involving competition among players and a clear method of determining the winner

Figure 2. Decision rules for differentiating games, simulations, and instructional materials (adapted from Gamegame II by Thiagarajan, 1974).

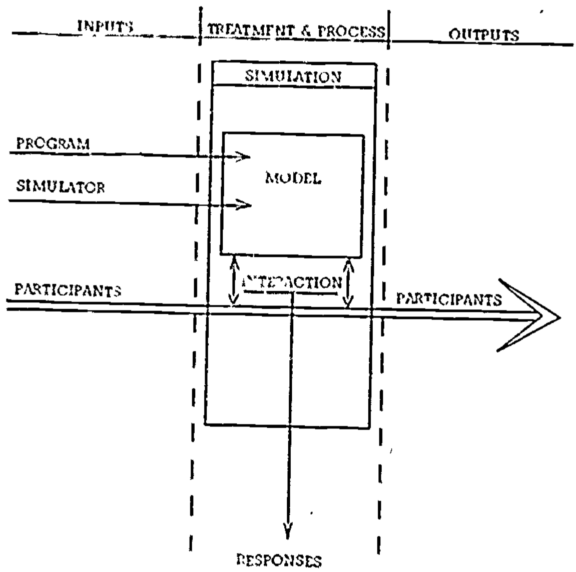


Figure 3. Systems view of simulation

lation (Dyrenfurth 1973) shown in Figure 3 uses the conventional notion of inputs—process—outputs. The five major system components of program, simulator, model, participants, and interaction are also clearly shown. Table 1 illustrates some of the variables of each component.

Table 1

Simulation components and their variables

Inputs

A. Program
1. Complexity
2. Fidelity
3. Linear — branching
4. Presentation media
5. Competitiveness
6. Open — closed model
7. Time frame
8. Administrator

B. Simulator
1. Complexity
2. Fidelity
3. Static — dynamic
4. Human — machine

C. Participants
1. Age
2. Sex
3. Education
4. Experience
5. Attitude
6. Demographic variables
7. Intelligence
8. Self image
9. Sense of control
10. Motivation
11. Ability to empathize

Process

A. Interaction
1. Rules
2. Mode
3. Frequency
4. Importance
5. Human — machine mediated
6. Stochastic — non-stochastic
7. Degree of involvement
8. Group effects

Output
- A. Participants
  1. Learning
  2. Attitude change
- B. Products
  1. Decisions
  2. Letters, memos, etc.

ASSESSMENTS OF THE TECHNIQUE

The review of literature was resplendent with a great many hunches, insights, guesses, opinions, and impressions as to the attributes of the simulation technique (taken in its broad meaning). Very little in the way of replicable experimental or quasi-experimental evidence was unearthed. The majority of such evidence, as it does exist, is found in literature outside of industrial education. Of the few introspective articles, Koeninger and Ward (1973) first summarized the claims generally advanced by the technique's proponents. They then went on to say that: "Too little research is available to testify as to the validity of these additional assertions (Koeninger and Ward, 1973, p. 56)."

Koeninger and Ward's claim is easily substantiated by inspection of Table 2, which reports the findings of a search for experimental, or quasi-experimental, verification of simulation's effects. Many gaps and contradictions are self-evident. Furthermore, some of the claims are merely obvious interpretations of the technique's characteristics.

Table 2. Summary of Simulation Research Findings

Claim	Pro	Con
INPUTS		
Program		
1. Realism is enhanced through simulation. (a)		
2. Simulations can present critical incidents that may not occur while training in the real situation. (a)	Self-evident	
3. Simulations can be designed for the purpose of conditioning certain behaviors. (a)	Confirmed by the practices of NASA and some of our airline companies.	
Participants		
Simulator		
PROCESS		
Interaction		
1. Simulation provides immediate feedback. (a)		Not for all simulations; it depends on the design.
2. Simulation allows time compression (or expansion) (a)	Self-evident	
3. Simulations allow safe learning without threat of censure or bodily harm. (a)	Self-evident	Note: censure may, however, be implied by the rules
4. Simulation allows participants to experience the complexities of group interaction. (a)	Self-evident	
5. Self-evaluation is possible through simulation and improvement is facilitated by repetition. (a)		Fletcher (1970) states that in spite of this supposed advantage, most research has relied on a single game play, thus not reinforcing this claim.

Table 2. Summary of simulation research findings, continued

Claim	Pro	Con
6. Simulations allow evaluation of performances that might involve danger. (a)	Self-evident	
7. Simulations allow awareness of, investigation of, and interaction with all those variables comprising reality. (a)		
OUTPUT		
Participant change		
1. Simulation encourages individual involvement and motivation toward the simulated activities (object system). (a)		Bell (1971) reported that concepts dealing with the object-system did not change in meaning after simulation. Dyrenfurth (1973) reported a similar finding.
2. Simulation facilitates transfer from instruction to reality. (a)		
3. Participants in simulation exhibit a positive attitude toward the learning experience. (a)	Cherryholmes (1966) reported confirmation of his hypothesis that students participating in simulation will reveal more interest in simulations than in traditional methods. This finding is also supported by Bell (1971), with respect to both written and observed behavior, and Ross (1968). Sprague et al. (1966) reported very favorable interpretations of simulation as an "educational experience." Dyrenfurth (1973) identified a result of simulation was a more positive evaluation of the technique.	Robinson (1967) found that students reported preferences for case studies, yet when observed revealed more participation in simulations. Dyrenfurth (1973) reported a shift in participants' views of simulation toward a less active and adaptable definition as a result of a simulation experience.
4. Simulations bridge the gap between theory and practice. (a)		
5. Simulations provide an effective learning environment. (a)	Baker (1968) found that students taught by simulation achieved better than when taught by conventional methods and also that students taught by simulations had greater attitude change. According to Wing (1968), simulation requires just half the time traditional methods need to result in equal learning. Kersh's (1965) earlier work also supports this finding.	Cherryholmes' (1966) findings caused rejection of the hypothesis comparing simulation to conventional techniques that students learn more facts and retain them longer. Cherryholmes (1966) also rejected the hypothesis that attitudes are significantly altered. Baker (1968) concluded that students taught by simulation had less retention than those taught by conventional techniques. Wing (1968) reported that there was no difference from the amount of learning resulting from the use of traditional methods. Boocock (1968 b) reported that there was little attitude change after playing the legislative game.

6. Decision-making skills are improved. (a)		Cherryholmes' (1966) findings rejected the hypothesis that simulations develop more decision-making skills.
7. Simulations can enhance self-concept of participants. (Coleman 1966)	Boocock (1968 b) and Vlcek (1965) both reported participants' increase in self-confidence.	
8. Simulation provides experience. (Deacon 1961)	Self vident	

(a) Summarized in Koeninger and Ward (1973).

The lack of consistent terminology undoubtedly contributes to some of the contradictory findings about the effectiveness of the technique. Clearly, there is room for more research and some greater caution in the adoption of the technique.

IMPLICATIONS FOR INDUSTRIAL EDUCATION

1. There is a need for research, specific to our field, investigating the technique's effectiveness.
2. There is a need for conscious adoption of a consistent model of simulation and increased control over the important variables.
3. Research suggests that we should take pains to use a simulation through several cycles to reinforce the learning experience. Single iterations are not enough.
4. The question of fidelity (verisimilitude) is not resolved. Our field tends to believe the "identical element" notion that suggests the more the realism, the greater learning. Simulation can test this hypothesis and probably can even answer some of our concerns about equipping our laboratories.
5. The most prevalent use of simulation in our field is the mass production activity. In terms of Figures 1 and 3 and the findings reported in Table 2, it seems that this technique could be improved by:
   a. The inclusion of a systematic model of industrial variables and relationships abstracted from the real world.
   b. The playing of the activity through several iterations.
   c. The use of student activity and results as inputs to a computer-manipulated model. This would give the effect of a much greater enterprise and the consequent more crucial decisions.
   d. The combination of several mini-simulations into a comprehensive model.

BIBLIOGRAPHY

Baker, E. H. A pre-civil war simulation for teaching American history. In S. S. Boocock & E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1968.

Bell, C. G. An assessment of simulation training on attitude change of prospective teachers. Paper presented at the Annual Meeting of the American Educational Research Association, New York, 1971.

Boocock, S. S. An experimental study of the learning effects of two games with simulated environments. In S. S. Boocock & E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1968.

Cherryholmes, C. H. Some current research on effectiveness of educational simulation: Implications for alternate strategies. American behavioral scientist, 1966, 10(2), 4-7.

Coleman, J. S. In defense of games. American behavioral scientist, 1966, 10(2), 3-4.

Deacon, A. R. Introduction. In R. J. Crow (Ed.), Simulation and gaming: A symposium. AMA Management Report 55. New York: American Management Association, 1961.

Dyrenfurth, Michael. Investigation of Relationships between participant involvement in simulation, as evidenced by physiological activity, and change in concept meaning. (Doctoral Dissertation Bowling Green State University) Ann Arbor, 1973 No. 1523-A.

Fletcher, J. L. Review of S. S. Boocock & E. O. Schild (Eds.), Simulation games in learning. Simulation and games, 1970, 1, 211-220.

Kersh, B. Y. Classroom simulation. A new dimension in teacher education, final report. (U.S.O.E. Title VII Project No. 886) Oregon State System of Higher Education, 1965.

Koeninger, J. G., and Ward, D. L. Simulation in Vocational Teacher Education. Journal of Industrial Teacher Education, 1973, 10(3).
Robinson, J. A. Simulation and games. In P. H. Rossi & B. J. Biddle (Eds.), The new media and education: Their impact on society. Garden City, N. Y.. Doubleday, 1967.
Ross, G. H. The use of game theory in the analysis of a simulation of collective negotiations in education. (Doctoral dissertation, University of Iowa) Ann Arbor, Mich.: University microfilms, No. 68-10687, 1968.
Sprague, H. T., and Shirts, R. G. Exploring classroom uses of simulation. La Jolla, Calif.: Western Behavioral Science Institute, 1966.
Stewart, L. A survey of business games. In R. J. Crow (Ed.), Simulation and gaming: A symposium. AMA Management Report 55. New York: American Management Association, 1961.
Thiagarajan, Sivasailam. Gamegame II, Phi Delta Kappan, 55(7), 1974, 474-477.
Twelker, P. A. Designing simulation systems. Educational Technology, 1969, 9(10), 64-70.
Vlcek, C. W. Assessing the effect and transfer of a classroom simulation technique. (Doctoral dissertation, Michigan University) Ann Arbor, Mich.: University microfilms, 1965, No. 66-450.
Wing, R. L. Two computer-based economics games for sixth graders. In S. S. Boocock & E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1968.

Dr. Dyrenforth is on the faculty of Valley City State College, Valley City, ND.

Psychomotor Skills with the Portable Video-Tape Recorder

G. Barry Ellis

Psychomotor is not just another fancy name for movement, it has a specific meaning that is of great import to industrial arts educators. Posner (1972) states that the ordinary definition of skill is typically confined to motor activities. A psychomotor skill is a coordinated action that requires thought to control the precise movements of the hand (Ellis, 1973). As industrial educators, one of our prime concerns is that the student will gather skills as well as process from the training. One of the ideals of vocational/industrial education is to impart skills to students in a way that will preserve the idea of the old world craftsman, who will sacrifice compensation in favor of quality. It has become apparent that this should be one of the major areas of emphasis in teaching.

Researchers in motor activity (psychologists) and concerned I.A. people have tried to find solutions to this training dilemma. Historically, instructors have simply shown the class how it is to be done with a demonstration. This method has failed, is failing, and will continue to fail to teach motor skills well. One to one (teacher to pupil) is the optimum condition, but rarely is a teacher able to give individual attention precisely when needed. Ellis (1973) tried to show one method, pictorially representing motor skill movement with black/white sequenced pictures. The student would be able to study the prints to see each element of the movement and thus know how to perform him/herself. One problem, however, is that to show truly how an action is to take place, there must be a movement, be it real, implied, or simulated.

For years commercial film companies have produced films to try to fill this role. Those films, both full length (20-45 min.) or single concept (3-6 min.) have been hampered by the realistic problem that the film must meet a wide audience to be profitable and thus loses its singleness of purpose. Riley (1973), in a research project to find out if SSCLF (Silent Single Concept Loop Films) added to the teaching of manipulative skills, concluded that "...SSCLF...is an efficient and effective method of presenting psychomotor skill information in all skill areas."

The portable video-tape recorder is the simplest, fastest, and cheapest method to present psychomotor information. A convincing review of some wonderful uses of the portable video-tape recorder may be seen in work by Elliot and Markham (1970). Donald

L. Marlow (1974) states, in an early video-taping session, that as he instructed the students, another student taped it.

The first problem that is usually mentioned is, "I don't know how to operate the video equipment."

Elliot and Markham (1970) explain:

> In the past, all television equipment was considered to be so complex that it could be used by faculty only when accompanied by a qualified operator. However, the simplicity of the ... portable video-tape recorders ... and its proven sturdiness has allowed the ... (schools) ... to give each user a brief training session in operating the unit. Once a faculty member or designated student is trained, the porta-pack can be borrowed by the person without question for operation in the college classroom.

The machine is nothing more than a tape recorder that receives information from a camera instead of a microphone. All the controls on the common units (Sony, Akai, Panasonic, Ampex) are exactly the same as a reel-to-reel audio-tape recorder. In fact, the industry has advanced to the point of using video cassettes which are almost exactly the same size, weight, and shape as the audio stereo cartridge. All the portable video equipment thus far is black and white recording. However, color is only important if it will add in some way to clarify the instruction given. As psychomotor skills have to do with action/movement, color will not add a great deal and is an expensive luxury to the case at hand.

Before discussing the specifics of how to use the equipment, one should first talk about advantages and/or disadvantages.

ADVANTAGES

1. There is no processing cost involved.
2. Anyone can operate the equipment.
3. Mistakes may be simply retaken as on an audio tape.
4. Material may be viewed in a lighted room.
5. Both audio and video are recorded together.
6. The equipment may be moved to any location for shooting.
7. Lights used are standard photographic equipment.
8. All material may be instantly replayed to check content and quality.
9. Tapes are cheap compared to sound motion picture film.

DISADVANTAGES

1. Tapes are not completely permanent.
2. Each copy of the original is of decreased quality.
3. Sound dubbing and special effects are technically very difficult.
4. P.V.T.R. equipment is expensive (extremely cheap to use if already owned by institution)
5. All adjustments to equipment (calibration, etc.) require trained service help.

I have "laid the cards on the table;" let's now talk about use.

Marlow (1974) shows an example of the P.V.T.R. being used to shoot a classroom demonstration. The tape may have two good uses when completed. First, any student desiring the demonstration information may view the tape when he/she needs it. Second, the tape may be used for those students who missed the class demonstration and require the information. Baker (1973), in a research study, concluded that P.V.T.R. would be excellent for shooting a tape of the student performing a psychomotor skill and allowing the student to view himself, either by slow motion or normal speed, to detect serious manipulative errors which, when corrected, would greatly improve performance.

It now seems appropriate to present a case study of shooting a psychomotor tape for increased instructional effectiveness.

Many students have traumatic difficulties with skew-cutting on a spindle turning project. The lathe will be set up for the demonstration as if it were to be shown to the entire class. The camera is mounted on a standard 35mm tripod with the tape recorder sitting on the cart close by. The cameraman (student, teacher, etc.) then asks the teacher to go through the process as it will be done. The teacher shows the skill and talks about it as it is executed. (Lights can be used, but if the room is well lit, that will be sufficient.)

EXAMPLES of SPECIFIC PSYCHOMOTOR SKILLS in the SEVERAL AREAS of INDUSTRIAL ARTS

By G. Barry Ellis, M.IE.
Doctoral Fellow
University of Utah
Salt Lake City, Utah

The following are some examples of psychomotor skills in the many different areas of industrial arts. They are not all at the same level of complexity, but each requires some form of psychomotor action to complete them.

Area One — Automotive and the Mechanical Arts

- -placing the nut on a stud
- -guiding a connecting rod onto a journal
- -positioning the distributor so that the rotor is pointing toward number one contact on the distributor cap
- -using a rotary-type wheel balancing apparatus
- -guiding a spline into a splined shaft
- -testing valve guide clearance
- -controlling the engine speed while watching the scope in dyno testing
- -using the torque wrench
- -narrowing a valve seat visually

Area Two — The Welding Arts

- -adjusting the tip on the welding torch
- -cleaning the tip
- -adjusting the arc length while arc welding
- -adjusting the arc width while arc welding
- -adjusting the arc angle while welding
- -adjusting the arc travel speed while arc welding
- -most hand welding operations
- -adjusting the bead height
- -adjusting the bead width
- -free-handing the cutting of a circle with a torch

Area Three — The Metal-working Arts

a. machine shop

- -drilling a hole
- -free-hand cutting on the band-saw
- -placing the drill in the center-punch mark to drill
- -manipulating the various feeds on the lathe to adjust to cut
- -draw filling to a line
- -free-hand bending of iron, etc.

b. foundry

- -removing the original form from the sand
- -repairing the sand mold
- -dusting out the sand mold before closing
- -closing the flask

c. sheet-metal

- -making a 90° bend on the hand brake
- -following a line with the hand/power shear
- -making a burr on the end of a cylinder
- -scribing line in the template
- -bending over a Pittsburgh lock with the power machine
- -lining up the center of the punch with mark

Area Four — The Graphic Arts

- -feeding the letter-press
- -hand-setting type
- -developing a plate
- -silk screen printing
- -air brush artwork
- -various parts of the etching process

Area Five — The Plastic Arts

- -hand tooling for thermo-forming
- -cutting out shapes in matte or cloth fibre glass
- -bending plastic to desired angle with heat
- -hot air welding of thermo-plastics
- -dipping frames in plastisol coating
- -plaster forming of molds
- -internal carving of plastic
- -hand shaping of heated plastic sheet

These are but a few ideas that can help you generate ideas of your own about specific skills you would like to teach using the portable video-tape recorder.

The teacher holds up a card containing the title of the skill, and the camera views the card for five to eight seconds. The camera then moves to the operation area. The teacher introduces the skill by showing and explaining the movement; then he slowly does it with the P.V.T.R. recording the information. After the first shooting, the cameraman and the teacher both view the results of the first "take" inside the camera to decide whether to retake it or use it as is.

SOME TECHNICAL INFORMATION

1. To start recorder, push play and record buttons at the same time.
2. The reels will not turn unless the trigger on the camera is pulled.
3. The cameraman will see a red light inside the camera, indicating that it is recording.
4. The sound is recorded automatically with no extra adjustments other than turning the volume up half way.
5. All focusing must be done with the player in record position, but the trigger need NOT be pulled. This allows checks for a good set-up.
6. Don't be afraid to experiment and re-record over original errors.

