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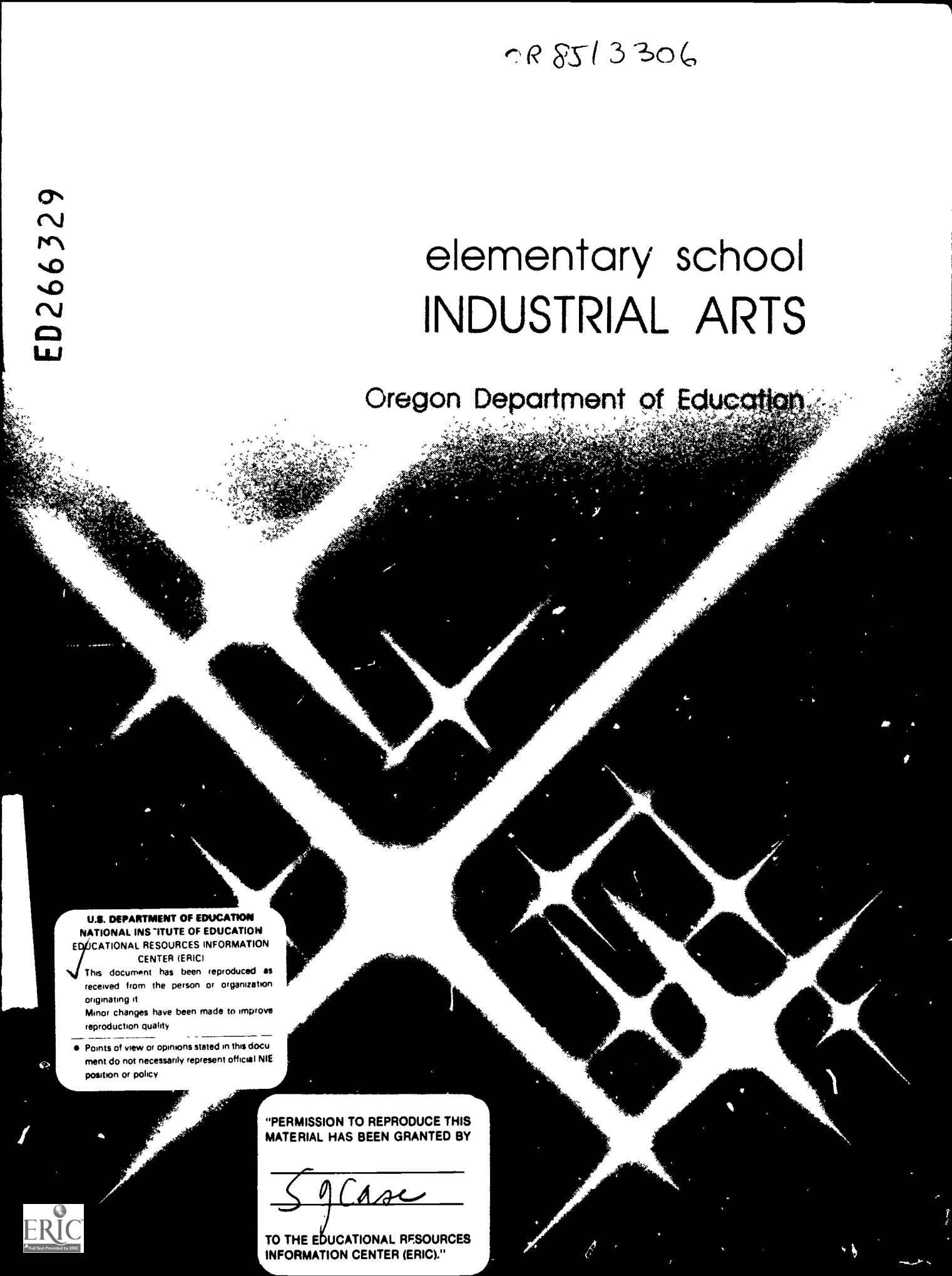
ABSTRACT

This handbook suggests ways elementary school teachers might use industrial arts (IA) activities as an alternative to traditional textbook assignments to teach or to reinforce some skills included in the state list of essential learning skills. An overview provides background information: a definition, content, scope and sequence for IA, and the integration of the essential learning skills. The next three sections contain IA goals and examples of teacher and student activities that help children acquire knowledge and skill in the three major areas of IA: graphic and electronic communication, energy-power-transportation, and materials--processes. The next section contains activity sheets that expand 17 of the 96 activities suggested in the three preceding sections. They are presented as examples to be used for planning and conducting elementary school IA activities. The final section lists resources available to develop and present IA experiences to elementary school students, including software, kits, books, human resources, and resource organizations. (YLB)

elementary school INDUSTRIAL ARTS

Oregon Department of Education



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INDUSTRIAL ARTS

a guide for teachers

1986

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FOREWORD

Today's elementary school students will live in a society that demands an understanding of advanced technology. As we move toward the next century, technical literacy will become increasingly important to all citizens. No longer is technology the sole domain of engineers and scientists, but all who seek more effective ways to live their lives.