To supplement the above material, three works have been done that will assist in understanding television tape recording, being familiar with literature, and ordering the presentation. McCabe (1971) wrote a dynamic and timely paper of the history of video tape. This background material will be helpful to understand some theory behind video recording. Ellis (1973) wrote a taxonomy, part of which offered a list of references to do with television and video-tape recording in industrial education. Harrow (1972) contributes a book, "A Taxonomy of the Psychomotor Domain," in which a chapter is devoted to a comprehensive review of literature.

It is an impossible task to explain in words how this procedure may be used. It is, therefore, the challenge of the reader to beg, borrow, or steal a portable video-tape recorder and simply become familiar with it. As the ease of operation becomes apparent, the many uses will be seen, one of which is the visual demonstration of the psychomotor domain to better teach manipulative skills.

BIBLIOGRAPHY

Baker, Norman A., The Effects of Differing Speeds of Videotape Feedback and Levels of Perceptual Speed on Psychomotor Performance, Journal of Industrial Teacher Education, Vol. 10, No. 2, 1973, pp. 50-54.

Ellis, G. Barry, Teaching Psycho-Motor Skills with Sequenced Photographs, School Shop, Feb. 1973, pp. 38-39.

_____, Open Sesame for 'Package' Media How To, School Shop, June 1973, pp. 33-34.

Elliott, Richard B., and David H. Markham, Portable Video Recorders in Higher Education, Audiovisual Instruction, Dec. 1970, pp. 46-48.

Harrow, Anita J., A Taxonomy of the Psychomotor Domain, David McKay Co., New York, 1972, p. 151.

Marlow, Donald L., Tape it Yourself, School Shop, January 1974, pp. 38-39.

McCabe, Edward, The Video Cassette, Training in Business and Industry, October 1971, pp. 43-53.

Posner, Michael I., and Steven W. Keele, Skill Learning, Second Handbook on Research in Teaching, Editor Travors, Rand McNally, 1972, p. 805.

Riley, John N., and Joseph G. McNeill, Testing the Value of Silent Super 8mm Single Concept Loop Films as an Aid to the Acquisition of Manipulative Skills in the Machine Trades, Journal of Industrial Teacher Education, Vol. 11, No. 1, 1973, pp. 80-83.

Simpson, Elizabeth Jane, The Classification of Educational Objectives: Psycho-motor Domain, University of Illinois, Research Project No. OE 5-85-104, 1966.

Mr. Ellis is a Doctoral Fellow, University of Utah, Salt Lake City, Utah, soon to be with Department of Industrial Education, University of Alberta, Edmonton, Alberta, Canada.

Curricular Materials Available Through the Community College of the Air Force

Richard N. Culbertson

The United States Air Force is a sizeable community. We number slightly over 1.2 million, and with this large number comes a tremendous training responsibility, as our personnel develop and maintain those skills necessary to do the job. Responsibility for most of the technical education rests with the Air Training Command, of which we at the Community College of the Air Force are a part. We have five major schools conducting this technical education, located in Illinois, Colorado, Texas, and Mississippi.

Last year our schools graduated 340,000 students, lending credence to our claim, "...the largest training system in the world." Our schools include courses spanning many occupational areas such as electronics, medical services, auto mechanics, administration, carpentry, electrical lineman, and many others. We have developed materials in support of all this training, and believe they would provide a tremendous resource for the civilian sector.

The courses we have are based on the instructional system concept described in detail in Air Force Manual 50-2. This process begins by methodically gathering task data in the form of job inventories. Education and training requirements are then defined on the basis of such inventories. Next, performance-based objectives and criterion tests are prepared. Instructional materials are then planned, developed, and validated, followed by evaluation. This closes the loop and provides input for further refinement of the system.

Our learning objectives are behaviorally stated—that is, we specify exactly what the student must do to demonstrate mastery of the training. This is probably the most critical step in shaping the instructional program. The objectives are converted to criterion test items, and course materials are then developed to enable the learner to achieve expected results.

Since these courses were developed using tax monies, the Air Force has directed us to share materials and instructional technology with civilian educators. In this way we are attempting to return a resource to the nation.

Many questions arise regarding relevance of these Air Force techniques and materials to civilian educators, and I will review the more common ones.

First, can Air Force instructional materials be transferred to civilian schools? Not only can they be, they have been adapted for use in civilian schools. The Utah Project, conducted by the Aerospace Education Foundation and Battelle Memorial Institute, was one of the first steps in proving the compatibility and value of Air Force materials in post-secondary education. The project objective was to obtain, field test, and evaluate certain Air Force courses in a civilian education environment. Although bits and pieces of such programs had been tested before, there had never been scientifically-designed evaluation by an independent research organization—one which could structure the program and assess the results.

For example, 90 hours of the Air Force Electronics Principles Course was tested in schools throughout Utah. A 30-hour segment of the Air Force Medical Service Specialist Course was tested at Utah Tech (Salt Lake City), and the wheels and brakes portion of the Aircraft Mechanics course, a 60-hour block, was introduced at Utah State.

Another question: Would the materials be accepted by the students? Results of the Utah Project indicate that both students and teachers prefer using materials based on the instructional system philosophy.

And still another: How effective would these materials be? In the Air Force, we have found that the use of criterion-referenced instruction results in improved student performance and retention. In fact, we have experienced an average reduction in training time of about one third, with no loss in student effectiveness.

As a result of the Utah experience, we find numerous additional questions arising concerning Air Force curricular materials. First, "What curricular materials does the Air Force have to offer?"

As indicated earlier, we have, in the Air Training Command, courses spanning many occupational areas. Our technical training centers develop curricular materials in electronics, medical services, aircraft maintenance, and welding, to name just a few.

INDEX TO THE INVENTORY

of U.S. Air Force Vocational-Technical Courses Applicable to Civilian Use

<u>Prerequisite Courses</u>
Aircraft Maintenance Fundamentals
Maintenance Electronics
Medical Service Fundamentals
Standardized Electronic Principles

<u>Administration</u>
Administrative Clerk**
Clerk Typist**
Postal Clerk
Statistical Clerk**

<u>Aircraft Maintenance</u>
Aircraft Engine Mechanic (Reciprocating)**
Aircraft Ground Equipment Repairman**
Aircraft Mechanic (Reciprocating Engine Aircraft)**
Apprentice Aircraft Electrician**
Apprentice Aircraft Pneudraulic Repairman**
Jet Aircraft Engine Mechanic**
Jet Aircraft Mechanic***
Oxygen System Specialist**
Propeller Repairman**

<u>Audio Visual</u>
Motion Picture Laboratory Technician
Photographer (Still)
Photo Laboratory Technician

<u>Avionics Systems</u>
Precision Measuring Equipment Specialist**

<u>Ecological Civil Engineering</u>
Entomology Specialist* **
Water and Waste Processing Specialist*

<u>Electrical Civil Engineering</u>
Apprentice Electrical Lineman**
Apprentice Electrician**
Refrigeration and Air Conditioning Specialist**

<u>Electro-Mechanical Civil Engineering</u>
Small Plant Power Production Specialist**

<u>Mechanical Civil Engineering</u>
Heating System Installer/Repairman**

<u>Structural Civil Engineering</u>
Apprentice Carpenter**
Apprentice Mason**
Apprentice Plumber**
Construction Equipment/Operation Specialist**
Pavement Maintenance Specialist**
Protective Coating Specialist**
Structural Engineering Assistant**

<u>Data Systems</u>
Computer Programmer**
Data Processing Machine Operator**

<u>Dental Services</u>
Dental Assistant**
Dental Laboratory Technician**

<u>Education and Training</u>
Technical Writer**

<u>Electronic Systems Communications</u>
Aircraft Electronic Navigation Equipment Repairman**
Aircraft Radio Repairman**
Flight Facilities Equipment Repairman**
Radio Communications Equipment Installer/Repairman**
Radio Relay Equipment Repairman**

<u>Fabric, Leather, and Rubber</u>
Fabric, Leather and Rubber Products Repairman**

<u>Fire Protection</u>
Basic Fireman and Crash Firefighter**

<u>Intricate Equipment Maintenance</u>
Photographic Equipment Maintenance Specialist**

<u>Management Analysis</u>
Management Analysis Clerk**

<u>Medical Services</u>
Assistant Radiology Technician**
Cardiopulmonary Laboratory Technician**
Dietetic Assistant
Electroencephalographic Specialist**
Food Inspector*
Medical Equipment Repairman* **
Medical Laboratory Assistant**
Medical Office Clerk
Medical Supply Clerk
Mental Health Specialist*
Nurse's Aide
Optometry Specialist*
Pharmaceutical Assistant/Technician**
Physical Therapy Aide**
Physician's Assistant*
Preventive Medicine Specialist**
Surgical Assistant

<u>Metalworking</u>
Aircraft Corrosion Control Specialist**
Airframe Structural Repairman**
Apprentice Machinist
High-Reliability Solderer
Metals Processing Specialist**
Non-Destructive Inspection Technician*

<u>Procurement</u>
Procurement Clerk

<u>Supply</u>
Stock Clerk

<u>Vehicle Maintenance</u>
Automobile/Truck Mechanic**
Body and Fender Repairman**
Heavy Vehicle Repairman**

<u>Weather</u>
Weather Observer**

<u>Wire Communications Systems Maintenance</u>
Apprentice Communications Lineman**
Assistant Telephone Installer and Repairman**
Cable Splicer**
Telephone Switching Equipment Repairman**

* "New and Emerging" Occupations   ** "Expanding" Occupations

In fact, the Aerospace Education Foundation, under the auspices of the United States Office of Education, did an exhaustive survey about three years ago in which 52 Air Force courses in 27 career fields were identified as having direct applicability to the civilian sector.

Another question: "How should the requester ask for them?" We can best identify materials which appear appropriate to your needs when those needs are stated in terms of desired student performance. When you have performance-based objectives and desire Air Force curricular materials, include these objectives in your request. Send the request to Community College of the Air Force LNC, Stop 28, Randolph AFB, Texas 78148.

How does the Community College of the Air Force respond to this request? Upon receipt, we will compare your objectives with our course documents to see which printed materials we have which may be of help. Let's review a typical plan of instruction.

PLAN OF INSTRUCTION (Continued)

Criterion and enabling objectives		Time	Support materials and guidance
(3) Brick set	F		Hand Tools Transparencies (13) Training Methods Discussion (1.0 hr) Demonstration (1.0 hr) Performance (4.0 hrs) Instructional Guidance Identify and name the various tools and equipment used in masonry construction. Have the students cut and shape various types of masonry materials.
(4) Trowel	E		
2. Concrete Block Construction		18 Days 22, 23, & 24	STS Reference, Code Level, and Objective Reference
a. Given a sketch of a masonry project, estimate the number of concrete blocks and the amount of mortar required to complete the project. Estimations must be within - 0% + 10%.	C	(1.5) Day 22	7a - 1a - 2a, 2b 7c - 2b - 2a, 2b 9d - 1a - 2a, 2b 9e(1) - 2b - 2c 13b - 2b - 2c 13c - 2b - 2c 13d - 2b - 2c 13f(1) - 2b - 2c, 2d 13f(2) - 2b - 2c, 2d 13f(3) - 2b - 2c, 2d 13i - 2b - 2d 13j - 2b - 2c, 2d
(1) Block size	E		
(2) Block shape	E		
(3) Type of block	E		
(4) Volume of mortar	E		
(5) Estimating procedures	E		Instructional Materials SG 3ABR55233-III-2, Concrete Block Construction WB 3ABR55233-III-2-P1, Estimating Concrete Block Construction
b. Using specified tools, materials, and instructions in the workbook, lay out a block wall for a one-story masonry structure. Indicate the location and size of the window and door openings.	C	(1.5) Day 22	WB 3ABR55233-III-2-P2, Laying Out a Concrete Block Wall

Plan of Instruction No. [illegible] | Date Changed 11 April 1972 | Block No. III | Page No. 22

A plan of instruction such as the one shown is developed for each course in Air Training Command. It prescribes behaviors required of the student, shows the maximum training time allowed, lists instructional materials, training equipment, etc., which the instructor has at his disposal in preparing the students for attaining the desired objectives. So, by comparing your objectives with ours, we can pinpoint printed materials which may be of help. For obvious reasons, we cannot provide slides, tapes, film, or mock-ups—only printed materials. I might mention, however, that many of the films used can be obtained from the National Audiovisual Center, National Archives and Records Service, General Services Administration, Washington, D.C. 20409.

Our objectives are stated in behavioral, measurable terms, and the more generally your objectives are stated, the more trouble we have in matching our materials with your requests. We do not store curricular materials at the Community College of the Air Force. However, we do advise the appropriate technical education center of your needs, requesting them to mail the materials directly to you.

Another typical question: What will these materials cost? Air Force materials cost less than you might imagine. If you represent an agency of a national, state, or municipal government (a non-profit school, for example), you are entitled to one copy of selected materials without cost. These materials were developed at the taxpayers' expense, and you are not asked to pay again. On the other hand, if you represent a profit-making organization, the very nominal fee is two dollars per request and one cent per printed page.

Lt. Colonel Culbertson is Chief, Liaison Division, Community College of the Air Force, Randolph AFB, San Antonio, Texas.

New Ways to Teaching Aids

Lewis Canaday

First of all, what do we mean by "teaching aids?" Probably none of us could imagine an industrial arts teacher without teaching aids, but could we define, on the spur of the moment, exactly what we mean? Just to get our thinking headed down the right track, let us try a definition or two.

We think of a teaching aid as an adjunct to training or teaching. This could include every piece of equipment in a school shop, of course, but what we are thinking of just now are those aids that are designed and constructed for a specific teaching situation.

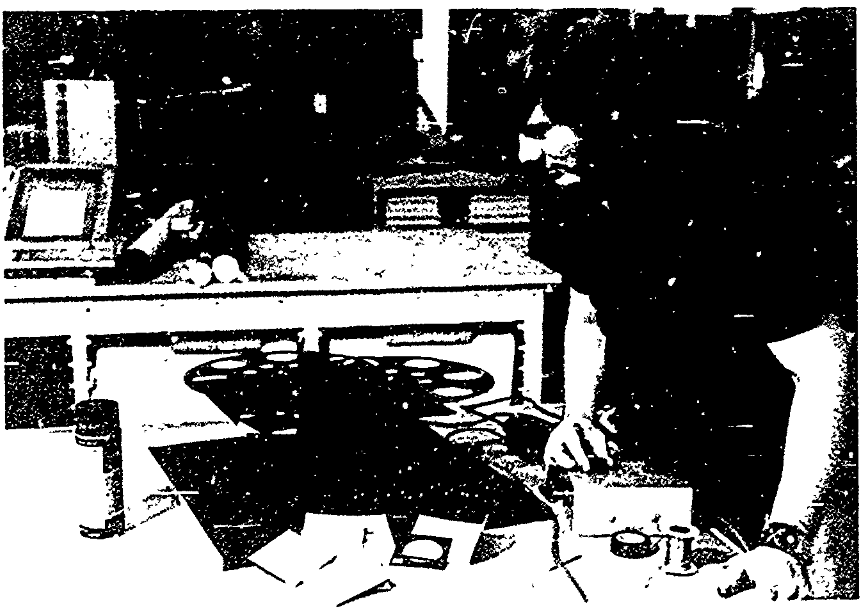
We should not confuse these aids with a method or a technique. They are not. They are things. They may be three-dimensional or two-dimensional, but they are material—they can be seen and touched.

They take the forms of models, mock-ups, cut-aways, charts, transparencies, and others. We are talking about devices to facilitate instruction. The history of these aids or devices goes back as far as the recorded history of man himself. In fact, one of the very earliest examples recorded is the Old Testament Bible story, familiar to Christians everywhere, of the sacrificial system, where the lamb was killed to portray the eventual death of the Christ. This was a teaching aid.

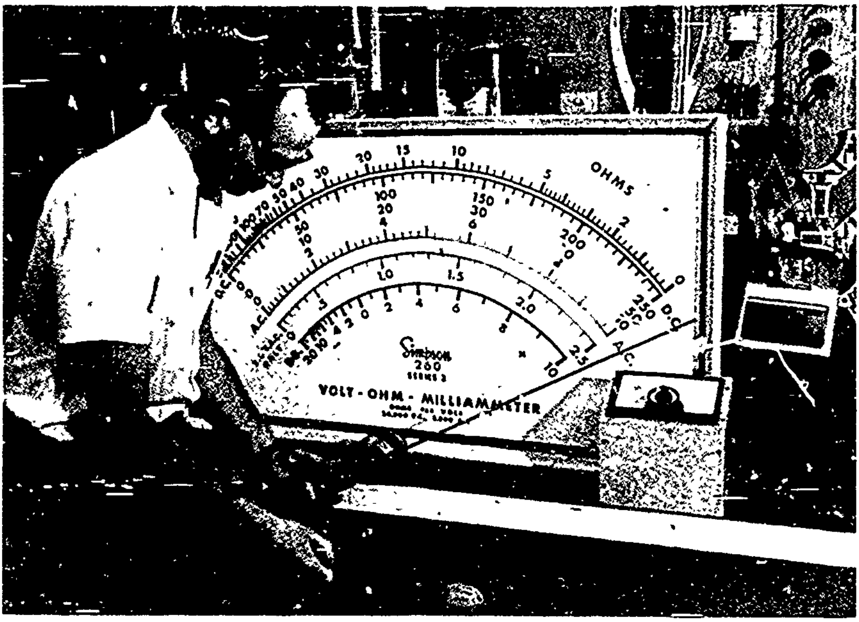
But again, we are thinking here of the teacher-built, student-built, or industry-built hands-on kind of device to aid students to learn. That they work, we scarcely need to argue.

Our experience with teaching aids is that very often a good device will enable the teacher to get across to the students in a few minutes an idea or an understanding or a concept that otherwise might take an hour or so of talking—and might not even then be entirely clear to the student. You have all experienced this. We are told that students attain as much as 85% of their knowledge through the sense of sight.

We will be constantly faced with a greater need to speed up and improve our teaching. Career education is booming. We have been hearing about that, and we will be hearing



Larry Johnson runs preliminary check on his Senior Problem, a double-wheel point light source filter changer which hangs on ceiling and is controlled from box on wall.



Final balance is adjusted on needle for giant wall-model VOM meter by Gerald Whitehead. Meter can be set and held at any position by teacher from remote control desk unit.

more. We will need more teaching aids to simplify the more complex technology we will be teaching.

So how do we do it? The teachers of the Department of Industrial Education and Technology at Walla Walla College believe the system they have been using for a number of years deserves consideration. Although we've termed it new, it is not exactly new. It has been suggested by several writers down through the years that students build teaching aids. Maybe some of you are doing the same thing we are. If you are not, we think you will want to consider it.

The concept, briefly, is that each student, before he graduates, must complete what we call a Senior Problem — which amounts to producing some kind if teaching aid, research project, or equipment. He gets one quarter-hour credit for this.

Two objectives are fulfilled by this plan. The first is that it gives the graduating student the opportunity to demonstrate his problem-solving ability, his knowledge of tools, materials, and processes. The second is that it leaves the school with a valuable teaching aid, paper, or piece of equipment that it would otherwise never have.