The suggestions in this guide will help elementary school teachers plan activities to reinforce ESSENTIAL LEARNING SKILLS through industrial arts experiences. In this manner students will build the foundation that each needs for growth and development while generating an awareness of technology and related careers available to them. As students study the processes and tools of industry, they begin to discover their own interests and talents, often laying the groundwork for future occupations.

Verne A. Duncan
State Superintendent
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Further, we are indebted to the many state departments of education for their cooperation in sharing materials.

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TABLE OF CONTENTS

If we want technology to liberate rather than destroy us, then we have to assume responsibility for it.

- Anonymous

industrial arts

OVERVIEW

This section provides background information: a definition, content, scope and sequence for industrial arts, and the integration of the essential learning skills.

PURPOSE

This handbook suggests ways elementary school teachers might use industrial arts activities as an alternative to traditional textbook assignments, to teach or reinforce some skills included in the state list of essential learning skills.

DEFINITION OF INDUSTRIAL ARTS

Industrial arts is that part of a general education which provides opportunities for students to develop an understanding of the many aspects of industry and technology: consumer, technical, occupational, managerial, social, historical and cultural. It helps students acquire problem-solving concepts such as experimenting, planning, designing, constructing and evaluating. Students also learn to use tools, machines, materials and processes.

These experiences also provide students with the opportunity to apply reading, writing, computing, speaking and listening skills to practical situations. Industrial arts activities also give students a chance to apply scientific principles to practical situations.

MAJOR INDUSTRIAL ARTS AREAS

This handbook contains industrial arts goals and examples of teacher and student activities that help children acquire knowledge and skill in the three major areas of industrial arts.

* Graphic And Electronic Communication
* Energy-Power-Transportation
* Materials-Processes

INDUSTRIAL ARTS CONTENT

Elementary school industrial arts activities are influenced by content clusters used in Oregon's middle and high school programs. These clusters include graphic and electronic communication, energy-power-transportation and materials-processes. They represent the general area covered by industrial arts and focus on nearly all types of technology. The content of each cluster is derived from appropriate industrial technical processes, industrial applications, related careers and technological impact.

GRAPHIC AND ELECTRONIC COMMUNICATION

Content is organized around technical processes, applications, careers and impact of the technology. The activities that children engage in include drawing/drafting, printing, photography, computer applications and all phases of electronic communication.

ENERGY — POWER — TRANSPORTATION

Topics of study include energy, power and transportation systems. In power systems children study the generation, conversion, transmission, control and use of power. The many aspects of moving people and materials are studied by children as they examine transportation systems. Energy systems is a study of how people use and control energy to do work.

MATERIALS — PROCESSES

This content cluster provides children with an awareness of the materials and processes used by industry. Children use tools and engage technical processes while they learn how people organize and control themselves to produce and manage activities in manufacturing and construction.

INDUSTRIAL ARTS SCOPE AND SEQUENCE

	FOCUS
ELEMENTARY SCHOOL	Learning Reinforcement and Awareness
MIDDLE SCHOOL	Exploration
HIGH SCHOOL	Prevocational

CONTENT AREAS	INSTRUCTIONAL EMPHASIS
Industrial arts activities integrated within the elementary curriculum	Provide students with introductory activities related to society and technology.
• Graphic and Electronic Communications • Energy-Power-Transportation • Materials-Processes	Provide students with an opportunity to discover and develop individual talents, attitudes, interests and potential as related to society and technology.
• Graphic Communications • Energy and Power • Materials-Processes	Provide students with a closer look at specific technologies. This level develops fundamental skills in the proper use of common tools, materials and processes.

RELATIONSHIP TO ESSENTIAL LEARNING SKILLS

This guide contains many activities that can be used as an alternative to traditional textbook assignments to teach or reinforce skills included in the state list of essential learning skills. Industrial arts activities are coded, where appropriate, to the skills listed in the Oregon Department of Education publication, "Essential Learning Skills," ODE, 1985. An example follows:

Industrial Arts Activity

IA 2.2.2 Have students construct and conduct experiments with a coin operated battery. (ELS 6.2)

Essential Learning Skill (ELS)

ELS 6.2 Generate and test interpretations, explanations, predictions and hypotheses.

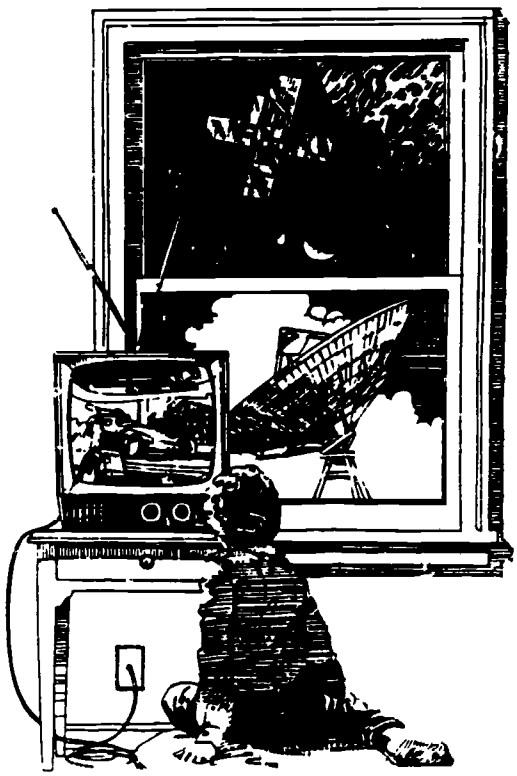
For clarification of essential learning skills refer to the ODE publication, "Essential Learning Skills." Your building principal can provide you with a copy.

The new electronic independence recreates the world in the image of a global village.

- Marshall McLuhan

graphic & electronic

COMMUNICATIONS



This section contains activities that can be used as an alternative to traditional textbook assignments to teach or reinforce skills listed in the state list of essential learning skills.

GRAPHIC AND ELECTRONIC COMMUNICATION

This section contains . ' trial arts goals and examples of teacher and student activities that help children acquire knowledge and skill in the area of graphic and electronic communication.

INDUSTRIAL ARTS GOALS

Each student:

1. Develops insights of industry and technology and their impact on our culture.

2. Discovers talents, attitudes and interests related to industrial or technical areas.

3. Develops abilities in the proper use of tools, machines and processes.

4. Develops problem-solving skills using the materials and products of industry.

5. Applies content of industrial arts to other school subjects in the curriculum.

6. Develops an understanding of careers.

7. Acquires and develops skills to manage personal resources.

8. Performs work in a safe manner.

ACTIVITIES

Many of the activities can be used as an alternative to traditional textbook assignments to teach or reinforce skills included in the state list of essential learning skills. For students to attain both the goals for industrial arts and essential learning skills, teachers must give instruction and feedback for both objectives. Examples of some of the activities that could fit this dual role are noted.

Selected activities have been expanded to help teachers implement them and are referenced as Activity Sheets in a later section.

GOAL IA 1.1

The student develops insights of industry and technology and their impact on our culture.

SUGGESTED ACTIVITIES

IA 1.1.1 Require that students make audio tape recordings of sounds created by technology (machines, vehicles, tools, sirens, bells, etc.). Then have students present the recorded sounds before classmates. Have classmates list their positive and negative reactions to the recorded sounds and give reasons why. (ELS 6.4)

IA 1.1.2 Give students specific examples of intended messages (magazines, private letters, invitations, telephone calls, television advertisements, newspapers, etc.) and have them identify to whom the messages are directed, groups or individuals.

IA 1.1.3 Provide students with a list of communication devices and have them distinguish the intended use and effectiveness of each device. (ELS 6.4)

IA 1.1.4 Have students video tape people in the school building who are using technology to communicate (telephone, typewriter, microcomputer, ditto machine, paper/pencil). Then have students present the videos before the class and have students describe the importance of technology to communication.

ESSENTIAL LEARNING SKILLS

ELS 6.4 Make reasoned evaluations.

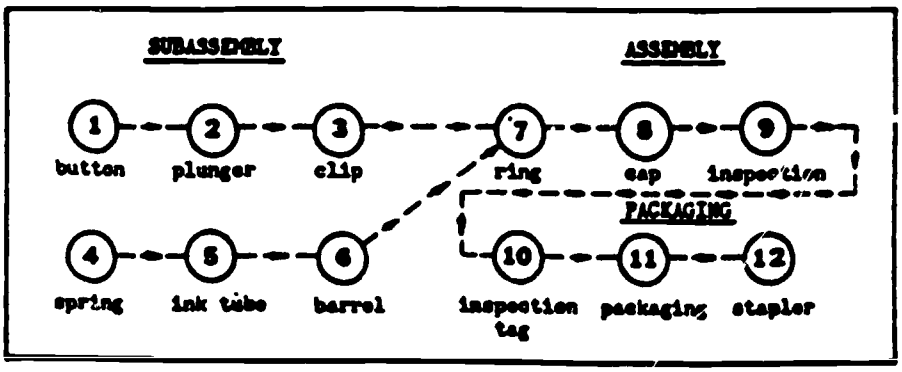
GOAL IA 1.2

The student discovers talents, attitudes and interests related to industrial or technical areas.