Each such project carries the name and year of graduation of the student. It is a sort of memorial that he leaves behind. Generally, he tries to put considerable finesse into it. And we try to have each project be sufficiently self-explanatory that it can stand by itself, even with no teacher there, and still get its point across. This cannot be done, of course, in every case.

During the fifteen or more years we have been doing this, we have gradually worked out the details to something like this. The bulletin or catalog lists the course, with the description saying, in part, "Satisfactory completion of this course constitutes the department comprehensive requirement for the Associate or Bachelor's degree with an Industrial Education and Technology major." We see to it that each senior knows he must complete this before graduation.

The student chooses the project, sometimes several quarters ahead. He does this in consultation with the teacher who will eventually get the most use from it, and who will supervise the student during its construction. He may talk with several teachers before he decides which he wants to do.

The student then fills out a proposal form that we have designed over several years' time, explaining what he proposes to do, and how he expects to do it. This form comes before the staff in meeting, where it is usually accepted but from where it may be sent back for revision.

When the job is completed, the student "makes a date" with the staff for a presentation time and personally presents the project, explaining what it does, how it does it, and any particular problems he encountered. After opportunity for the teachers to ask questions, the student is dismissed, and the staff proceeds to assign a grade to the student's work, using a point-system grading chart developed over the years.

Now I think I can guess the next question that is coming up in your mind. You are wondering where we keep all these things. That is a good question – and it becomes a better question (or a worse one) every year. We occupy an old, temporary building anyway, and space is at a premium. But, fortunately, a few years ago we were able to remodel and gain a small room near our front door and next to our department library that we could use just for this. It has cabinets and shelves around the walls, but is now filled nearly to the limit with teaching aids. It has become quite a favorite place to take visitors.

Many of the devices are kept in the separate laboratories – especially the ones that are frequently used there. Nearly half of them, I suppose, are stored in this way. We hope to have a new building some of these days, and we have planned into it a teaching materials center or centers to care for these things. We think it is well worth it.

It definitely is a benefit to the student. It provides a learning situation he would not otherwise have. It benefits the teacher – I suspect we would not know how to teach without some of these aids. And it benefits the department, not only by speeding up the learning process and increasing the material we can cover in our courses, but by increasing student and visitor interest. These teaching aids have become a drawing card.

We know this plan will work on the college and university level. We think there should be no reason why it could not be worked on the secondary school level as well. Why not? You could not require it of every student, but who does not have students who are so superior that he has a very hard time keeping them challenged and busy? Why not take these students in as your "special helpers" and let them build teaching aids? You can't get them all done yourself, they will learn from it and enjoy doing it, and you will get some real help.

We even think there are teaching aids simple enough to make that elementary schoolers can build them where such courses are taught on the grade-school level – and there are going to be more and more of these courses taught, you can be sure. Think about it – what better teaching situation could you find than for the faster students to be making devices to help the slower students to understand? And how much better could you care for the problem of "individual differences" than that?

I have long felt that the industrial arts teacher had it made when it came to taking care of individual differences among his students. He can assign the slow student to a simple project and the fast student to a complicated one, and both can be challenged and both have a success experience. This works all the way up through college – at least it does for me in the area that I teach.

Mr. Canaday is an Associate Professor of Industrial Education and Technology on the faculty of Walla Walla College, College Place, Washington.

Transportation

Fuels—Man and His Vehicles

Louie Melo

Since the introduction of the horseless vehicle nearly 200 years ago, man has attempted to resolve many related vehicle engine and fuel problems. The first vehicle was a solid-fueled external-powered steam-propelled mechanism that, during the following century, evolved into a more efficient liquid-fueled system.

By the latter part of the 19th century, the electric and internal combustion gasoline-powered vehicles were introduced and, as a result, vehicle energy problems reached a new level of complexity. By 1920, some sixty years after its introduction, the internal combustion engine dominated the overland transportation field.

This paper will strive to present some of the major vehicles' operational variables and the fuels oxidation problems that they present. No attempt will be made to discuss highly specialized fuel blends designed for modified engines or future vehicle designs.

EXTERNAL AND INTERNAL COMBUSTION

The major vehicle energy systems have been categorized as external and internal combustion. In both cases, the required heat energy is generated by ignition and oxidation of raw material.

External Combustion
Combustion of solid or liquid fuels to generate steam to:
1. operate the engine and deliver required power
2. drive electric turbines, thus generating electricity used to charge batteries that will ultimately operate electric motors to provide the power to propel the vehicle.

Internal Combustion
Liquid or gaseous fuels (light oils, gasoline, and bottled gases) directly used in a combustion chamber (2 strokes, 4 strokes, or jet turbine) and directly transforming the expanding heat energy into a mechanical force that will propel the vehicle.

FUEL CONSUMPTION AND EFFICIENCY

Some of our most recent studies indicate that fuels from petroleum crudes account for 96% of the energy used by the 115 million U.S. transporting vehicles. Quantitatively speaking, this amounted to approximately 95 billion gallons in 1970 and is expected to reach 140 billion gallons by 1985. It is estimated that over two-thirds of this fuel is used by passenger cars. Moreover, while nationally all fuel-using equipment has been rated at 50% efficiency, the internal combustion engine vehicles are still only averaging 25%. This low level of fuel thermo-efficiency adds to the nation's transportation fuel consumption and pollution problems.

While some of these losses, such as mechanical friction and temperature control, are unavoidable, others, such as power to work-load balance, varying mechanical loading, power inefficiencies, inaccurate metering systems, incomplete combustion, poor fuel vaporization, improper fuel selection or utilization, and others are operational variables and realities and should continually be subjected to careful educational review and/or classroom study.

FUEL'S OPERATIONAL VARIABLES

The automotive educator cannot adequately discuss engine performance with his students if he does not first understand the fuel's operational variables.

Understanding the scientific principles of combustion is only a small part of the total combustion cycle problem. The chemist may identify the combustion or burning of hydrocarbon fuels as a form of rapid oxidation which may be viewed as follows.

Hydrocarbon fuels	+	Oxygen from air	=	Carbon Dioxide gas	+	Water vapor	+	Heat Energy to do work

For example, if man could develop fuel-using engines that would always meter to the combustion chamber, under all operating conditions, a chemically balanced air-fuel ratio (14.7 to 1) that, in turn, would gasify and thoroughly diffuse with the air stream, thus assuring complete combustion, the exhaust product from such engines would be only carbon dioxide (CO_2) gas and pure water (H_2O). To accomplish this, refineries would have to provide vehicle owners with a high-performance fuel free of impurities or modifiers of any kind. If this were possible, Americans would only have to concern themselves with the power requirements and physical flow of vehicles, and the air pollution problem would only involve a study and control of nitrogen oxide compounds.

To further understand engine fuels, some of the major variables that affect the performance of a typical gasoline engine are listed below:

1. The engine's fuel and air delivery system, incorporating the carburetor and intake manifold, have not been perfected to totally meter and gasify exact air-to-fuel ratios during all engine accelerating periods. Most often, sudden acceleration momentarily delivers more liquid fuel than the engine can effectively gasify and oxidize.
2. Operating temperatures of engines present additional variables. Cold engines cannot generate the necessary heat to gasify all the atomized fuel delivered by the carburetor.
3. Liquid fuels, even though atomized, do not totally diffuse readily with the air stream, thus hampering uniform and complete oxidation of the air-fuel charge. The high hydrocarbon-low oxygen zones cannot totally oxidize, and thus emit unburnt hydrocarbon molecules and/or carbon monoxide as part of the exhaust gas.
4. Some of the larger non-gassified liquid fuel particles will flow through the engine's power system and be exhausted as unused hydrocarbon molecules (CH) or partially oxidized molecules (CO).
5. The density of the air-fuel charge will fluctuate greatly as engine power demands are increased or decreased. Highest combustion chamber air-fuel densities are reached during open throttle periods under load, while lowest densities exist during low engine load demands or decelerating periods.
6. Changing barometric pressures and humidity also effect air-fuel ratios.
7. The fuel's flame, or burning time span, during engine operation, is not uniform. All other variables being equal, high-density air-fuel charges burn more rapidly than low-density charges.
8. Gaseous fuels exhibit very high molecular mobility, and therefore would readily diffuse with a proportionally metered air stream on its way to the combustion chamber. These promote much more uniform oxidation (burning) of the gaseous hydrocarbon fuels and are identified as our cleanest burning fuels.

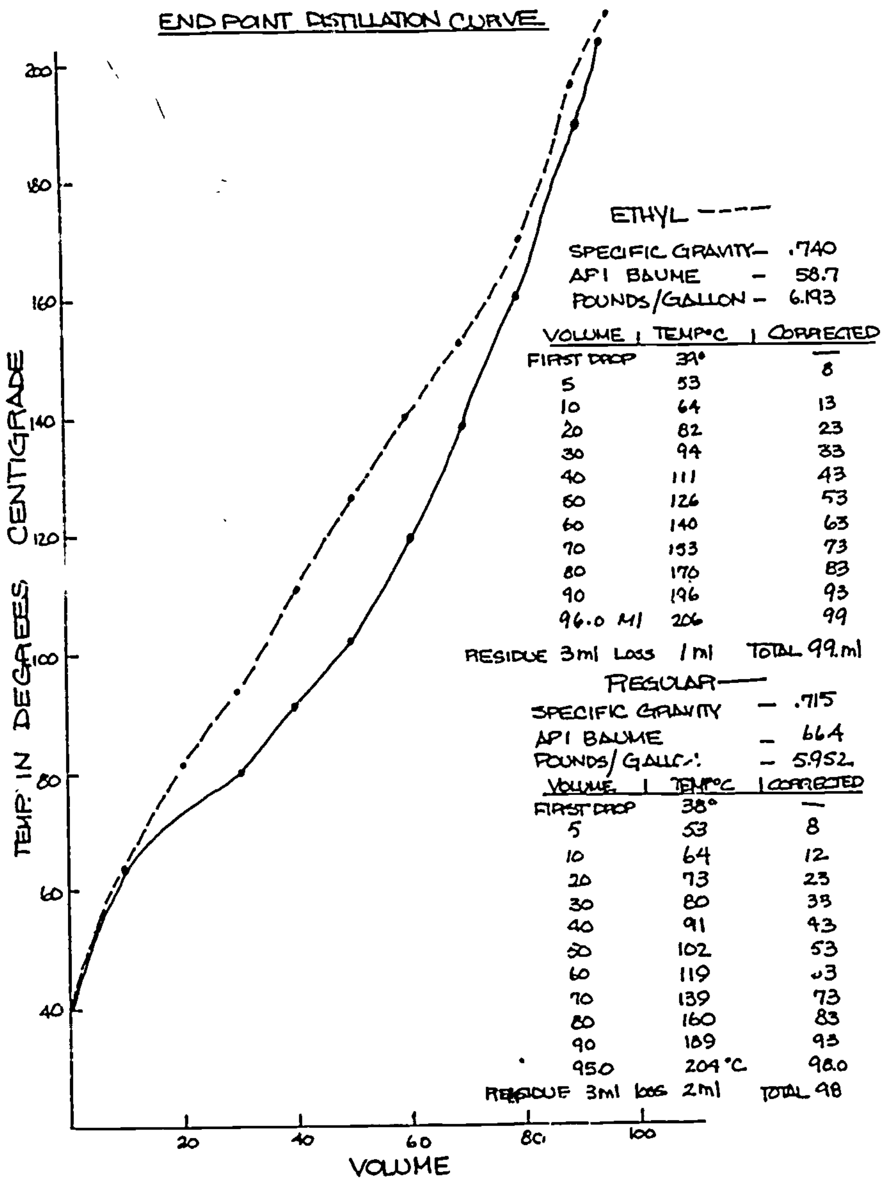
THE FUEL-GASOLINE

Theoretically, gasoline molecules fall between the C_4 and the C_{12} hydrocarbon chain families, with a basic boiling range from 100°F to 400°F, however, an actual sample of gasoline is said to have as many as or more than 500 different hydrocarbon structures. Even though the available data indicate that these molecular structures are in small quantities, they do affect the stability and burning characteristics of the final air-fuel charge.

The gasifying temperature range of gasoline is one of its most important operational characteristics. Theoretically and ideally, gasoline should completely vaporize and totally diffuse into the air stream before it reaches the combustion chamber. In this state, the mixture may be classified as a dry homogeneous gaseous mass. In practice, however, this does not happen because many of the hydrocarbon molecules near and above the upper theoretical boiling limit do not vaporize and thus enter the combustion chamber as fine liquid droplets.

ENGINE BY-PRODUCTS

Since nearly all of our transportation needs are directly or indirectly dependent on hydrocarbon fuels, and man has not, as yet, developed the ultimate in perfect fuels and



A typical distillation diagram, prepared by students, showing the gasification temperatures of automotive fuels.

fuel-using engines, it seems significant to identify some of the major pollutants or by-products from the most common vehicles we use. One of many such tables identifying the vehicle emission rates on a gram per vehicle mile basis is presented in Figure 1.

Figure 1.

VEHICLE EMISSION RATES FOR VARIOUS POWERPLANTS
g/Vehicle Mile

Power Plant and Duty	HC	NO_x	SO_2	CO
Automobile, Uncontrolled	14.0	6.0	0.27	75+
Automobile, 1976 Standard	0.41	0.4	0.27	3.4
Bus, Diesel, Arterial	1.65	36.3	5.2	28.3
Bus, Diesel, Downtown	2.76	54.4	5.2	50.6
Bus, Gas turbine, Arterial	0.20	10.5	5.2	4.0
Bus, Gas turbine, Downtown	1.15	12.2	5.2	6.8
Commuter train, Turbocharged	80.0	235.0	48.0	240.0
Rail transit, Typical cycle (coal)	2.7	271.1	1030.0	6.75

While the table identifies one of many such samplings of by-products from vehicle engines, it is not very meaningful unless the data are viewed in terms of the engine's mechanical condition and by-products per person per mile. For example, the family car transporting an average of 1.4 persons per trip would emit 53 grams of carbon monoxide per mile, while a bus transporting 10 people per trip would emit only 5.1 grams of carbon monoxide per person per mile.

Since the major transportation pollutants are carbon monoxide, hydrocarbons, nitrogen oxide compounds, and sulfur compounds, additional information about each is given.

1. Carbon monoxide (CO) gases are generated when the engine combustion chamber is receiving a rich fuel mixture. This often happens during engine idling, rapid deceleration, sudden and frequent throttle acceleration, and rich mixture of fuel-to-air adjustments.
2. Hydrocarbons (HC) are discharged by the engine when nongasified fuel fractions and other hydrocarbon molecules move through the engine's combustion system without being oxidized. This problem is very complex since engine temperature,

Students reviewing the outcome of a gasoline distillation test and how the data may be used to understand the engine's fuel operational problems.

gasification rate of fuel, diffusion rate of oxygen with fuel molecules, and others are operational variables contributing to the by-product problem.

Hydrocarbon emission is also highest during engine warmup, rapid deceleration, sudden and frequent throttle acceleration and very rich idle, and engine operation at nearly full throttle.

3. Nitrogen Oxide Compounds (NO_x) are generated when engines are running hot (1500°F+) and the air-to-fuel ratio is in chemical balance (14.7 to 1) or in the lean fuel range. The excess oxygen and nitrogen gas from the air will react chemically at the higher operational temperatures. Temperatures to nearly 3000°F have been recorded within the moving flame front during the combustion cycle of gasoline engines.

   A drop in engine compression, temperatures, and/or increase in fuel richness will bring about a drop in nitrogen oxide generating tendencies, however, this will increase HC and CO emissions.
4. Sulfur Compounds are generated when the fuel contains sulfur as an impurity. In general, sulfur content in gasoline is very low, however, it is still a problem in some diesel fuels. Sulfur, when oxidized, becomes sulfur dioxide (SO_2) gas that in turn has a strong affinity for water (H_2O), thus converting itself into sulfurous acid (H_2SO_3) and/or sulfuric acid (H_2SO_4). These acids are very strong corrosive materials and have an adverse effect on exhaust system components.

CONCLUSION

Over the years, many innovative devices purporting to deliver a gaseous homogeneous stoichiometric air-fuel mixture to the combustion chamber, thus improving engine performance and increasing mileage per gallon, have been presented. To this day, most of the suggested fuel system modifications have not been very productive.

This writer will admit that a recent article describing a piezo-electric sonic mixer that purports to reduce droplets to 40-60 microns (1/10 the size of current carburetors) and almost simultaneously diffuse them into the air stream seems to hold some promise. It is currently being tested by Autotronic Controls Corporation, El Paso, Texas. If all it purports to do proves to be true, we may have the breakthrough that pollution control people have been looking for.

REFERENCES

A. Cruse and D. Stevens, Chemical Technology of Petroleum, McGraw-Hill Publishing Co.

W. Cruse, Motor Fuels, Reinhold Publishing Corporation.

C. Eberson and F. Manning, Engine Performance and Exhaust Emissions, Society of Automotive Engineers, August 1972, West Coast Meeting.

A. Austin, A Survey of Hydrogen's Potential as a Vehicular Fuel, Lawrence Livermore Laboratory, University of California.

NAPCA – Determination of Air Pollution Emission from Gasoline Powered Motors, U.S. Department of Health, Education and Welfare.

California Emission Inventory, California Air Resources Board.

W. Daty and E. Olejnik, Exhaust Emission on Road, Shell Research Laboratory, Wood River.

HC-CO-NO_x How They'll Be Controlled, Chevron Research Company.

W. Daty and E. Olejnik, Mobile Test Vehicle Measures Exhaust Emissions on the Road, Automotive Engineering, January 1972.

L. Duke, R. Barron, S. Lestz, and W. Meyer, Knock Cuts Exhaust Hydrocarbons But Boosts Nitric Oxide Levels, The SAE Journal, February 1970.

R. McJones and R. Corbeil, Natural Gas Fueled Engines Have Lower Exhaust Emissions, The SAE Journal.

Guy Wetzel, Automotive Diagnosis and Tune-up, McKnight & McKnight.

Jim McFarland, Sounds Like Good Gas Mileage, Hot Rod, January 1974.

Mr. Melo teaches in the Industrial Studies Department, Industrial Materials Division, San Jose State University, San Jose, California.

Transportation Technology in Industrial Arts Education

Myron Bender

The theme of this conference, "A Humane Technology For the Future," is indeed timely and worthy of our best efforts. This is especially so in the area of transportation technology, because it affects the fabrics of all human societies. There is little doubt that man's creative technological developments for mobility are some of the most powerful expressions of modern technology. Yet, we have not identified the area of transportation technology as a high-priority objective. This is necessary if we are to promote the need to understand its impact on man and the environment.

There have been numerous attempts to include the study of transportation technology in industrial arts education (14, p. 137). Even with these attempts, we have not recognized it as a major objective in industrial arts curriculum development. Consequently, there are few programs in existence that include transportation technology as an area of study.