SUGGESTED ACTIVITIES

IA 1.2.1 Direct students to design and print iron-on T-shirt transfers with the aid of a microcomputer. Use a Macintosh computer; Apple Imagewriter, IBM, Epson, Okidata or Star Gemini dot matrix printer; Draw 'N Wear or Underware printer ribbon; and set of Underware color pens.

IA 1.2.2 Have students organize information about classroom production activities with the aid of a flow-process chart. (ELS 5.2)



Sample Flow-Process Chart of Ballpoint Pen Assembly Line

IA 1.2.3 Have students make a relief printing block using sponges, cardboard, rubber, string, blotter, or erasers. (Activity Sheet IA 1.2.3)

IA 1.2.4 Have students make a screen stencil print. (Activity Sheet IA 1.2.4)

ESSENTIAL LEARNING SKILLS

ELS 5.2 Organize ideas in an understandable format.

GOAL IA 1.3

The student develops abilities in the proper use of tools, machines and processes.

SUGGESTED ACTIVITIES

IA 1.3.1 Give students pictures or models of common communication devices and have them identify each by name.

IA 1.3.2 Have students become knowledgeable about computers by using the program, "Welcome Aboard: A Muppet Cruise to Computerland." By using this program and an Apple computer, students will become familiar with five key computer concepts.

IA 1.3.3 Using an Apple computer and a program designed for elementary school children (Turbo Turtle), have students learn the Logo programming language.

IA 1.3.4 Have students make prints using the intaglio printing process. (Activity Sheet IA 1.3.4) (ELS 7.2)

ESSENTIAL LEARNING SKILLS

ELS 7.2 Use resources beyond the classroom.

GOAL IA 1.4

The student develops problem-solving skills using the materials and products of industry.

SUGGESTED ACTIVITIES

IA 1.4.1 Have students design and then assemble a classroom mural that depicts the evolution of printing. (ELS 5.2)

IA 1.4.2 Provide student with radio experiment kits (available at local electronic stores) and have them conduct electronic communication experiments.

IA 1.4.3 Give students empty cereal boxes and have them create new designs for the packages. Insist that basic geometric shapes be used in the designs. Give awards for the most colorful, best designed, most creative, humorous, etc. (ELS 1.5)

IA 1.4.4 Have students produce a classroom newspaper with the aid of a microcomputer and word processing program. (ELS 5.2, 5.4, 5.6, 5.7)

ESSENTIAL LEARNING SKILLS

ELS 1.5 Recognize and use geometric patterns, relationships and principles to describe and classify.

ELS 5.2 Organize ideas in understandable format.

ELS 5.4 Present ideas in understandable sequence on the topic selected.

ELS 5.6 Evaluate and revise own writing for clarity, meaning, and comprehensiveness.

ELS 5.7 Apply the conventions of writing to produce effective communication.

GOAL IA 1.5

The student applies the content of industrial arts to other school subjects.

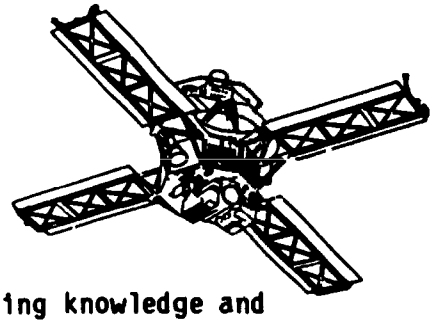
SUGGESTED ACTIVITIES

IA 1.5.1 Have students use a microcomputer and word processing program to edit and make a final draft of a report on LASER communication. (ELS 5.6)

IA 1.5.2 Require that students use a table of contents and index to locate information on communications satellites. Then have them use the information to build model satellites (use styrofoam balls, toothpicks, paper clips, etc.). (ELS 2.2)

IA 1.5.3 Have students identify and then draw basic geometric shapes using a microcomputer and graphics program. (ELS 1.5)

IA 1.5.4 Give students appropriate hand tools to layout and cut wooden geometric shapes that represent common road signs. Then have them paint the signs and make a classroom display. (ELS 1.5)



ESSENTIAL LEARNING SKILLS

ELS 1.5 Recognize and use geometric shapes.

ELS 2.2 Use instructional materials as a basis for gaining knowledge and improving comprehension.

ELS 5.6 Evaluate and revise own writing for clarity, meaning and comprehensiveness.

GOAL IA 1.6

The student develops an understanding of careers.