THE RELATIONSHIP OF TRANSPORTATION TECHNOLOGY, MAN, AND THE ENVIRONMENT

Transportation technology has a history as long as the history of man (7, p. 10). We have evolved together with techniques and devices over millions of years. The major changes in human population are due to the technology we have developed to meet our needs and desires. The changes can be directly attributed to man's creative technological endeavors in the production of goods, communication, and in the area of transportation.

The explosive growth of transportation technology in recent history has provided man increased mobility. However, this mobility has created environmental problems. As we enter an era of ecological awareness, there is a pressing demand that our efforts be controlled in relation to the associated ecological expenditures, e.g., limited energy sources, atmospheric equilibrium, and the effects on other living systems. Beyond such critical issues as these, however, are other direct and indirect human costs associated with transportation (20, pp. 1-2).

To show the relationship of transportation to man and the environment, it is essential that the concept "Transportation Technology" be clarified. It may be said that it is the sum of man's technological endeavors in mobility born of a certain idea of progress and of certain preconceptions about the deterministic structure and nature of movement. This historical phenomenon was developed because of the inability to mass at one point in space all resources, persons, and related activities essential for minimal existence. Therefore, it necessitated various types of movement. The movements vary in frequency, distance, timing, temporal extension, and function according to variations in environmental contingencies, aspiration, and level of technology (20, p. 1).

The term "transportation" is used to designate the process of movement. It involves the relocating of objects and humans by an energy-consuming mechanism, through an environmental medium which may be terrestrial, marine, atmospheric, or space (4, p.20).

The transportation process has been organized into systems. These systems are manifestations of man's insatiable desire to overcome the intrinsic limitations of space and time. So pervasive and fundamental is this culture's propensity for physical mobility that few of its members have questioned the principle in history. It can be viewed as the source and the solution to the problems of human density, environment, and distribution. It can both relieve and induce human stress and well being. This is one of several areas of human innovations where ends and means can become seriously imbalanced, where solutions can become problems very swiftly, and where conflicts between man and technology can be most profoundly felt as it shapes the fabric of our culture (20, p. 1).

Gerhard Lenski, in his book Human Societies, indicated that there are four basic components essential to satisfy man's needs and desires within every sociocultural system (12, pp. 34-41):

1. Language. This is the principal means by which man culturalized his environment. It is the most basic of the four components. Every human society must have a system of symbols capable of transmitting and storing information.

2. Social organization. The structural system of relationship among members of a society. The social organization concept includes an entire society or relationship of various systems within that society.
3. Ideology. A society's basic belief system as it is applied to daily life. The ideology components include a society's views, norms, and values.
4. Technology. This system includes information, techniques, tools, and intellect which man utilized through environmental material resources for satisfaction of his varied needs and desires.

Lenski (12, pp. 27-32) further indicated that technology is the most dominant component of our sociocultural systems. Man's societal needs tend to rise to its own distinctive technology. Every society possesses elements referred to as functional requisites. They are a system of communication, a system of production, a system of distribution (transportation), a system of defense, a system of member replacement, and a system of social control.

Man's basic needs are met by the activities involved in each of the six functional requisites based upon societal values and level of technology. For example: Man's need for mobility and distribution is met through various means of transportation technology. Man's need for goods and services is fulfilled through systems of production. Man's need to extend his ability to communicate is satisfied by the development of communication technology.

The techniques utilized within each of the distinctive technologies have had a significant role in man's evolutionary success.

Transportation themes are heavily intwined in the history of a nation, for it aids in shaping a nation's development, especially the economics and social components of the sociocultural system of society. Earlier in history, a man's position in the social structure depended largely upon the status into which he was born and from which he could not easily escape. However, with improved means of transportation, a man could strike out for himself in a new area and make his own place in society. This ability to move about freely has helped to mold a more democratic society.

The kind and quality of transportation affect the economic efficiency and development of living patterns. American cities, which originally were closely clustered around ocean or river ports, have been conditioned as to development, shape, and life style by a series of transportation technological developments (8, pp. 169-171).

First was the railroad, which freed industry and commerce from exclusive dependence on ports, linked cities with hinterlands and other cities, encouraged suburban towns to develop like pearls along a string, and initiated a peculiar urban phenomenon, the commuter. Railroad technology produced several offshoots—the trolley car, interurban railroads, and surface-subway rapid transit.

A second major technological development was the high-speed elevator, which spread cities into the third dimension, made possible great increases in land-use densities, and created problems, not yet solved, of integrating horizontal and vertical movement.

Third was the motor vehicle, it loosened the bonds which historically had tied many activities to the central city and transformed, much more drastically than had the railroad before it, the city-suburban complex and its functions.

Fourth was the airplane, while not a significant intra-urban transportation mode, it has had several important urban shaping effects. Air transportation, for instance, links many urban residents more closely to the outside world in ways that affect their working and living patterns.

Transportation has been a dominant force in the formulation of the sociocultural components of society. Ullman indicated that few forces have been more influential in modifying the social and physical environments, yet transportation itself is a result of other forces (25, p. 862). It has guided or misguided the development of urbanization, strongly influenced business operations, and helped to shape man's personal and social relationships. Today, man has grown to rely on a transportation system to enhance his possibilities for a better quality of life.

Transportation technology has vastly widened the choices available to mankind in his social and economic relationships. It has provided man new opportunities, accessibility, and economic efficiency which have altered man, society, and his environment.

In spite of these accomplishments, our way of life has failed to take into account the environmental aspects caused through the exploitation of mobility. People have placed a high priority on convenience without understanding how this may eventually choke off open space, clean air, and clear water. For example, few people realized that the automobile which was introduced during the latter part of the 19th Century would revolutionize transportation in approximately 75 years. Today, the automobile has become one of the most powerful forces in our society. It is the broadest symbol of our time, both because its production typifies modern industrial and business organization and because more than any other single contribution of modern technology, it has transformed the average man's way of life (5, pp. 10-17).

Transportation created the cities and other new facets of urban living. This trend has greatly accelerated in recent years. Although cities and urban living are a result of improved technologies, they have also created problems.

Volpe, former Secretary for the United States Department of Transportation, has sai' "A century ago 15% of America's population lived in cities. ten years from now, thr out of every four Americans will be urban dwellers, and the United States population will have grown to 273 million" (26, p. 59).

Accompanying the urbanizing trend is an increase in over-all mobility. The development of the technology of increased mobility has helped to shape a more independent social environment, but at the same time it has taxed the physical and natural environments with congestion, air, and noise pollution.

During the last three decades, there has been a greater increase in pollution level as compared with population increase in the United States. The difference is accounted for by the increased per capita consumption created through increased economic activities, of which transportation has been a distinct part (17, p. 9).

In 1970, the nation's automobiles poured out more than 90,000,000 tons of pollutants. The automobile accounts for more than 60% of the chemicals that pollute our atmosphere. In some urban areas, that figure rises to an appalling 90% (13, p. 51).

The pollution problems caused through man's use of the automobile may be attributed to the relationship of increases in population, affluence, and the number of motor vehicles (16, p. 15). They may be considered the root causes of nearly all environmental problems. All three factors have grown drastically over the past century and will go much higher in the next three decades if present trends continue.

THE STUDY OF TRANSPORTATION TECHNOLOGY IN INDUSTRIAL ARTS EDUCATION

There should be little doubt concerning the importance of studying transportation technology in industrial arts. The term "transportation" has been used in some industrial arts circles for a number of years. however, most curriculum efforts have been directed toward automotive and, more recently, power technology. This approach appears to be a limited view to the study of transportation technology.

John A. Volpe, former secretary of the United States Department of Transportation, expressed concern over the obsolete content, processes, and educational techniques being utilized in the traditional transportation technology programs in our nation's schools when he stated:

> It is essential that young people confidently understand the transportation systems that are so large a part of their daily lives. This is especially true if we are to make those systems responsive to public needs and human objectives. A good example is the family automobile, a mechanical wonder that auto mechanic classes have been dissecting for years. We know its spark plug firing sequence, its piston bore, and its carburetion air intake, but we should also know its crash-worthiness, the reliability of its brakes, and all the other structural factors which could save, or destroy, the lives of the driver and passengers. Such knowledge represents a new dimension in transportation technology. It means that technology must be assessed in terms of human values and taught in terms that make the student aware of his influence in shaping transportation systems (27, p. 5).

Education, for the most part, has neglected to study and investigate one of man's most creative intellectual endeavors — transportation technology. Man lives in and is continually exposed to the transportation technology environment. Yet, many lack a true understanding and comprehension of the impact this technology has on himself and his environment. Transportation accounts for approximately one-fifth of our GNP, and when we translate this into a personal context, this is rather thought-provoking. Consider that each and every one of us spends about one-fifth of his efforts for transportation. This is a rather high commitment of one's personal resources for conquests of time and space.

We have a rather inadequate understanding of how transportation systems fit into our social and economic environment. Education must provide a comprehensive understanding of the total role that transportation plays in human activities. In recent years a wealth of new transport systems have been produced — vehicles that operate on water foils, air cushions, and air films, moving platforms, monorails, the personal rocket belt, and scores of new technological devices that are still at the experimental stage (1, pp. 16-20). Technological and environmental literacy concerning these new forms of transportation systems must be promoted in educational programs in the technologies if the systems are to be effectively utilized in the future.

The new technologies in transportation have resulted in greater choice — new opportunities — available to those who could use that technology. To insure that proper choices will be made, it will require an understanding of the behavioral characteristics involved in this new technology to control the environmental consequences.

It is not easy to have many choices. It is the nature of a choice that to take advantage of one, a person must refuse another. Joseph B. Platt stated (15, p. 17):

> As technology presents us with more choices, many of them interrelated, the task of planning and of selection becomes more complex.... Choices, for an individual or for a society, are guided by values. We tend to identify the values of a society — or a person — by the choices made.

We know that values change with time, and as new technologies or choices come into existence, these choices force us to examine our values: Do we really value clean air more than low-cost fuel? Do we want the random-route personalized transportation more than sound ecological conditions?

These must be human value choices. To assure that proper decisions are made will require technological and environmental literacy to adequately deal with the numerous options available.

The basic sciences will continue to provide basic physical laws for transportation technology and for understanding the interaction of forces in society. These forces must be identified to avoid undesirable consequences as they are being applied.

Education can provide a better understanding in the area of transportation technology by analyzing past developments and use the information gained to plan our future. We have been concerned up to this point in history with only the classical technology which dealt with the construction and operating principles of physical structures. It has been within the last 40 years that more emphasis has been placed on planning, control, operation, and replacement aspects of transportation systems. The future requires that a greater effort must be placed on human needs and constraints and the relationship of this technology to the total environment. (See Figure 1.)

COMPONENTS OF TRANSPORTATION

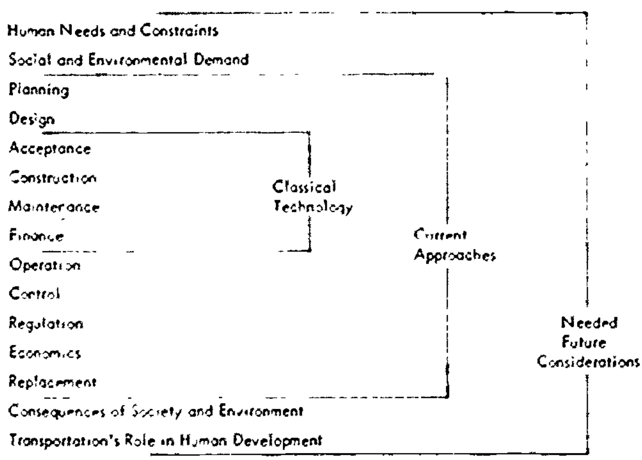


Figure 1.

Practitioners in the field of industrial arts education must be concerned with long term educational goals for the study of transportation technology based upon a sound structure of knowledge. The foundation for such a structure could be three major sub-systems involved in the area of transportation technology. These are the physical sub-system, the human sub-system, and the activity sub system (21, pp. 159-178).

A system may be evaluated in terms of input to output. The activity sub-system is actually an interface between the human sub-system with its properties and the physical sub-system with its own characteristics. The input aspects include the land, labor, capital, materials, and information which lead to the physical sub-systems. (See Figure 2.)

TRANSPORTATION SYSTEM

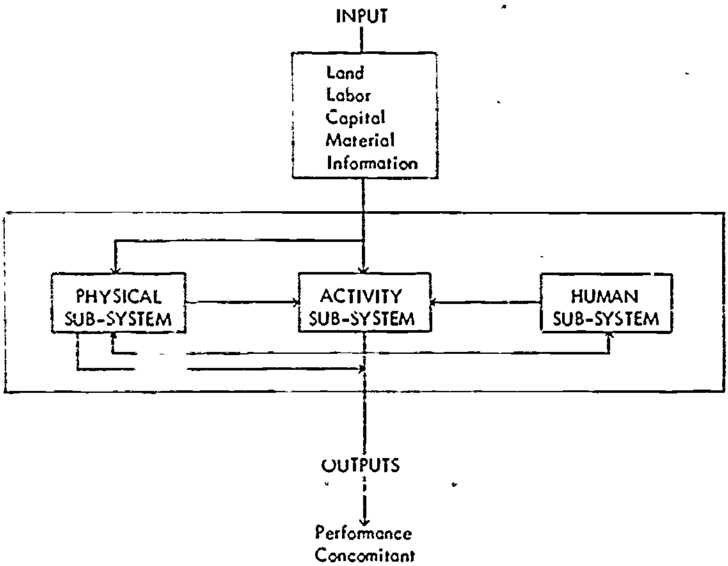


Figure 2. Input-Output

The physical sub-system has components which are both natural and man-made. The natural would include such items as water, land, air, and space, while the man-made elements include roads, monorails, vehicles, terminals, and control devices.

There is a close interrelationship, through the activity sub-systems, between the man-made and natural sub-systems. The vehicles, journeys to and from work, and air pollution exemplify this, vehicles are man-made physical facilities and journeys are the activities. The performance of the automobile or other vehicles during the journey liberate hydro-carbons, which in turn affect the quality of the air, an element of the natural physical sub-systems. (See Figure 3.)

The human sub-system is divided into two categories. individual and group. This area is concerned with economic, biological, social, and psychological characteristics. Individuals and groups undertake activities utilizing the physical sub-systems. Some of the results of these activities are fed back into the human sub-system. An example of this would be the wages one earns for a production activity or ownership of some artifact for a consumption activity. (See Figure 4.)

Developing a concept of transportation technology for industrial arts necessitates a serious re-evaluation of our present efforts in this area. Since industrial arts cannot possibly be all things to all people, it is paramount that we critically assess our unique advantages and limitations in terms of purpose and contributions promoting technological and environmental literacy.

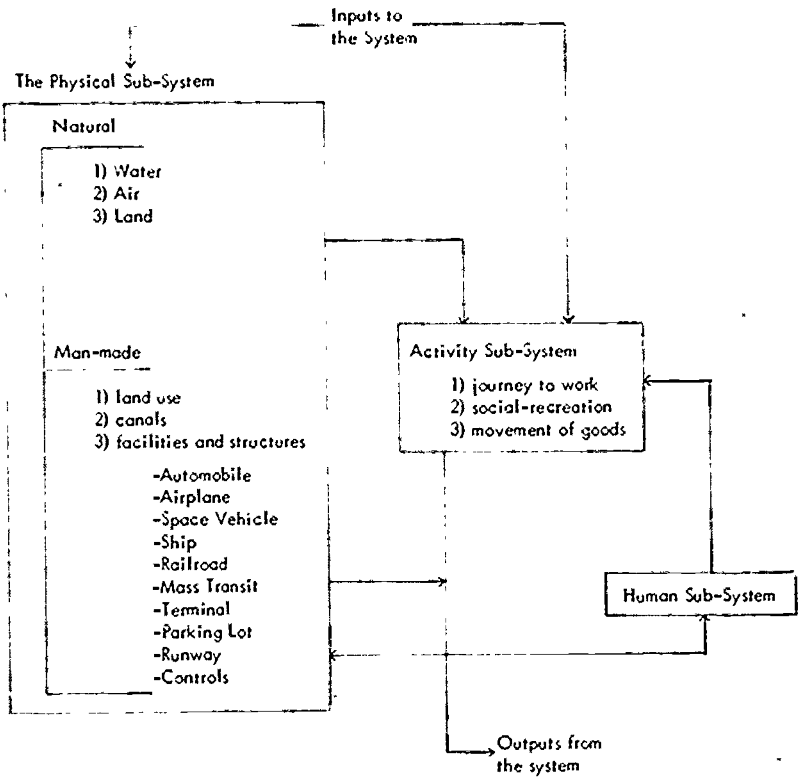


Figure 3. Relationship between the physical sub-system and other sub-systems.

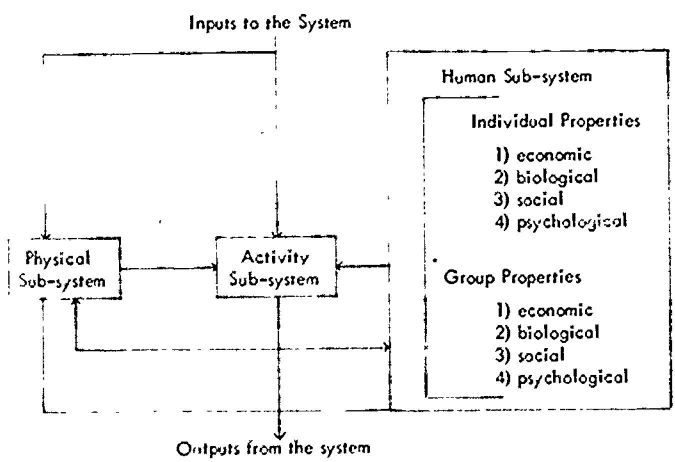


Figure 4. The human sub-systems.

The study of transportation technology for industrial arts should focus more sharply on understanding the problems and issues facing man in transportation and how to identify and solve these issues, in addition to the current emphasis on the tangible objects and artifacts. The essence of concern for transportation in industrial arts is more than a knowledge of the system components, but rather a serious study of the ideas, innovations, successes and failures of man as he creates and invents, and of the techniques man uses to solve problems related to transportation.

For the curriculum developmental purpose, a systems analysis approach has been recommended. This approach would identify the basic functional systems involved in transportation technology. The functional systems may include the following, which are involved in each mode or type of transportation system, whether it be used in terrestrial, marine, atmospheric, or space vehicles (4, pp. 19-22).

1. Energy source: Primary form of energy input, i.e., electrical, fossil fuel, etc.
2. Propulsion. The means by which energy is applied to create or retard the motion of vehicles in or through a given medium.
3. Guidance and guideway. Systems which gather and feed information to the control system. The guideway would include the continuous track, pad, ribbon, tube, or other device upon which the vehicles travel.
4. Control system. The method which enables destination selection, automatic cueing, feed-in, and exit in a pilotless system.
5. Support system. The method which sustains the operation of any given mode of transportation. These may range from systems of life support to maintenance of the vehicle.
6. Suspension system. The method used to suspend a vehicle in or on a given environment, with such types as mechanical, contact, magnetic forces, and fluid suspensions.
7. Structure system. Design and construction techniques and practices which are used to construct transportation vehicles, access terminals, etc.

If educational programs in any area are to serve effectively, they must be responsive to the changing needs of the society they serve. Today man lives in and is continually exposed to the transportation technology within his environment. Yet, many lack a true understanding and comprehension of this technological phenomenon. They may know the principles underlying the internal combustion engine, fluid power, mechanical transmissions, linear induction motors, and air foils. They know and understand and often can control these devices. But the issue is not to understand and control a single device, the issue is the understanding and control of the behavior of transportation technology as a major force for change within society.

The study of transportation technology should be centered on the behavioral characteristics of a system — operational-performance and environmental. The concern should not be on what the device is but what it does. It is an attempt to gain knowledge, to gain control and thereby attain mastery over transportation technology for man.

In conclusion, let me focus briefly on the interacting forces involved in transportation technology. The term "transportation technology" implies a comprehensive and complex network of ideas, inventions, and devices which function as an integrated system of conveyance for the convenience of man as he moves his goods, himself, and others from one place to another. The significance of transportation as a technical, economic, social, political, and environmental function of man is unchallenged. It is considered one of man's major technological endeavors which has educational imperatives for those disciplines engaged in the study of technology. Because industrial arts is a discipline area purporting to promote technological and environmental literacy, transportation should become an essential element of the industrial arts curriculum.

Every effort should be expended to insure that the study of transportation technology in industrial arts provides an understanding of the fundamental nature and consequences of the interaction of man, technology, energy resources, and the environment. To do this constructively, we need to look at the physical systems as well as the human and activity sub-systems. This understanding provides a fuller understanding and appreciation of how these interactions contribute to our body of new intellectual and physical capability and to its use as we require. (See Figure 5.)

If we truly are interested in the theme of this conference, "A Humane Technology for the Future," then we need to incorporate transportation technology as a body of knowledge in the industrial arts curriculum. We must provide for understanding of this technological phenomenon if it is to be a humane technology in the future. We all know transportation modes are influenced by a variety of forces that can determine its future.

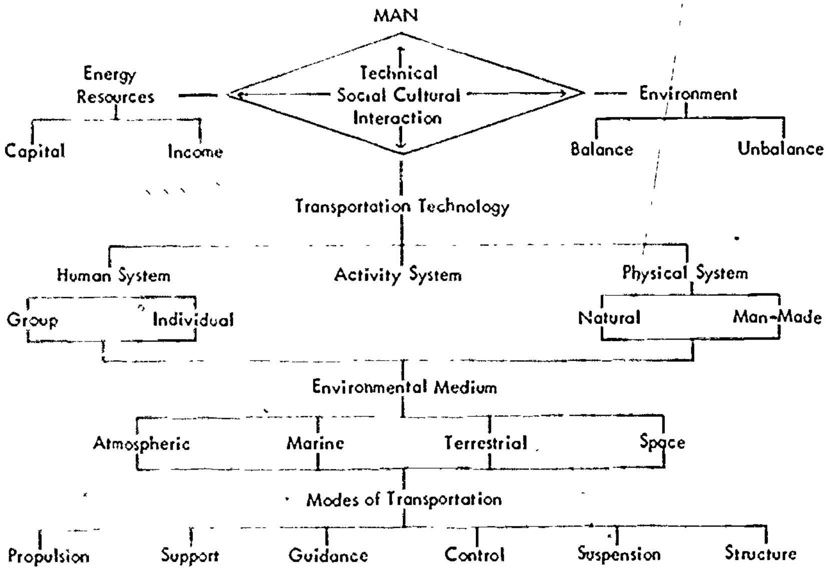


Figure 5. A taxonomic structure of the Man-Transportation Technology-Environment Equation.

However, only education can provide a human force that can demand a technology to create a livable future.

Joseph B. Platt has stated that human force will be necessary to develop a humane technology, and this must be accomplished through education. He stated (15, p. 27).

> That force (human force) is organized knowledge, and it is transmitted by education. It is education, perhaps more than any single factor, that will determine how to survive — the way in which developing nations develop, the quality of life in all nations, and the extent that human freedom and dignity flourish in a complex and highly organized world. Our global civilization will be shaped more by the activity and content of its classrooms, books, and television screens than by its forges and factories.

This role of education should challenge industrial arts teachers to plan and develop a succession of experiences for the study of transportation technology in existing study of technology educational programs. These experiences should provide students with a strong interdisciplinary background to enable them to attain coherent insights into the social, economic, technological, and environmental forces relating to transportation systems. It is our responsibility to prepare this human force that will plan for a humane technology for the future.

REFERENCES & SELECTED BIBLIOGRAPHY

1. Anderson, Edward J. "PRT. Urban Transportation of the Future?" The Futurist. Vol. VII, No. 1. February 1973, pp. 16-20.
2. Appel, Fredric C. "The Coming Revolution in Transportation." National Geographic, Vol. 186, No. 3, Sept. 1969.
3. Danforth, Paul M. Transportation. (Doubleday Science Series) New York. Doubleday & Co., 1970.
4. DeVore, Paul W. "Transportation Technology. The Identification of Content and Methods." The Journal of Industrial Arts Education, Vol. XXIX, No. 6, May-June 1970.
5. Edel, Mathew. "Autos, Energy and Pollution." Environment, Vol. 15, No. 8, October 1973, pp. 10-17.

6. Farris, Martin T., and McElhiney, Paul T. Modern Transportation. Selected Readings. Boston: Houghton Mifflin Company, 1969.
7. Firestone, Harvey S., Jr. Man on the Move. The Story of Transportation. Garden City, New York: Doubleday & Co., Inc., 1969.
8. Fitch, Lyle C. "Improving Urban Transportation." The Future of American Transportation. (Edited by Ernest W. Williams, Jr.) Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971, chapter 7, pp. 169-196.
9. Hellman, Hal. Transportation in the World of the Future. New York. M. Evans and Co., Inc., 1968.
10. Kranzberg, Melvin, and Pursell, Carroll W. (Eds.) Technology in Western Civilization, Vol. II, New York: Oxford University Press, 1967.
11. Larson, Thomas D. "Closing Gap in Transportation Education." High Speed Ground Transportation Journal. Vol. II, No. 1, Jan. 1968.
12. Lenski, Gerhard. Human Societies. New York: McGraw-Hill, 1970.
13. McLeod, Sterling. How Will We Move all the People? Transportation for Tomorrow's World. New York: Simon & Schuster, Inc., 1971.
14. Olson, Delmar W. Industrial Arts and Technology. Englewood Cliffs. Prentice-Hall, Inc., 1963.
15. Platt, Joseph B. "The Value of Science & Technology to Human Welfare." Science and Public Affairs. Bulletin of the Atomic Scientists. Vol. XXIX, No. 8, October 1973.
16. Resources for the Future, Inc. Annual Report, 1971. Washington, D.C.. Resources for the Future, Inc., 1971.
17. Resources for the Future, Inc. Annual Report, 1973. Washington, D.C.. Resources for the Future, Inc., 1973.
18. Sanders, LeRoy J. "Looking at Power from Land, Sea and Air." Journal for Industrial Education. Vol. 61, No. 11, November 1972, pp. 55-57.
19. Smerk, George M. "The Environment and Transportation." Transportation Journal. Vol. 12, No. 1, Fall 1972, pp. 40-49.
20. Studer, Raymond G. "Human Factors." Urban and Regional Ground Transportation. James J. Murray (Ed.) Durham, North Carolina. Planning-Transport Associates, Inc., 1973, pp. 1-9.
21. Taff, Charles A. "The Economics and Industrial Aspects in Transportation." High Speed Ground Transportation Journal. Vol. II, No. 2, May 1968, pp. 359-368.
22. Thomas, Edwin N., and Joseph L. Schofer, "Toward the Development of More Responsive Urban Transportation System Models," High Speed Ground Transportation Journal. Vol. 1, No. 2, May 1967.
23. U. S. Department of Housing and Urban Development. Tomorrow's Transportation: New Systems for the Urban Future. Washington, D.C., U.S. Government Printing Office, 1968.
24. United States Department of Transportation. Transportation and Environment. Synthesis and Action. Vol. 3, July 1971.
25. Ullman, Edward L. Man's Role in Changing the Face of the Earth, Edited by William Thomas et al. "The Role of Transportation and the Basis for Interaction." Chicago Press, 1956.
26. Volpe, John A. "Urban Transportation Tomorrow," The American City, 1969, p. 59.
27. Volpe, John A. "Transportation Technology. A New Dimension." The Journal of Industrial Arts Education, Vol. XXIX, No. 6, May-June 1970.

Dr. Bender is Chairman of the Department of Industrial Technology, University of North Dakota, Grand Forks, North Dakota.

Wood

Wood and Wood Technology— A Curriculum Guide

Olan C. Oatman

In the Spring of 1969, B. Eugene Brightwell, Supervisor of Industrial Arts Education for the State of Missouri, appointed the present Woods Curriculum Guide Committee. Bobby Taylor, industrial arts teacher at Dexter High School, was selected as Chairman, with Everett Mitchell of East Prairie High School and Olan Oatman of the Industrial Education faculty at Southwest Missouri State University as active committee members.

Several meetings later, after much discussion of information collected from resource materials, students, I.A. teachers, educators, parents, and individuals connected with various wood product industries, the committee decided on the direction and scope of the new woods curriculum guide.

"New and used ideas" involving seven process areas were selected and the detail work commenced. Industrial education students working on their Bachelor of Science and/or Bachelor of Science in Education degrees at S.M.S.U. researched the various process areas, designed or redesigned products, developed the materials and drawings, fabricated and assembled specialized pieces of equipment with jigs and fixtures, and produced a variety of products.

Slides and pictures were taken as the process areas were developed and proved to be workable. Presentations and discussions were presented to students, teachers, and educators at local, district, and state meetings in an effort to inform as well as receive suggestions for assembling an effective curriculum guide.

In an effort to obtain a broader viewpoint, the bulletin, "Wood Technology, Techniques, Processes and Products," was printed and mailed to selected college and university wood technologists and other industrial educators throughout the United States. Favorable letters and suggestions offered by these educators and industrialists convinced the committee that we were going in the right direction.

A slide-tape presentation with 160 color slides and two tapes, one 52 minutes and the other one hour and 13 minutes, were assembled to enable teachers and students to preview the woods curriculum guide before it was completed for publication. A booklet, "Wood Technology, Techniques, Process and Products," containing 137 sheets of printed materials, pictures, charts, and drawings was printed. This publication is sold in our university book store, used by our wood technology students, and has proven beneficial in improving the process areas.

The 1974 Woods and Wood Technology Curriculum Guide has been printed and will be distributed to Missouri industrial arts teachers, administrators, and educators during the spring and or summer.

It has been a long and very busy five years, but the committee feels the effort has been worthwhile. This comprehensive approach is working in our industrial arts programs and should present a challenge to teachers and students alike.

COMMENTS FROM THE WOODS CURRICULUM COMMITTEE

It is the opinion of the Woods Curriculum Committee that industrial arts woodworking in Missouri has primarily and traditionally been directed toward only one area of the vast forest products industries, that of furniture and cabinet construction. Fabrication of large products such as furniture and/or cabinet work is expensive, time consuming, and has limited the viewpoint of the general education industrial arts woodworking student and his investigations into other equally important areas of forest product industries.

The continued production of finished products in the various process areas is still the best method to motivate and hold the interest of our woodworking students. A comprehensive approach is recommended which will necessitate the construction of smaller products but will permit investigation in at least three or more of the seven process areas listed in the woods curriculum guide. Conventional manipulative woodworking activities have not been removed in this approach, but are included in their proper perspective according to the level of instruction and units covered.

Related information, sequence studies, and drawings in each of the process areas have been included in the curriculum guide giving suggested methods, techniques, procedures, equipment, and supply sources. This guide will aid the teacher in broadening the scope of his or her industrial arts woodworking curriculum.

Several of the process areas listed in the guide could lend themselves very well to the material-science approach rather than the product-oriented approach. It is the committee's opinion that industrial arts woodworking should continue to have a product orientation, especially in Levels I-III.

Each of the areas included in the guide has a complete set of equipment drawings to enable the industrial arts teacher and/or students in Levels III and IV to fabricate and assemble the process equipment for use in the industrial arts laboratory. Level III and IV students should welcome the opportunity to re-design and/or construct equipment useful to their class activities. In the teacher preparation programs of the undergraduate, selected process equipment may be constructed in a college or university special problems or investigation-type course. For the post-graduate, it is suggested that the teacher take advantage of in-service-type workshops being held to familiarize teachers with the various process areas covered in the guide.

Equipment can presently be purchased for all of the process areas with the exception of the Wood Plastic Composition (WPC) unit. School equipment and machine suppliers have indicated that this and other specialized pieces of equipment are now being developed and should be available in the near future. Adaptation of existing equipment can make this a worthwhile experience for teachers and students.

The unit method presently being used to teach industrial arts woodworking (furniture making) can still be elected by Level III or IV students to continue their educational manipulative experiences and investigations in greater depth. It is also possible to add one or more of the other process areas to enrich the traditional approach in the teaching of industrial arts woodworking.

The committee urges you to read carefully and study the entire guide and weigh the advantage of this "general shop" type of approach to the teaching of industrial arts woodworking, particularly in Levels I and II.

INTRODUCTION TO WOODS AND WOOD TECHNOLOGY

Wood is man's most intimate material. He is in daily contact with it in some form throughout his life. Wood is the major material in his home, his furniture, his newspapers, magazines, and books, and in more than 5,000 other products made for his necessities, comforts, and pleasures.

Wood in all forms is an intriguing material. All who work with it are constantly challenged by its many properties, uses, and vast potentials, they are stimulated by wood's beauty, warmth, and other characteristics that many materials so often imitate, but never equal.

Wood is not a material of the past. It actively serves the present, and offers hundreds of untapped uses for the future. Only by proper instruction in both the classroom and laboratory manipulative experiences in the basic properties and current uses of wood can the importance and potentialities of wood be recognized. Woodworking classes should offer sound, fundamental knowledge that is applicable to modern living.

The systematic study of industry and technology is an essential part of the education of all youth from the elementary school through college. At each education level, the subject is organized to take advantage of the interests and needs of the students.

The various levels, I-IV, referred to in this woodworking guide have reference to the re-alignment of industrial arts curricula developed by the various Curriculum Development Committees. A brief summary of the chart found in the bulletin, Planning and Equipping Industrial Arts and Instructional Facilities, Missouri State Department of Education, p. 3-3, 1971, follows:

> Level I, exploratory industrial arts (general shop), should be required in the middle and/or junior high school. The course is exploratory in nature and provides an opportunity for all students to become oriented to a number of content areas in industrial arts.
>
> Level II courses are designed as elective education beginning at the ninth grade and are built upon the exploratory experiences provided at Level I. These courses promote unique interests, needs, and abilities of individuals rather than those common to all.
>
> Level III courses are advanced technical courses designed to provide experiences in a rather specialized phase of a single content area of industrial arts and must, or should be, preceded by a Level II course in the same content area. Although these courses are quite

specialized, their primary purpose is to meet the more unique interests and needs of the individual and not to prepare him for a specific occupation.

Level IV courses should meet the specialized needs of youth. The strength of industrial arts offerings at this level is in its adaptability to new conditions and new circumstances.

The seven selected process or content areas of woods and wood technology that made up the curriculum guide are presented in a brief overview in the following pages and illustrate applicable techniques, processes, and products for your industrial arts woodworking curriculum.

I. Wood Lamination

Wood lamination is not a new process, however, many of the applications of the current techniques of lamination are relatively recent in origin. Stacked wood veneers are capable of being bent and glued to conform to a surface which has a marked curvature, as illustrated in Figure 1. Laminates, flat or curved, are fabricated by sandwiching adhesive-covered veneers in a mold or form and bonded under pressure. Laminates are under internal stress at all times and, like solid wood, react to humidity in an expanding or contracting movement, therefore making it necessary to design the form, mold, or caul to the final equilibrium moisture content shape of the finished product.

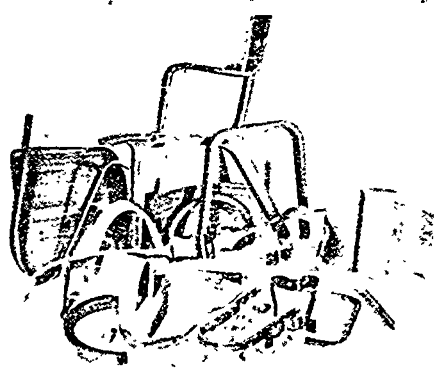


Figure 1. Wood laminated components.

Lamination is important to the industrial arts woodworking student because of the design possibilities it offers. The process permits designs which are lighter in weight, exceptionally strong, and much less wasteful of wood than products constructed from solid wood. Lamination provides an opportunity for the student to improve an important natural material without sacrificing its inherent beauty and without undue material waste.

The individual industrial arts woodworking student will find the possibilities of wood laminations fascinating. The laminated napkin holder has been selected as a product, or as a guide for products to be developed in Level I. The in-out tray has been developed to challenge the Level II industrial arts student in his first year of woodworking. The in-out tray will introduce the student to a more complex product than the napkin holder and combines laminated components with solid wood construction. Level III and IV woodworking students will discover the area of wood laminations to be a challenge to their creative abilities and a continued development of their manipulative skills.

II. PEG Diffusion

PEG (polyethylene glycol) treated wood is permanently kept from shrinking, swelling, or warping, regardless of the atmospheric humidity to which the finished product will be subjected. PEG, a white wax-like material developed by Forest Products Laboratory at Madison, Wisconsin, when properly diffused into individual wood cell lumens and walls, will have a bulking effect that tends to stabilize wood in use. This treatment allows various species of wood with different specific gravities to be combined in a single product.

Green wood or wood with a moisture content above the fiber saturation point, treated in a 30-50% water solution of PEG and dried to equilibrium moisture content, can be machined, sanded, and finished into aesthetic or functional products by industrial arts

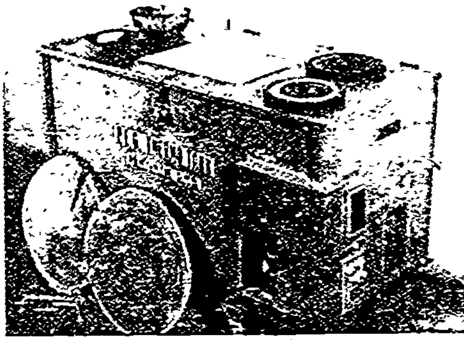


Figure 2. PEG diffusion process.

students in Levels I and II. Continued research, development, and construction of treatment and drying equipment is recommended for woodworking students in Levels III and IV.

Elevated temperature of the PEG solution in a Thermo Tank (Figure 2) is not absolutely necessary, but will shorten the long diffusion time required by the cold or room temperature method. Drying of PEG-treated woods can be accomplished under rather drastic heat conditions in a kiln or drying chamber. The Automatic Drying Chamber can cut down on the drying time, enabling woodworking students to continue their hand or machine laboratory operations without the long delay required when using the room temperature drying method.