SUGGESTED ACTIVITIES

IA 1.6.1 Provide students with pictures, objects and tools relating to people working in communications jobs. Then have them identify the persons shown by the job being performed; e.g. radio announcer, newspaper reporter, radar operator, typesetter, television camera operator. (ELS 6.4)

IA 1.6.2 Give students a list of communications workers and have them name the place(s) where each performs their job.

IA 1.6.3 Give students a list of communications occupations and have them describe the work each person performs.

IA 1.6.4 Have students associate people with communications processes and devices. Tell them to identify those people who work at making, using or operating communications devices.

ESSENTIAL LEARNING SKILLS

ELS 6.4 Make reasoned evaluations.

GOAL IA 1.7

The student acquires and develops skills to manage personal resources.

SUGGESTED ACTIVITIES

IA 1.7.1 Have students prepare a computer development timeline using the library classification system and services to locate required information. (ELS 7.2)

IA 1.7.2 Require that students prepare a personal plan of work before beginning production of a recycled notepad. (Activity Sheet IA 1.7.2) (ELS 7.3)

IA 1.7.3 Have students follow a study plan as they use resources beyond the classroom to locate information on basic printing processes; relief, planographic, screen stencil, and intaglio. (ELS 7.3)

IA 1.7.4 Have students keep study materials on planographic, screen stencil, relief, and intaglio printing processes organized and accessible in a three-ring notebook. (ELS 7.3)

ESSENTIAL LEARNING SKILLS

ELS 7.2 Use resources beyond the classroom.

ELS 7.3 Select and use appropriate study techniques.

GOAL IA 1.8

The student performs work in a safe manner.

SUGGESTED ACTIVITIES

IA 1.8.1 Form a student safety and health committee.

IA 1.8.2 Help students develop a safety checklist for the classroom.

IA 1.8.3 Have students conduct weekly classroom safety inspections using self-designed checklists.

IA 1.8.4 Have students prepare safety slogans/posters to emphasize safe work practices. (ELS 7.4)

ESSENTIAL LEARNING SKILLS

ELS 7.4 Practice appropriate and positive health behaviors to enhance learning.

The real blast-off in computer innovation is going to happen when today's kids, growing up with pocket calculators and home computers, become the engineers of the 1990s.

- Anonymous

ENERGY–POWER–TRANSPORTATION

This section contains activities that can be used as an alternative to traditional textbook assignments to teach or reinforce skills listed in the state list of essential learning skills.

ENERGY — POWER — TRANSPORTATION

This section contains industrial arts goals and examples of teacher and student activities that help children acquire knowledge and skill in the area of energy-power-transportation.

INDUSTRIAL ARTS GOALS

Each student:

1. Develops insights of industry and technology and its impact on our culture.
2. Discovers talents, attitudes and interests related to industrial or technical areas.
3. Develops abilities in the proper use of tools, machines and processes.
4. Develops problem-solving skills using the materials and products of industry.
5. Applies content of industrial arts to other school subjects in the curriculum.
6. Develops an understanding of careers.
7. Acquires and develops skills to manage personal resources.
8. Performs work in a safe manner.

ACTIVITIES

Many of the activities can be used as an alternative to traditional textbook assignments, to teach or reinforce skills included in the state list of essential learning skills. For students to attain both the goals for industrial arts and essential learning skills, teachers must give instruction and feedback for both objectives. Examples of some of the activities that could fit this dual role are noted.

Selected activities have been expanded to help teachers implement them and are referenced as Activity Sheets in a later section.

GOAL IA 2.1

The student develops insights of industry and tecnnology and its impact on our culture.

SUGGESTED ACTIVITIES

IA 2.1.1 Give students a list of places to visit in the community and have them identify the most appropriate means (bicycle, automobile, walk, boat, bus, etc.) to get to each location. (ELS 6.4)

IA 2.1.2 Provide students with a list of items they use daily and have them identify those that must be transported.

IA 2.1.3 Give students examples of disruptions in transportation system (truck driver strike, fog forces closure of airport, snow storm closes the interstate, bus breaks down, etc.) and have them describe how transportation or a lack of it affects and/or influences people. (ELS 6.1)

IA 2.1.4 Have students construct a model layout of their community complete with all existing transportation systems (bike paths, major streets, bus routes, river, airport, etc.). Then have students identify and compare the importance of each system to the community. (ELS 6.4)

ESSENTIAL LEARNING SKILLS

ELS 6.4 Make reasoned evaluations.

GOAL IA 2.2

The student discovers talents, attitudes and interests related to industrial or technical areas.