The PEG diffusion process opens up a new field of conservation and marketability of waste tree parts that can be developed into a variety of products limited only by the imagination and ingenuity of woodworking industrial arts students.

III. Wood Flour and/or Particle Molding

Particle, ply, and plastic molding in the Trio Press will give the woodworking student an opportunity to produce a product (molded wood), component (plastic disc), or fabricated materials (ply or laminated wood) to use in other laboratory experiences.

Current processes of molding wood consist of mixing wood particles with thermosetting synthetic resin adhesives, depositing the mixture into the cavity of a heated mold (Figure 3), and applying pressure hydraulically until the curing of the resin is completed. The mold is then opened, and the molded product can be removed in a nearly finished condition.

It is recommended that the Level I student not only perform wood particle molding operations, but that he be permitted to prepare wood particle-resin molding mixtures, weigh out molding charges, and beautify moldings by means of various finishing operations. Level II woodworking students could, in addition to the molding operations, design a mold, fabricate a pattern, and cast an aluminum mold which will produce an item displaying his original design. Level III and IV students should have the skills and ability to construct the Trio Press and conduct further research with the process of molding wood particles.

In addition to molding wood particle coasters or other individually designed products, the Level I student can utilize scrap thermoplastic pieces and produce a disc in the test die to be used in fabricating a product for the plastics area. Plywood or laminated blanks can be used in fabricating switch plate covers.

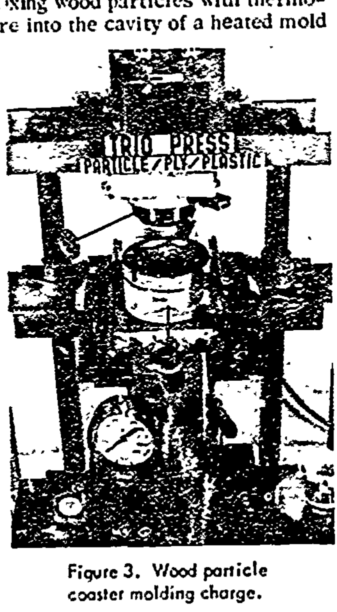


Figure 3. Wood particle coaster molding charge.

IV. Production Product of Industry

The production product of industry is possibly better known in industrial arts curriculums as Mass Production: Principles, Applications, and Operations.

A better understanding of industry should be one of the objectives your students will encounter in their woodworking courses. Industrial arts students should have an opportunity to participate in simulated situations which will allow them to experience social and technical problems similar to those they will meet in adult life. The production product can be used for skill development, will involve problem solving and creativity, and serve as a unifying experience for developing a comprehensive conception of industrial systems.

Mass production can become an extremely complicated and time-consuming study. However, it is recommended that it be just one of the several areas developed and utilized in woodworking courses. Informational content in the form of class discussions, reports, homework, and committee activities should prepare the class for a production run.

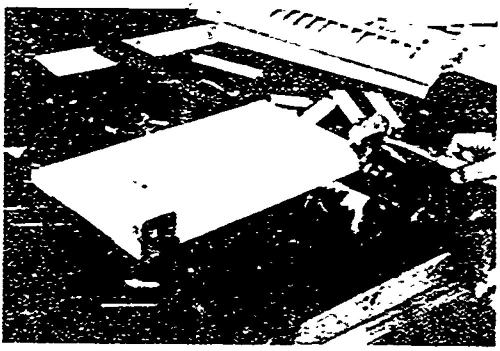


Figure 4. Assembly of an interior window shutter.

The product, interior window shutters (Figure 4), has been redesigned and process-analyzed to give students of a Level II woodworking class an opportunity to plan, redesign, organize, set-up, and produce a product. It is recommended that this unit of study be instituted near the end of the regular school year.

The production product should be attempted by the class only after the students have developed an appreciation of wood, its properties, and potentials for use in our society. To provide the most effective learning situation, the students involved should have gained a satisfactory level of skill with hand and machine tools and an understanding and appreciation of processes needed for a successful completion of the product selected.

The drawing and procedure for developing this product has been set up in a conventional "plans and steps" type of industrial arts project.

Adaptation of the design, jigs and fixtures for production and assembly, areas, machines, and processes to be used, assignment of machine operations, inspection and control personnel are just a few of the many phases of industrial production units to be worked out by woodworking students in Levels III and IV.

V. Wood Plastic Composition (WPC)

Wood impregnation by Wood Plastic Composition (WPC) upgrades wood as a structural material by increasing its strength, hardness, abrasion resistance, durability, and dimensional stability. The improved wood has resistance to mildew, fungus, insect attack, and can be made fire retardant by the incorporation of appropriate chemicals. WPC-modified wood accentuates the grain pattern, especially when dyes are included in the liquid monomer mixture. No surface coating is required on the impregnated wood, but finish can be applied if desired for special decorative effects.

Modified-wood-plastic materials are compatible and adaptable to contemporary industrial arts curriculums. The WPC wood impregnation unit (Figure 5) can be fabricated by Level III or IV industrial arts students to impregnate wood in the industrial arts laboratory. This type of facility would provide the industrial arts woodworking program with a replication of a realistic, contemporary industrial process and also provide a less expensive source of modified wood for products produced by woodworking students in Levels I and II.

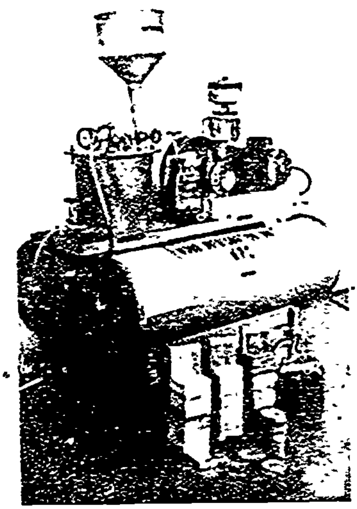


Figure 5. WPC wood impregnation unit.

This process of wood modification is also known as methacrylated wood. This term refers to the composite structure formed by impregnating the lumens of wood with the monomer, methyl methacrylate (the polymerized form is better known as Lucite), and hardening the plastic monomers. Two processes for bringing about the polymerization of methyl methacrylate in wood are in commercial use today. The first method is used by industries such as ARCO Chemical Company of Philadelphia, Pa., manufacturers of Perma Grain" wood-plastic composite flooring. This company hardens the liquid plastic by nuclear radiation. The second method uses a chemical initiator. The preferred initiator or catalyst is Vazo, it is efficient and inert to degradation by chemicals in the wood. The Vazo powder is dissolved in the monomer just before impregnating the wood.

The chemically-initiated methacrylation process is adaptable to industrial arts facilities and involves the following four steps:

1. Evacuating the air from the pores or lumens of kiln-dried wood.
2. Immersing the evacuated wood in methyl methacrylate containing a chemical initiator.
3. Releasing the vacuum to impregnate the wood with monomer.
4. Polymerizing the monomer within the wood by gentle heating.

The modified wood produced by this process is twice as hard as the initial wood. Density and specific gravity will double, as well as sheer strength both parallel and perpendicular to the grain. An additional feature of WPC materials is built in; no finish is required on the completed product. Suggested broad area uses for industrial arts products or components of products constructed from WPC or methacrylated wood are handles, furniture, building materials, musical instruments, marine construction, and sporting equipment. Industrial arts woodworking students through Levels I - IV will find this improved wood an exciting medium to work with.

VI. Residential Construction

Residential construction, with scaled-down models, should be a part of the industrial arts woodworking curriculum in Levels II and III.

Models of "light" construction, adaptable to woodworking classes, could include homes, farm structures, small churches, schools, commercial and industrial buildings. Homes or residential buildings, one of lumber's largest markets, amount to more than a million houses a year. Of these, four out of five are of wood construction, each averaging 10,000 board feet of lumber.

It is extremely important that every I. A. student be given an opportunity to acquire some knowledge of good home design and basic building construction methods. This area of woodworking will enable him to buy or build wisely, thus solving many building problems, even though he may not enter the building industries. Residential construction model building should not be vocationally oriented, however, students will have learned concepts of a large phase of the wood industry.

The house plans selected to aid in the residential construction unit have been divided into 4 sections, as noted on the floor and foundation drawings. This method will allow a team of students to construct a section of the house at varied times during the school year. After all sections have been completed, the four sections could be moved into the proper position, showing the assembled structure in its proper perspective.

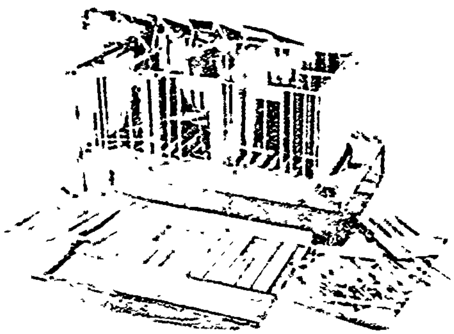


Figure 6. Scaled-down portion of residential construction model with wall frame jig.

The recommended scale, 1-1/2 inch equals 1 foot, was used on the teaching model shown in Figure 6. Also shown in the illustration is a wall frame jig, a construction technique that lends itself to the mass-production, assembly-line basis in factories. This concept, modular construction, is one of the latest steps away from the traditional method of building homes. It is more efficient and less costly. Other techniques in the building construction industries, materials, and processes can be researched and developed by Level II industrial arts woodworking students.

VII. Wood Structure, Properties and Identification

A study of wood structure, its properties, and methods of identification is essential to Level II woodworking students to aid in their selection of appropriate materials for product development.

Modern wood industries devote considerable time to analysis, evaluation, and selection of materials appropriate to a given product's physical, mechanical, and environmental requirements. Our industrial arts classrooms and laboratories should be areas where research and experimentation can be applied to better understand the complex structures of the basic raw material we use, wood.

Wood is so commonplace that we take it for granted. The solid piece of wood used in our products, when viewed under a microscope, becomes intricate arrangements of strong though tiny cells seen as either ring porous, diffuse porous, or non-porous structures. This network of cells may also be seen if the surface or edge of wood is trimmed with a sharp knife or single-edge razor blade and either viewed with the unaided eye or with a 10X hand lens.

The majority of wood cells are long and thin with tapered ends, rather like hollow toothpicks. Fibers, one type of cell in hardwoods, are actually very minute, approximately 1/25 of an inch in length. Tracheids, a type of cell in softwoods, are about 1/8 of an inch in length, or about 4 millimeters. Most hard and softwood cells are tapered in shape and have their length dimension nearly parallel to the long direction of the tree stem. Whether we see the large or small dimension of the cell depends on how the wood is cut.

Generally, for structural purposes, woods are divided into two groups, hardwoods and softwoods. Softwoods consist of the cone-bearing trees which have needles or scale-like leaves such as the pines, spruces, and firs. Woods from this group are considered non-porous. Hardwoods consist of broad-leaved trees which usually drop their leaves in the fall. Woods from this group have diffuse or ring porous cell structures. These include the oaks, ashes, birches, maples, and many others commonly used in our woodworking courses. The separation into these two groups does not mean that all hardwoods have harder wood than the softwoods, it is a convenient way to divide woods based on their cell structure.

An excellent manual has been prepared by Forest Products Laboratory of the Forest Service, U.S. Department of Agriculture, entitled, "Classroom Demonstrations of Wood Properties." This manual will aid IA woodworking teachers in demonstrating some of the properties of wood and how these properties relate to the cellular structure of wood. These demonstrations can be used in Levels I-IV and can be expanded to meet the needs of particular students.

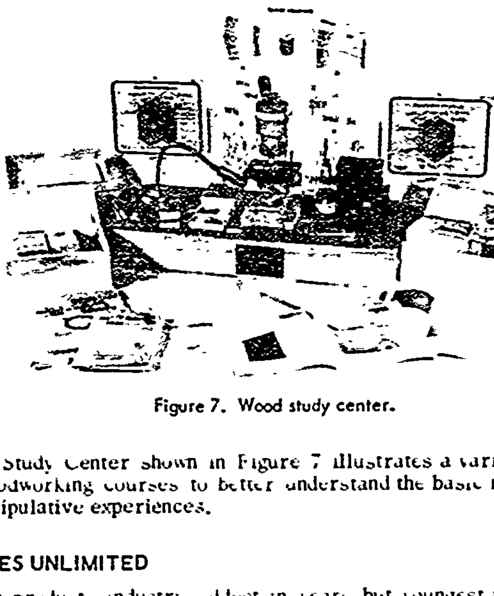


Figure 7. Wood study center.

The Wood Study Center shown in Figure 7 illustrates a variety of materials to aid students in woodworking courses to better understand the basic materials used in their laboratory manipulative experiences.

OPPORTUNITIES UNLIMITED

The forest products industry, oldest in years but youngest in opportunities, offers prestige and profit to those who choose this exciting field for their future careers. Major career areas in the forest products industries are: forestry, manufacturing, wood sciences and technology, research and development, marketing, and information and communications. Each area has multiple fields for specialists in technical and non-technical activities. Private industry is the largest employer of forest products technologists. There are also many career opportunities in the wood research and forest utilization programs of federal and state agencies.

The construction industry, largest lumber consumer, is open for men and women trained in designing and fabricating wood. There are also fine career opportunities in the teaching profession. Energetic students who choose careers in the forest products industries will find a broad field with multiple opportunities and only limited competition for top positions.

Wood industries are ever mindful that trees are a renewable resource and are consistently expanding their scientific efforts in growing timber as a crop and in developing more and wiser uses of each tree harvested. This foresight assures an endless supply of raw materials with which to fill demands for wood products. These industries enjoy a stability that justifies their investments of billions of dollars in land, equipment, and selection and training of employees.

Activities in the wood fields present a challenge and fulfillment. There are no dull moments for technical workers in the forest product industries. They enjoy sights and sounds in the forest, mills, and plants. They find thrills and excitement all the way from tiny seedlings growing tomorrow's timber crops to giant wood trusses or arches in a modern timber building.

This curriculum guide has been organized to aid the woodworking teacher in developing a more complete course of study and presenting a more challenging woodworking program for intermediate and secondary school students in the state of Missouri. Each teacher using this guide should make adaptations to meet his or her teaching conditions found in the laboratory and/or classroom facilities.

REFERENCE

*Wood Industry Careers. National Forest Products Association, 1619 Massachusetts Ave., N.W., Washington, D.C. 20036.

Mr. Oatman is a member of the Industrial Education faculty at Southwest Missouri State University, Springfield, Missouri 65802.

Wood Beam Lamination Technology and Building Construction

Paul T Nicholas

The American Institute of Timber Construction is a national trade association with member laminating companies located throughout the United States. Species used for laminating are primarily southern pine in the South and in the East and Douglas fir in the West.

Glued laminated timbers are manufactured from lumber into a variety of sizes and shapes for many applications. Glued laminated timbers may be used in straight configurations for simple post and beam types of applications. Curved members are used for various arch configurations such as the tudor arch or the radial arch, as well as various truss configurations. Dome-type structures have been constructed utilizing glued laminated timbers with clear spans of up to 350 ft.

A recent development in laminated timber utilizing the old concept of the covered bridge is the glued laminated panel deck system. This system uses glulam stringers for the main bridge structure, and the deck system is made up of glued laminated deck panels which are essentially laminated beams laid on their side to form the deck surface. These deck panels are fastened together using steel dowels so that the deck system works as an orthotropic plate and also acts as a roof to protect the stringers from precipitation.

Glued laminated timber is a versatile, economical construction material which has a variety of applications in various construction projects.

Mr. Nicholas is Manager of Engineering Services, American Institute of Timber Construction, Englewood, CA.

Business of the Association

Minutes of the Delegate Assembly Business Meeting

April 19, 1974
Seattle, Washington

Edward Kabakjian

President Joseph F. Littrell called the meeting to order at 3:30 p.m. Dr. Kenneth Brown was appointed Parliamentarian for the business meeting.

Franzie Loepp, Chairman of the Credentials Committee, was called upon by the President for the seating of the Assembly.

The President called for the reading of the Minutes of the 1973 Annual Business Meeting. Edward Kabakjian, Executive Secretary, read the minutes. Jack Brueckman, Jr., New York, moved for the approval of the minutes as reported and amended. The motion was seconded by Kenneth Shank, New York, and passed.

Dr. Littrell called for the reading of the Treasurer's Report. Dr. Kabakjian presented a "Statement of Fund Balance" and a Summary Report of the Fiscal Accounts. Frank Ingram, Indiana, asked that the Delegates be provided with a more detailed report on fiscal income and expenditures at future Delegate Assembly Meetings. The Treasurer reported that the request was justified and that an expanded fiscal accounting would be included in future Treasurer reports. Edward Kabakjian moved for acceptance of the report. Lowell Campbell from Texas seconded the motion. A division of house was called. The motion carried, 50 for and 33 against.

Copies of the "1973-74 President's Report" were made available to the Delegates. After amplifying certain parts, the President submitted the report to the Recording Secretary.

The President called for old business. He reviewed several resolutions passed at the Atlantic City Conference, and particularly emphasized resolutions pertaining to Governance and Constitutional changes. The Executive Board had appointed a Constitutional Committee which had eighty people working under the chairmanship of Dr. Larry Wright. The constitutional revisions suggested by the committee had been received by the Executive Board at the Seattle Board meeting. The Board felt that the revisions should be submitted to the membership for study and examination.

No other old business was brought to the floor. The President called for new business.

Horace Mayo, Delegate representing NEA, moved that

> "the Treasurer provide a major line item accounting of the finances of the Association to the delegates at each annual meeting." It was seconded by Bob Thrower, New Jersey, and passed.

Carl York, Illinois, moved that

> "the President of the AIAA shall cause to be prepared a written report from each committee which summarizes the actions of the committee for the year preceding the convention, with recommendations for actions on any business so delegated to it by the President or the Delegate Assembly, and it be further moved that these summaries be included with the President's Report submitted to the delegates at the Delegates' Informational Meeting for review and/or action."

Motion was seconded by Allan Myers, Maryland, and passed by the Delegate Assembly.

The President asked Paul DeVore to present the 1974 Acknowledgement Resolutions to the Delegates. DeVore moved for the acceptance of Resolutions A-74-1 through A-74-12. Horace Mayo, NEA, seconded the motion, which carried.

The President called for the Standing Resolutions.

Paul DeVore moved for the acceptance of Resolutions S-74-1 through S-74-9. Louis Ecker, Michigan, seconded the motion, which carried.

The President called for the Current Resolutions. Paul DeVore presented C-74-1 through C-74-5.

Horace Mayo, NEA, asked for individual discussion and action on the Current Resolutions. Darrell Eason, Oregon, moved that the discussion of proposed current resolutions be reordered to the following, Resolutions #5, 1, 2, 3, and 4. Carl York, Illinois, seconded the motion, which carried.

Paul DeVore moved the acceptance of Resolution C-74-5, which was seconded by Carl York, Illinois. After much discussion, it was moved by Horace Mayo, NEA, that C-74-5 be amended by placing a period after the word allotment in the last sentence, thus eliminating the reference to an automatic increase of a fixed amount. Robert Thrower, New Jersey, seconded the motion, which carried. The resolution was passed.

Paul DeVore moved the acceptance of Resolution C-74-1, which was seconded by Louis Ecker, Michigan. The motion failed.

Paul DeVore moved for the acceptance of C-74-2, which was seconded by Carl York, Illinois. Franklyn Ingram moved an amendment to the resolution, which was seconded by Maurice Guptil, Arizona, and approved by the Delegates. The amended resolution passed.

Paul DeVore moved the acceptance of C-74-3, which was seconded by Lowell Campbell, Texas. The resolution passed.

Paul DeVore moved the acceptance of C-74-4, which was seconded by Tom Watkins, Arizona. Robert Thrower, New Jersey, moved dropping the second "resolve" and proposed a new paragraph. Horace Mayo, NEA, seconded the amendment resolution, which passed. The resolution was approved as amended.

After advice by Edward Kabakjian, the Delegates agreed to reconsider Resolution C-74-2. Horace Mayo moved for reconsideration, seconded by Allan Myers, Maryland, and approved by the Delegates. James Boone, Texas, moved that the reference to specific amounts of money be eliminated in the resolution. Seconded by William Scarsborough, North Carolina, the amended motion was passed by the Delegate Assembly.

Horace Mayo, NEA, moved that future Presidents' Reports include a copy of the accounts for the fiscal year through June 30 of the preceding year and an up-to-date report on the current fiscal year ending 30 days prior to the Annual Conference. The motion was seconded by Robert Thrower, New Jersey, and passed.

Thomas LaClair, New York, moved that all committee chairmen prepare an annual report, indicating the disposition or progress of the Delegate Assembly actions so that all members be aware of Association activities, these reports to include committee charges, responses, financial actions, and committee recommendations. Seconded by William Schelegeter, New York, the motion passed.

Dean Wertz, Illinois, moved that a copy of Executive Board minutes or abstracts be given to each Delegate at the first Delegates meeting at the National Conference. The minutes are to be from all Board meetings during the previous year. Luther Burse, Pennsylvania, seconded the motion, which carried.

Thomas LaClair, New York, moved that a draft of the Recording Secretary's minutes of the National Representative Assembly be mailed to each Delegate within 60 days. Frank Ingram seconded and the Delegates approved the motion.

Robert Sharp, Maryland, moved that the 1975 Convention Planning Committee be directed to schedule the Delegate Assembly meeting and the Annual Business meeting to begin no later than 10:30 a.m. on their respective scheduled days, and that these meetings not be scheduled ahead of other activities requiring the attendance of the Delegates. William Schelegeter seconded the motion, which passed.

New AIAA officers introduced were Laura Lewis, vice president for classroom teachers, and Al Rudisill, president elect.

It was announced that the next AIAA Conference will be held in Cincinnati, Ohio.

The meeting adjourned at 5:30 p.m.

Resolutions of the Delegate Assembly

ACKNOWLEDGEMENT RESOLUTIONS

A-74-1. Appreciation to the President. WHEREAS Dr. Joseph T. Littrell, as President of the American Industrial Arts Association, has given so liberally of his time and his talents, exhibiting an outstanding capacity for leadership, and

WHEREAS, the Association has made exemplary progress under his leadership,
BE IT HEREIN RECORDED that the Association, through its membership, officers, and executive board, expresses its fullest appreciation to him.

A-74-2. Appreciation to the Conference Committee, the Program Committee, and the Program and Conference Participants. INASMUCH as the Thirty-sixth Annual Conference of the American Industrial Arts Association was possible through the direct, dependable, and efficient service of great numbers of members of the Association, and inasmuch as the Conference has achieved an outstanding level of success,

BE IT HEREIN RECORDED that sincerest appreciations are expressed to William Bakamis, Program Chairman, and Sam Porter and Herbert Bell, General Co-Chairmen, to the members of Conference committees, and to all the teachers, supervisors, teacher educators, and students whose efforts in total produced this Conference.

A-74-3. Appreciation to the Ship. INASMUCH as the continuing support for and participation in the conduct of the Annual Conference of the Association, and, in view of the excellence of this year's commercial exhibits as a feature of the Conference,

BE IT HEREIN RECORDED that the American Industrial Arts Association expresses its appreciation to Educational Exhibitors for their participation in the 1974 Conference.

A-74-4. Appreciation to the Teacher Recognition Program. INASMUCH as the Association is dedicated to encouraging excellence in teaching, and

INASMUCH as its program of recognition of outstanding teachers is marked with increasing excellence,

BE IT HEREIN RECORDED that expressions of appreciation are tendered to Kenneth Cile, Vice-president for Classroom Teachers, and his committee for their contribution in the conduct and promotion of this program, and

BE IT ALSO RECORDED that appreciation is expressed to the officers and members of state associations who have participated in the teacher recognition program.

A-74-5. Appreciation to the Vice Presidents and Other Officers. WHEREAS Bernard Dutton, Vice-President of the American Council of State Association Officers, has given so liberally of his time in the leadership as President of his Council for the past two years and has devoted and exhibited outstanding leadership services as Vice-President of the American Industrial Arts Association, and

WHEREAS, Billy Mayes, Vice-President for Classroom Teachers for the American Industrial Arts Association, has exhibited steadfast devotion and effective and solid leadership to the American Industrial Arts Association, and

WHEREAS, Rodney Anderson, Vice-President for Supervisors, has made outstanding contribution to the Association, and

WHEREAS, Willis Ray, Vice-President for Teacher Educators, has provided excellent leadership through his service in numerous efforts, and

WHEREAS, William Hoots, Vice-President for Elementary Industrial Arts, has served the Association effectively during his tenure, and

WHEREAS, James Littleford, Vice-President for College Students, has evidenced exemplary service to the Association, and

WHEREAS, Paul W. DeVore, Immediate Past President, provided continued leadership and service to the Association, and

WHEREAS, the Association has made exemplary progress under the leadership of these Executive Board members,

BE IT HEREIN RECORDED that the Association, through its membership, officers, and executive board, expresses its fullest appreciation to them.

A-74-6. Appreciation to the Governor of the State of Washington. IN VIEW OF his support for industrial arts in Washington and the 1974 Conference of the Association in Seattle,

BE IT HEREIN RECORDED that the Association expresses its appreciation to Governor Daniel J. Evans for his assistance in making this Conference a success.

A-74-7. Appreciation to the Superintendent of Public Instruction of the State of Washington. BECAUSE the progress of industrial arts education within each state reflects the philosophy and efforts of the Chief State School Officer, the Association expresses its appreciation to the Washington Superintendent of Public Instruction, Frank D. Brouillet, for his demonstrated support of industrial arts education and to this conference.

This appreciation is further extended to Herbert Bell, State Supervisor of Industrial Arts, for his cooperation toward this Conference and for his achievements for the improvement of industrial arts education in the great State of Washington.

A-74-8. Appreciation to Personnel of the Washington Industrial Arts Association. The cooperation of the members of the Washington Industrial Arts Association in preparation for and conducting of the Thirty-sixth Annual Industrial Arts Association Conference is recognized as a major factor, and the AIAA through its Executive Board expresses its sincere appreciation.

A-74-9. Appreciation to Educational Personnel. The success of the Thirty-sixth Annual Conference rests in large measure on the devotion and contributions of the personnel of public schools and collegiate institutions. The membership of the AIAA through its Executive Board expresses its thanks and appreciation for their contributions.

A-74-10. Appreciation to the Public Schools. INASMUCH as the success of the 1974 Conference was insured by the fullest cooperation of Loren Troxel, Superintendent of Seattle Public Schools, and his staff,

BE IT HEREIN RECORDED that the officers and members of the American Industrial Arts Association express their gratitude for their assistance.

A-74-11. Appreciation to the World Future Society (Evergreen Chapter). The Evergreen Chapter of the World Future Society has made many unique and valuable contributions to the Thirty-sixth Annual Conference, and for their contributions the AIAA membership through its Executive Board extends its thanks and appreciation.

A-74-12. Appreciation to the National Office. BECAUSE of the vital role of the National Office of the Association in the effectiveness of the service to the Association and its members, appreciation by the membership and the Executive Board is herein expressed to the National Office Staff.

STANDING RESOLUTIONS

S-74-1. The AIAA believes that excellence in the classroom is the foundation of a good education system. The Association, therefore, supports the philosophy that only properly certified individuals be permitted to teach industrial arts. The Association further seeks the abolishment of all substandard teaching certificates currently being issued.

S-74-2. The AIAA believes that an industrial arts program offers one of the best educational opportunities that can be used to help young people grow to the maximum of their individual abilities, therefore, the Association further believes that a program of industrial arts should be offered in all elementary, middle, and secondary schools in the nation.

S-74-3. The AIAA believes that program and institution accreditation assures the continued development of quality programs of instruction. To this end, the AIAA encourages its committees and member councils to formulate accreditation and/or update standards for all programs of industrial arts conducted in elementary, middle, and secondary schools, colleges and universities. The standards should be designed to promote improvement through self-evaluation, as well as provide criteria used by accreditation agencies.

S-74-4. The AIAA believes that a maximum effort should be extended in soliciting membership for and continuing the development of the industrial arts student clubs at both the high school and college levels.

S-74-5. The AIAA believes that all persons regardless of race, creed, color, or sex should be given the opportunity to participate in the programs of industrial arts in the schools of the nation.

S-74-6. The AIAA believes in and continues to support the international movement to standardize and convert to the metric measurement system and encourages all of its members to include instruction on the metric system in their classes.

S-74-7. The AIAA believes that all educators and all professional associations should work together in the education of the youth of our schools to better prepare them for an ever-changing technological society.

S-74-8. The AIAA believes that a maximum effort should be extended in the business-industry-education partnership for the purposes of keeping that segment of the society informed of the contribution of industrial arts to the youth of the nation.

S-74-9. The AIAA believes in and supports the efforts of its International Relations Committee in strengthening the industrial arts associations and programs in all nations of the world.

CURRENT RESOLUTIONS

C-74-1. WHEREAS, the financial health of the Association rests largely upon the financial success of the Annual National Conference, and

WHEREAS, the financial success is determined largely by the attendance at the Annual National Conference, and

WHEREAS, attendance at the Conference is usually severely limited when it is held at geographic extremes (east coast or west coast) of the country, and

WHEREAS, attendance can be greatly increased by holding the Conference in a city within a "Golden Triangle" established by the points of Chicago, Pittsburgh, and St. Louis, now therefore be it

RESOLVED that plans for future Conference sites be limited to cities within the population concentration of the Golden Triangle or its nearby environs. (Defeated by the Delegate Assembly.)

C-74-2. WHEREAS, The Crossroads '76 Exposition will be the focal celebration for the 100th anniversary of industrial arts in the United States, and

WHEREAS, the celebration will involve extensive preparations, expanded programs, special awards and ceremonies, and considerable public and professional promotion, and

WHEREAS, a personal commitment on the part of our membership may lead to a personal commitment of attendance at this anniversary conference, be it therefore

RESOLVED that the AIAA Executive Board be authorized to solicit a special tax-deductible contribution from each member to help finance the planning, organization, administration, and programs of the centennial exposition, and be it further

RESOLVED that this solicitation be organized and conducted by the Crossroads '76 Planning Committee and monies so collected be sent directly to the treasurer of the AIAA.

C-74-3. WHEREAS, the state affiliate associations act as membership recruiters for the American Industrial Arts Association, and

WHEREAS, other national professional organizations provide a reduced rate for dues when the member joins through a state affiliate, be it therefore

RESOLVED that any member joining the American Industrial Arts Association through the efforts of the state affiliate may do so at a reduced rate if at the same time he is also joining the state affiliate. (Defeated by the Delegate Assembly.)

C-74-4. WHEREAS, President Paul DeVore during his tenure requested Dr. Fredrick Kagy to conduct a study on the governance of the American Industrial Arts Association, and

WHEREAS, Dr. Kagy did conduct and submit a study on governance to the Executive Board, and

WHEREAS, Paul DeVore requested the Delegates to the 1973 annual conference to consider the issue of governance of the association, and

WHEREAS, the Delegates at the annual meeting in Atlantic City requested the Executive Board to appoint a Constitutional Revision Committee, and

WHEREAS, the Constitutional Revision Committee was appointed by President Joseph Littrell, and whereas said Committee has submitted its report to the Executive Board,

NOW THEREFORE BE IT RESOLVED that the Executive Board be directed to have prepared proposed revisions of the Constitution of the Association based on the above actions, and

BE IT FURTHER RESOLVED that said proposed revisions be printed and distributed to all members through their respective state associations with instructions for reviewing and discussing the constitution and proposed revisions, and

BE IT FURTHER RESOLVED that the respective state representatives and/or the respective state associations be requested to conduct sessions for the purpose of revising and discussing the constitution and proposed revisions and report their recommendations to the Executive Board.

C-74-5. WHEREAS, the funding of a National Conference is dependent on the financial resources of State Association, and whereas a current $600.00 allotment from the AIAA is not adequate.

BE IT RESOLVED that the AIAA Executive Board review the $600.00 allotment.

VOTING DELEGATES

1974 AIAA ANNUAL CONFERENCE — BUSINESS MEETING

WEST COAST
Alaska
None
California
Charles Brady
Howard Decker
Kenneth Bush
James Edwards
Walter Mattson
Hawaii
None
Idaho
None
Nevada
None
Oregon
Darrell Paxson
Washington
Jack Estep
Carl Boe

SOUTH
Arizona
L. J. Pardini
Maurice Guptil
Tom Watkins
Arkansas
None
Colorado
Larry Denton
William Grove
Alan Aagaard
Louisiana
None
New Mexico
None
Oklahoma
Joe Richards
Robert Phelps
Texas
Ronald Foy
David Lorms
James L. Boone, Jr.
Lloyd Campbell
W. A. Mayfield
Utah
Leo Mower
Thurlow L. Bailey

NORTH
Iowa
Dan Roberts
Rooney Scholten
Kansas
Noel Mintz
Minnesota
None
Montana
Everett A. Sheffield
Nebraska
Jerry Hepp
North Dakota
Robert Moore
Wyoming
Joe Svoboda
South Dakota
Stephen Evans
Canada
None

CENTRAL
Illinois
Carl A. York
Bill Cady
Joe McCraith
Bill Hayes
Dean Wertz
Indiana
Edward Paloney
Joe Mrak
Frank Cackowski
Frank Moriconni
Kentucky
George Glover
Michigan
Louis Ecker
Robert Mathers
Frank Ingram
Missouri
D. D. Northdurft
Phillip Schooley
Damon Vincent
Victor Ragaini
Ohio
C. J. Kolezynski
C. Richard Lanier
Albert Squibb
Russell Henderly

Wisconsin
Lee Smalley
James Bensen

NORTH EAST
Connecticut
Ronald Rogers
Maine
None
Massachusetts
None
New Hampshire
None
Rhode Island
None
Vermont
Spencer Whitney

NEA
Horace Mayo

EAST
Delaware
Gary Bell
District of Columbia
None
Maryland
Allan Myers
Robert Sharp
Harvey Starkey
New Jersey
Laura Lewis
Robert Thrower
New York
Thomas LeClair
Jack Brueckman, Jr.
Kenneth Shank
Wm. Schelegeter
Mrs. Mary Good
James Good
Michael Adams
Pennsylvania
Luther Burse
Robert Hostetter
J. Alan Little
William Skelly
Olan Sterback
William Wilkinson
Aaron Wilson
Virginia
James Cook
West Virginia
James Snyder

SOUTH EAST
Alabama
Wally Hartzog
Florida
Ed Kenyon
Dave Skinner
James McLaughlin
Georgia
None
Mississippi
None
North Carolina
Raymond Truce
W. S. Surbough
Puerto Rico
None
South Carolina
Harvey Morgan
Tennessee
John Folks

Credentials Committee
(Pres., Joe Littrell)
1. Lee Carter, Boise, ID
2. Les Litherland, Jefferson Co., CO
3. Lynn Lundy, Laramie, WY
4. Ken Winters, Murray, KY
5. Bartlett Lund, Ridgefield, CT
6. Mike Adams, Oswego, NY
7. Ray Ginn, Atlanta, GA
Franzie Loepp, CHRM., Normal, IL

367/368

Teacher Recognition Program

Fifty-one Outstanding Industrial Arts Teachers of the Year 1974 were honored at the Seattle AIAA Conference on Thursday, April 18. Of this number, 47 are from the United States and 4 from the provinces of Canada. Each Teacher of the Year received a ribbon upon arrival at the Conference and an engraved plaque and certificate of honor at the Teacher Recognition Program.

Industrial Arts Teachers of the Year 1974. Alabama, Richard H. Barnes, Alaska, Irvin S. Crane, Arizona, Richard L. Troxel, California, Gerald Hansen, Colorado, William F. Grove, Connecticut, Ronald A. Rogers; Delaware, Gary P. Bell, Florida, Jack L. Ladue; Georgia, Jimmie Cone, Hawaii, Frank J. Martin, Idaho, Donald W. Halbmaier, Illinois, Bill Cady, Indiana, Frank Cackowski, Iowa, Dan W. Roberts, Kansas, Donald L. Hrabik; Kentucky, George L. Glover, Louisiana, Reed Landry, Maryland, J. Paul Skellchock; Massachusetts, Roger F. Wilder, Michigan, Kenneth W. Barnes. Minnesota, Louis J. Filippi, Mississippi, William L. Summers, Missouri, Phillip K. Schooley, Montana, Howard R. Randall, Nebraska, Marion F. Childress, Nevada, James L. Amburn, New Jersey, Eugene C. Compton, New Mexico, Charles F. Eastburn, New York, William G. Schlageter, North Carolina, Jerome J. Pearson, North Dakota, Robert J. Moore, Ohio, Russell C. Henderly, Jr., Oklahoma, Hugh C. Gouldy. Oregon, Ronald J. Kucharik, Pennsylvania, John R. Fisher. Rhode Island, James A. MacInnes, South Carolina, Linda L. Hedgpeth, South Dakota, Stephen H. Evans, Tennessee, Thomas F. Chambliss, Texas, Roy Linnartz, Utah, Thurlow F. Bailey, Vermont, Ernest Levesque, Jr., Virginia, Paul L. Cummings; Washington, Jack D. Estep, West Virginia, James T. Kelley; Wisconsin, Wesley E. Gadbaw, Wyoming, Orris L. Wickham, Ontario, Marvin R. Sheppard, Saskatchewan, Arnold Flegel, Alberta North, Walter Ilchuk. Alberta South, Howard E. Langdon.

Much of the success of the Teacher Recognition Program is due to the effort of the state association officers and state representatives. We wish to thank Dr. Edward Kabakjian and his staff for forwarding the necessary supplies and information to the committee. Dan Lopez accepted the responsibility of producing the certificates of honor. Russell Amling printed the forms for reporting state association officers, teacher recognition awards, press release information, and regulations and information. William J. Wilkinson was charged with the production of the plaques. J. A. Rodgers Swan conducted the program for the Canadian Provinces. Thomas J. Barber printed the ribbons for the Teachers of the Year. David M. Mordavsky wrote the press releases and mailed them to newspapers. Besides coordinating the project, Committee Chairman Kenneth E. Gile enlisted the services of his family and the business students at Mount Anthony High School for the necessary typing.