SUGGESTED ACTIVITIES

IA 2.2.1 Have students use a microcomputer to design and manufacture paper airplanes. Use a Macintosh computer, printer and program titled, "The Paper Airplane Construction Kit." A book by the same name is available for use by those who do not have a microcomputer. (ELS 6.2)

IA 2.2.2 Have students construct and conduct experiments with a coin operated battery. (Activity Sheet IA 2.2.2) (ELS 6.2)

IA 2.2.3 Have students construct and use a solar powered light meter. (Activity Sheet IA 2.2.3) (ELS 6.2)

IA 2.2.4 Have students conduct experiments with sensors that respond to light, sound, magnetism and moisture (A Sensor Robot Electronic Project Kit is available at local electronics stores). (ELS 6.2)

ESSENTIAL LEARNING SKILLS

ELS 6.2 Generate and test interpretations, explanations, predictions and hypotheses.

GOAL IA 2.3

The student develops abilities in the proper use of tools, machines and processes.

SUGGESTED ACTIVITIES

IA 2.3.1 Give students a set of mechanics tools and have them identify each tool by name and function. (ELS 2.3)

IA 2.3.2 Provide students with a set of hand and power tools and have them identify what makes each tool operate (muscle, electricity, spring, etc.). (ELS 6.2)

IA 2.3.3 Have students follow verbal instructions as they perform routine maintenance on their bicycles using wrenches, pliers, and screwdrivers. (ELS 2.3, 6.2)

IA 2.3.4 Have students repair a bicycle tire inner tube by following instructions found in a tire patch kit. (ELS 2.2, 2.3)

ESSENTIAL LEARNING SKILLS

ELS 2.2 Use instructional material as a base for gaining knowledge.

ELS 2.3 Use oral communication to give/receive information and directions.

ELS 6.2 Generate and test interpretations, explanations, predictions and hypotheses.

GOAL 1A 2.4

The student develops problem-solving skills using the materials and products of industry.

SUGGESTED ACTIVITIES

IA 2.4.1 Challenge students to design and construct a container that will protect one egg from breakage when dropped from a height of six feet. Use styrofoam packing and other materials for the container. (ELS 6.3)

IA 2.4.2 Have students build a mousetrap powered car (Activity Sheet IA 2.4.2) (ELS 6.3)

IA 2.4.3 Direct students to research principles of aerodynamics and have them build a functioning wind tunnel. (Use cardboard mailing tubes for the tunnel, hair dryers for the wind source, and Plexiglas for a viewing window). Then test different objects in the tunnel. (Activity Sheet IA 2.4.3) (ELS 6.3)

IA 2.4.4 Using an aeronautical laboratory kit (Radio Shack) design and construct a helicopter, airplane, helium balloon or rocket. (ELS 6.3)

ESSENTIAL LEARNING SKILLS

ELS 6.3 Identify problems and approach the solutions in an organized manner.

GOAL IA 2.5

The student applies the content of industrial arts to other school subjects.

SUGGESTED ACTIVITIES

IA 2.5.1 Using the Fischertechnik Robotic Computing Kit, have students build a simple computer-controlled traffic signal. (Available from Fischer America, 175 Route 46 West, Fairfield, NJ 07006)

IA 2.5.2 Have students inflate balloons and then release them to illustrate rocket propulsion. Then direct them to use the library to learn more about how rockets are propelled and the application of Newton's third law of motion, "For every action there is an equal, but opposite reaction." (ELS 7.2)

IA 2.5.3 Give students a map showing airline routes between major cities. Have them estimate distances between selected cities. (Maps showing these routes are available from major airlines.) (ELS 1.7)

IA 2.5.4 Have students study a chart comparing the percent drag of different rocket nose cones and then require that they select from a chart of various nose cone shapes the one that would have the least drag. (Activity Sheet IA 2.5.4) (ELS 2.2)

ESSENTIAL LEARNING SKILLS

ELS 1.7 Estimate and measure quantities.

ELS 2.2 Use instructional materials as basis for gaining knowledge and improving comprehension.

ELS 7.2 Use resources beyond the classroom.

GOAL IA 2.6

The student develops an understanding of careers.

SUGGESTED ACTIVITIES

IA 2.6.1 Give students a set of vehicle cards and operator cards and have them match the operator to the proper vehicle.

IA 2.6.2 Provide students with pictures of an airplane pilot, taxi driver, astronaut, bus driver, truck driver, ship's captain, etc., and have them name the occupation of the person by their uniform. (ELS 6.4)

IA 2.6.3 Give students pictures of a gasoline station attendant, airline baggage handler, tollbooth attendant, auto mechanic, traffic officer, etc., and have them identify how each person's occupation relates to transportation.

IA 2.6.4 Provide information to students on careers in transportation and have them categorize the careers according to movement, storage or service in transportation. (ELS 6.1)

ESSENTIAL LEARNING SKILLS

ELS 6.1 Recognize and test interpretations, explanations, predictions and hypotheses.

ELS 6.4 Make reasoned evaluations.

GOAL IA 2.7

The student acquires and develops skills to manage personal resources.

SUGGESTED ACTIVITIES

IA 2.7.1 Direct students to gather and record information on six basic forms of energy using noncirculating reference materials. (ELS 7.2)

IA 2.7.2 Have students organize information on basic forms of energy and have it readily accessible in a three-ring notebook. (ELS 7.3)

IA 2.7.3 Have students use the library classification system to locate specialized resources for a report on the space shuttle. (ELS 7.2)

IA 2.7.4 Require that students prepare written clarification questions about the procedures they must follow in constructing a model rocket. (Activity Sheet IA 2.7.4) (ELS 7.3)

ESSENTIAL LEARNING SKILLS

ELS 7.2 Use resources beyond the classroom.

ELS 7.3 Select and use appropriate study techniques.

GOAL IA 2.8

The student performs work in a safe manner.

SUGGESTED ACTIVITIES

IA 2.8.1 Have students identify potential hazards while handling tools and materials; electrical shock, hot lights, chemicals, moving parts. (ELS 7.4)

IA 2.8.2 Give students safety rules and transportation situations and have them name at least one rule for each situation; school bus, bicycle, street crossing, roller skate automobile, skate board, row boat, etc. (ELS 7.4)

IA 2.8.3 Give students pictures or models of vehicles and safety devices for each. Then have them identify the significance of using the devices while riding in or on these vehicles: automobile--seat belts, boat--life jackets, bicycle--helmet, skate board--arm and knee pads, etc. (ELS 7.4)

IA 2.8.4 Provide students with pictures or models of a motorcycle, elevator, escalator, sailboat, train, etc., and have them identify potential hazards while using these vehicles. (ELS 7.4)

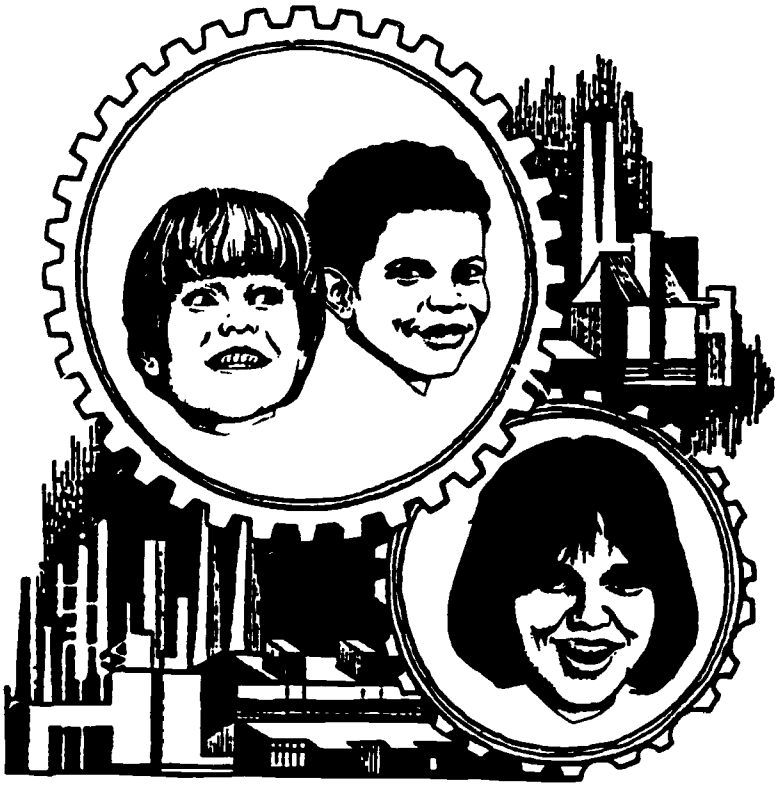
ESSENTIAL LEARNING SKILLS

ELS 7.4 Practice appropriate and positive health behaviors to enhance learning.

There are only two lasting bequests we can hope to give our children. One of these is roots; the other, wings.

- Hodding Carter

MATERIALS — PROCESSES



This section contains activities that can be used as an alternative to traditional textbook assignments to teach or reinforce skills listed in the state list of essential learning skills.

INDUSTRIAL ARTS GOALS

This section contains industrial arts goals and examples of teacher and student activities that help children acquire knowledge and skill in the area of materials-processes.