The President's Report, 1973-1974

Joseph J. Littrell

The first AIAA proceedings were published in 1964 for the 26th Annual Convention. Growth and development of the AIAA may be seen in the ten years by examining first the 1964 Convention theme, "New Directions for Industrial Arts," and then the 1974 theme, "A Humane Technology for the Future." The direction has been, and continues to be, forward. Forward to the future as industrial arts progressively studies its relationship to the total society and educational scene.

As President of the AIAA for 1973-74, I have looked for some way to adequately recognize the thousands of hard-working industrial arts teachers who have found time to serve the profession. I submit that they are the unsung leaders who have not sought personal recognition, but who have contributed in many capacities.

THE ASSOCIATION

Although the professional association is made up of individual members, it operates and functions through the Executive Board, the National Office, Councils, State Affiliates, Committees, Annual Conference, and the Delegates' Representative Assembly. Each has an important part in promoting the profession.

In Cooperation

The efforts of many came to fruition in 1973-74, when through Public Law 92-318, industrial arts education was added to the definition of vocational education. After months of study and combined effort, the AIAA in conjunction with the Industrial Arts Division of the AVA succeeded in securing federal legislation which recognizes the unique contribution of industrial arts. Time will reveal the impact of this legislation.

At the same time that we are looking ahead to future experiences for industrial arts, it is also well to look back. It was my pleasure to sign an agreement between the AIAA and Millersville State College, Pennsylvania, for the establishment of an Industrial Arts Archives at that institution's library. This agreement resulted from the work of the AIAA History and Archives Committee, the importance of whose contribution is yet to be realized.

Another significant achievement was the completion of the Guidelines for Industrial Arts in Career Education. This, too, was accomplished through joint efforts of members of the AIAA and the Industrial Arts Division of the AVA. The report was finalized following a lengthy review at the 1973 AIAA Conference in Atlantic City.

Executive Board

The AIAA Executive Board met in two separate sessions during the year. Action taken included (1) approval of the 1974-75 fiscal year budget request, (2) approval of the 1976 conference site for Des Moines, Iowa, (3) employment of James D. Dixon as Coordinator of Professional Services, (4) acceptance of a three-year grant from the Directors of the Damon Foundation, Inc., whereby the Foundation will underwrite the expenses of a keynote speaker at each of the AIAA Conferences for the next three years.

National Office

Communication lines emanate from and to the National Office where a hardworking staff handles membership, collects dues, maintains records, coordinates publications, and acts as a liaison with other agencies. To assist with the work of the office, a new addressing machine was purchased.

COMMITTEE HIGHLIGHTS

The backbone of the Association is its committees. Efforts toward decision-making by members have been increased through committee activity. All resolutions requiring committee action requested at the Delegates' Representative Assembly in Atlantic City were remanded to committees. President-elect Don Hackett has received complete reports from all committees.

Standing Committees

Teacher Recognition Committee, active since 1963, is now working cooperatively with state representatives and state associations. Awardees have been from every state, Canada, Puerto Rico, and Virgin Islands. There has been an increase in state activities in High School Clubs (AIASA) with a revised Student Handbook. The 1973-74 president was John Schreer, Madison High School, Madison, Kansas. The College Clubs (AIACSA) have developed goals and purposes which will appear in a new handbook. The 1973-74 president was James Littleford, Auburn University, Alabama.

The Safety Committee, which is working on a safety survey through industrial arts supervisors, plans to publish a bibliography on safety. A set of qualifications and responsibilities for state and local supervision of industrial arts is being prepared by the Accreditation and Evaluation Committee. An ambitious Curriculum Committee is studying the organization of subject matter in industrial arts, also, a subcommittee has been suggested as a clearinghouse for the changeover to the metric system.

The role of the industrial arts teachers in their professional association (AIAA) is being studied by the Research Committee. Through Dr. Everett Israel, the committee is also preparing a series on teaching of concepts for the classroom teacher. The Recruitment Committee has a goal to recruit women to become industrial arts teachers. The important Legislation Committee is attempting to put together a status report so more states may include industrial arts in the state plans for vocational education.

The M S/L Advisory Committee constantly searches for new ideas and contributors as they set themes for each issue. The Publications Committee has released several new publications, including Growing Together to Insure the Future by the Environmental Education Committee. The new Focus Series are booklets on points of view and interest items taken from articles in recent AIAA Conference Proceedings. Film and slide-sound presentations have also been produced.

The 1974 Nominations and Elections Committee completed their procedures with the AIAA, upon the election of Alvin L. Rudisill as President-elect and Laura L. Lewis as Vice-president for Classroom Teachers.

Policies and procedures were prepared by the Credentials Committee to improve the seating of delegates to the Representative Assembly. The International Relations Committee is planning for an international consortium, with representatives from countries all over the world.

A complete organizational plan was developed by an active Membership Committee. Promotional material is being prepared to get information to every industrial arts teacher. Through the Affiliation Committee, the new Industrial Arts Association of Missouri obtained affiliation with the AIAA in August 1973.

New and Ad Hoc Committees

The new Scouting Committee is attempting to identify potential tasks, including a handbook on conducting a merit badge program. The temporary Bicentennial Committee has worked with the 1976 Conference Committee to coordinate activities.

The large Constitution Committee has proposed extensive changes in the AIAA Constitution. An extensive search has been conducted by the Special Services Committee to obtain an adequate liability insurance agency for AIAA members. The Environmental Committee has been actively gathering information and contributing articles and editorials.

Exploring areas of mutual interests where combined efforts might make a stronger voice for industrial arts is being examined by the Liaison Committee with the Industrial Arts Division of AVA. The Awards and Recognition Committee selects and makes awards to members and non-members. A new award is to be known as the "AIAA Distinguished SHIP Member Award."

RECOMMENDATIONS

1. One of today's educational patterns is for public-supported education from kindergarten through college and continuing education. The two-year post-secondary school has become a major institution, and industrial arts education should become an important part of the community junior college segment. I suggest that the AIAA promote curriculum studies and encourage activities through industrial arts programs in these post-high-school institutions. Furthermore, teachers and administrators of these institutions should be recognized by the AIAA and their membership in the AIAA encouraged, whereby they may become involved at both state and national levels.

2. I recommend that an ad hoc committee be appointed to make a National Office Site Study to consider a location by 1980. This study should include a rationale for a move, suggested sites, funding, and accounting safeguards for a site fund.

3. A growing concern is the health and safety of the individual industrial arts teacher. I recommend that the AIAA, through the combined efforts of the Research and the Safety Committees, conduct studies aimed at reducing noise and particulate pollution in school industrial arts shops, and that these combined committees compile a report making recommendations for improvement.

4. Educational needs and educational goals of industrial arts have been well recognized, but there is need to identify national priorities. These need to be clear and easily understood and not clouded by sophisticated educational jargon. I recommend that a committee, perhaps a National Goals Committee, be appointed. This committee should comprise members from a variety of geographic regions, subject areas, and positions, and should carefully examine issues, goals, and needs as have been presented as resolutions by the AIAA Representative Assembly for the past five years and project these, and other needs, to the year 1980-81. These should be identified, categorized, and placed in an order of priority from the standpoint of feasibility, promotion of the AIAA, and as they relate to the excellence of learning by students of all ages who may participate in the subject area of industrial arts.

5. Through its membership, the AIAA should immediately become responsible for providing instructional programs that will contribute to the study and practice of conserv-

ing the nation's energy resources. Long-range planning through appropriate committees should include requests that there be placed in the Federal Budget specific funding for a National Industrial Arts Program which will include instruction in energy extraction, energy use, and energy management. Such program should include support for research, national centers, course development, workshops, and model programs.

6. I recommend that every state have a designated state affiliated association with the AIAA. Each affiliate's state representative to the AIAA would be a contact person for a nationwide communication network to carry information concerning legislation and important issues to the membership.

7. There has been much work done by individuals and by committees of the AIAA which has gone unrecognized. I recommend that the Executive Boards of the future consider readjustment of budgets to permit an increase in publication of monographs, books, and articles with emphasis on work done by committees and that these publications be made available to the membership.

8. In light of recent federal legislation which has placed industrial arts within the definition of vocational education, I recommend that the AIAA encourage state departments to establish workshops to inform industrial arts teachers, supervisors, and teacher educators about:

a. State legislation, state plans, and vocational funding to include industrial arts
b. Occupational Safety and Health Act (OSHA)
c. Metric conversion
d. Youth groups

9. To gain visibility for the AIAA and the image of the industrial arts teacher, I recommend that the Executive Board investigate the possibility of a Commemorative Coin to be struck by such a source as the Franklin Mint and that this represent a 100-year industrial arts commemorative.

CONCLUSION

The year 1973-74 was difficult from the standpoint of energy shortage, and there are many unresolved areas of concern. Leaders in school districts must be convinced, and be able to convince school boards, that industrial arts can be a large umbrella for many areas of instructional concern, including career education, occupational education, and study of industrial technology.

There is a feeling of optimism with an evolving concept in the American society that leans toward an increase in family activities, to professionalism, and to working together. This has great significance to associations and societies such as the AIAA. The importance of industrial arts goals has become well recognized. The AIAA must be the stimulus and often the prime mover in promoting the philosophy and the practice of industrial arts education.

Chronological Index

T.9:00.7 AIAA
Credentials Committee Meeting
Chairman, Franzie L. Loepp
T.9:00.8 AIAA
Curriculum Committee Meeting
Chairman, David W. Weber
T.9:00.9 AIAA
Elections Committee Meeting
Chairman, Edward Kabakjian
T.9:00.10 AIAA
History and Archives Committee Meeting
Chairman, Ervin A. Dennis
T.9:00.11 AIAA
Industrial Arts College Clubs Committee Meeting
Chairman, W. A. Mayfield
T.9:00.12 AIAA
International Relations Committee Meeting
Chairman, John Pollock
T.9:00.13 AIAA
Legislative Committee Meeting
Chairman, Dennis A. Dirksen
T.9:00.14 AIAA
Membership Committee Meeting
Chairman, Antnony Scime
T.9:00.16 AIAA
Nominating Committee and Environmental Education Committee Meeting
Chairman, Donald Lauda
T.9:00.17 AIAA
Past Presidents Committee and Resolutions Committee Meeting
Chairman, Paul DeVore
T.9:00.18 AIAA
Public and Professional Relations Committee Meeting
Chairman, Frank Ingram
T.9:00.19 AIAA
Publications Committee Meeting
Chairman, R. J. Vasek
T.9:00.20 AIAA
Recruitment Committee Meeting
Chairman, William D. Wargo
T.9:00.21 AIAA
Research Committee Meeting
Chairman, James J. Mooney
T.9:00.22 AIAA
Safety Committee Meeting
Chairman, David R. St. John
T.9:00.23 AIAA
Scouting Committee Meeting
Chairman, J. C. Brueckman, Jr
T.9:00.24 AIAA
Special Services Committee Meeting
Chairman, Alvin E. Rudisill
T.9:00.25 AIAA
Teacher Recognition Committee Meeting
Chairman, Kenneth E. Gile
T.9:00.26 AIAA
Constitution Committee Meeting
Chairman, Larry Wright
T.9:00.27 AIACSA
AIACSA Committee Meeting
Chairman, James Littleford
T.1..:0.1
Tour, Juanita High School

T.10:30.1 ACESIA
ACESIA Executive Session
Chairman, William R. Hoots, Jr.

T.10:30.2 ACIAS
Tour of Occupational Versatility
Chairman, John Lavender

T.1:30.1 ACIAS
"OSHA Requirements"
Chairman, John Fessant, Presentation, "An OSHA Inspection by Supervisors and OSHA Officials for Comparison Purposes"

T.1:30.2 ACESIA
ACESIA Committee Work Sessions
Chairman, W. R. Miller

T.1:30.3 MACSA
MACSA Meeting
Chairman, James Littleford

T.1:30.4 ACIATE 56, 58, 65
"Competency-Based Industrial Arts Teacher Education"
Chairman, Stanley Brooks
"Survey Report on the State of the Art," Presenter, Jack C. Brueckman
"One College's Approach," Presenter, Dean A. Hauenstein
"Role of the Public School," Presenter, Carl Heiner

T.1:30.5 AIAA
Tour of Lumber Mills

T.3:30.1 ACIAS
ACIAS Council Annual Business Meeting
Chairman, Rodney Anderson

T.3:30.2 MACSA
MACSA Annual Business Meeting
Chairman, James Littleford

T.3:30.3 AIAA
AIAA Campus and State Representatives Meeting
Chairman, Edward Kabakjian

T.3:30.4 FEA
FEASHIP's Board of Directors Meeting
Chairman, Tom Rogers

T.3:30.5 ACIATE 70, 76, 82, 83
"Designing Teacher Education Experiences to Meet Performance Objectives"
Chairman, Stanley Brooks, Panelists, Philip Wynn, Ross C. Hilton, Larry Wright, John Bies

T.3:30.6 ACIASAO
ACIASAO Executive Board Meeting
Chairman, Bernard Dutton

T.7:00.1 ACIAS
Session on Supervision with Industrial Representatives
Chairman, Ralph Steeb

T.7:00.2 ACESIA 22, 24, 28, 31
"Developing Human Potential Through Career Awareness in Grades K-6"
Chairman, F. Milton Miller, Presenters, James L. Hasz, Wayne A. Wonacott, Panelists, Mary-Margaret Scobey, Walter Hall

T.7:00.3 ACIATE
ACIATE Committee Work Session
Chairman, Willis E. Ray

T.7:00.4 MACSA
MACSA Inter-Collegiate Competition
Chairman, W. A. Mayfield

W.9:00.1 AIAA 2
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Chairman, Joseph T. Luetzell
"Education or Training: Alternative Futures for the Teacher"
Presenter, Robert Theobald, Panelists, Daniel J. Evans, Phil Swain, Edward Lindaman

T.1:30.12 ACIASAO
ACIASAO Annual Business Meeting
Chairman, Bernard Dutton
T.3:30.1 AIAA 369
AIAA Teacher Recognition
Chairman, Kenneth E. Gile; Presenter, Edward Aguirre
T.6:30.1 AIAA
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T.7:00.2 AIAA
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T.7:00.3 WIAA
WIAA Executive Board Meeting
Chairman, Jack Estep
T.10:00.1 AIAA
AIAA Conference Planning Committee Meeting. Seattle/Cincinnati/Des Moines
Chairman, James Dixon
F.8:30.1 AIAA
Washington Plymouth Trouble-Shooting Contest
Chairmen, John Moore, Paul Stephens
F.9:00.1 AIAA 12
AIAA General Session #3
Chairman, Walter Brown
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F.10:15.1 WIAA
WIAA Business Meeting
Chairman, Jack Estep
F.10:45.1 AIAA WFS
"Reaction to Michael Michaelis' Address"
Chairman, Harold Padelford, Reactor, Steven Flajser
F.10:45.2 AIAA 160
"Career Education—Evaluation by the National Assessment of Educational Progress"
Chairman, Robert Thrower; Presenter, Ralph Bohn
F.10:45.3 AIAA
"Workshop on Newspaper Reporting Techniques"
Chairman, Myron Bender; Presenter, Colleen Stamm
F.10:45.4 AIAA 260
"Software Design for Teachers"
Chairman, Howard Gerrish, Presenter, Clarence H. Preitz, Allen E. Morris
F.10:45.5 AIAA 283
"ACTION Company Program"
Chairman, William Gassert, Presenter, Robert C. Stewart, Roger Jessup
F.10:45.6 AIAA 241, 244
"Scenario Building: A Method of Studying the Future of IA"
Chairman, James N. Yadon, Presenter, Robert J. Gelina, Panelists, William McPherson, Edward Pytlik, J. Barry DuVall, Normal Tomazic
F.10:45.7 ACESIA 38
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Chairman, Mary-Margaret Scobey, Presenters, Alvin White, Ronald Frye; Panelists, William A. Downs, Keith Blankenbaker
F.10:45.8 ACIATE 110, 115, 123
"The Future: A Humane Technology—Implications for Teacher Education"
Chairman, Eckhart A. Jacobsen, Presenters, Marshall S. Hahn, Donald P. Lauda, John T. Fecik, Panelists, Louis Melo, Louis Pardini, Kendall Starkweather
F.10:45.9 MACSA
"Technology and Ecology"
Chairman, Willis Guise; Presenter, Lloyd Robison

F.12:15.1 AIAA 219
"Polytechnic Education in Soviet Elementary Schools"
Chairman, E. Keith Blankenbaker; Presenter, Lorin V. Waitkus
F.12:15.2 AIAA 154
"Getting a Start in Career Education"
Chairman, Richard Lutz; Presenter, Charles Brady
F.12:15.3 AIAA
"Student Clubs and Their Future"
Presenter, James Dixon
F.1:30.1 AIAA 290
"Cast Metals in Tomorrow's IA Curriculum"
Chairman, Al Morris; Presenter, John M. Svoboda
F.1:30.2 AIAA
"Automated Drafting and Design"
Chairman, Richard Kain; Presenters, Harold L. David, Daniel Ryan
F.1:30.3 AIAA 297
"Silicone Rubber Molds and Urethane Foam Materials for the Future"
Chairman, Ronald L. Foy; Presenter, Dale Nish
F.1:30.4 AIAA 295
"The Future of Plastics in Tomorrow's IA Curriculum"
Chairman, James Grossnicklaus, Presenters, Maurice Keroack, Claude Hill, Elmer Meyer, Chal B. Rogers
F.1:30.5 AIAA 210
"Teaching Color Television Servicing for the Future"
Chairman, Richard Fowler; Presenter, Norman H. Sprankle
F.1:30.6 AIAA
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Chairman, Michael Seal, Presenter, Roger Erickson
F.1:30.7 AIAA 360
"Wood Beam Lamination Technology and Building Construction"
Chairman, D. Kenneth Calhoun; Presenter, Paul T. Nicholas
F.1:30.8 AIAA 333
"New Ways to Teaching Aids"
Chairman, C. L. Trautwein; Presenter, L. H. Canaday
F.1:30.9 AIAA
"Computer-Aided Instruction"
Chairman, David Jelden; Presenter, Bernard H. Goddard
F.3:30.1 AIAA 363
AIAA Annual Business Meeting
Chairman, Joseph J. Littrell
F.3:30.2 AIAA
AIAA Conference Planning Committee Meeting. Seattle, Cincinnati, Des Moines
Chairman, George Horton
F.4:00.1 WIAA
"Ken Pattie 25-Year Award Reception"
Chairman, Jack Estep
F.7:00.1 AIAA
AIAA Banquet
Presiding, Joseph J. Littrell
S.8:00.1 AIAA
A A Executive Board Meeting
Chairman, Donald Hackett

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