Each student:

1. Develops insights of industry and technology and its impact on our culture.
2. Discovers talents, attitudes and interests related to industrial or technical areas.
3. Develops abilities in the proper use of tools, machines and processes.
4. Develops problem-solving skills using the materials and products of industry.
5. Applies content of industrial arts to other school subjects in the curriculum.
6. Develops an understanding of careers.
7. Acquires and develops skills to manage personal resources.
8. Performs work in a safe manner.

ACTIVITIES

Many of the activities can be used as an alternative to traditional textbook assignments to teach or reinforce some skills included in the state list of essential learning skills. For students to attain both the goals for industrial arts and essential learning skills, teachers must give instruction and feedback for both objectives. Examples of some of the activities that could fit this dual role are noted.

Selected activities have been expanded to help teachers implement them and are referenced as Activity Sheets in a later section.

GOAL IA 3.1

The student develops insights of industry and technology and its impact on our culture.

SUGGESTED ACTIVITIES

IA 3.1.1 Have students make model trucks and require them to identify how people are affected and/or influenced by production processes. (Activity Sheet IA 3.1.1) (ELS 6.4)

IA 3.1.2 Give students examples of manufacturing enterprises and require that they list the consequences of these production activities (environmental impacts, economy, jobs, life-style, etc.). (ELS 6.4)

IA 3.1.3 Provide students with information on production activities in the local community. Then have each student identify the importance of each activity to the community.

IA 3.1.4 Give students examples of manufacturing and construction activities and have them describe the importance of these activities to their daily life.

ESSENTIAL LEARNING SKILLS

ELS 6.4 Make reasoned evaluations.

GOAL IA 3.2

The student discovers talents, attitudes and interests related to industrial or technical areas.

SUGGESTED ACTIVITIES

IA 3.2.1 Have students gather information outside the classroom and then produce miniature flower pots using an assembly line. (Activity Sheet IA 3.2.1) (ELS 7.2)

IA 3.2.2 Give students a robotics worksheet and have them identify the component parts of a robot. (Activity Sheet IA 3.2.2) (ELS 2.3)

IA 3.2.3 Have students follow oral instructions to manufacture paper. (Activity Sheet IA 3.2.3) (ELS 2.3)

IA 3.2.4 Give students oral instructions on how to prepare a timeline that illustrates the development of basic industrial tools. (ELS 7.1)

ESSENTIAL LEARNING SKILLS

ELS 2.3 Use oral communication to give or receive information and directions.

ELS 7.1 Clarify purpose of an assignment.

ELS 7.2 Use resources beyond the classroom.

GOAL IA 3.3

The student develops abilities in the proper use of tools, machines and processes.

SUGGESTED ACTIVITIES

IA 3.3.1 Give students a set of common hand tools and have them point to and give the names of each tool displayed.

IA 3.3.2 Divide students into two groups and have them compete in a tool identification relay. Provide each team with a set of tool name cards. Instruct the first member of each team to draw a card, walk across the room and identify the tool whose name appears on the card. The team whose members correctly identify all tools first wins the relay.

IA 3.3.3 Form two student relay teams whose purpose is to drive a nail all the way into a pine block. Start a nail in a pine block for each team. Then allow each team member one opportunity per round to strike the nail. Continue the rounds until one team successfully completes the task.

IA 3.3.4 Set up two workstations each with a saw, clamp, try square, sawhorse and pine boards. Form two teams and have each team member measure and cut a board to length. The team whose members each cut a board to proper length are declared winners.

GOAL IA 3.4

The student develops problem-solving skills using the materials and products of industry.

SUGGESTED ACTIVITIES

IA 3.4.1 Have students use library resources to locate information on geodesic domes and their use as houses. Then have students design and build model geodesic houses. (Use tagboard and mailing tape to build the models.) (ELS 7.2)

IA 3.4.2 Provide students with a variety of mechanical fasteners; nuts, bolts, washers, wood screws and nails. Have them design and carry out a series of experiments where they test the holding power of each fastener. Require that they make a written report of their findings. (ELS 5.6, 6.3)

IA 3.4.3 Have each student design and build a container in which to store their personal school supplies, e.g. pencils, erasers, crayons, scissors, etc. Give awards for the most creative, colorful, smallest, largest, heaviest, etc. (ELS 6.3)

IA 3.4.4 Divide the class into teams of three-to-four students and have them design and build trash receptacles using readily available materials. You may wish to place limitations on the receptacles such as size and weight. Present awards to each team for their work, the most creative, colorful, odd-shaped, largest, smallest, etc. (ELS 6.3)

ESSENTIAL LEARNING SKILLS

ELS 5.6 Evaluate and revise own writing for clarity, meaning and comprehensiveness.

ELS 6.3 Identify problems and approach their solution in an organized manner.

ELS 7.2 Use resources beyond the classroom.

GOAL IA 3.5

The student applies the content of industrial arts to other school subjects.

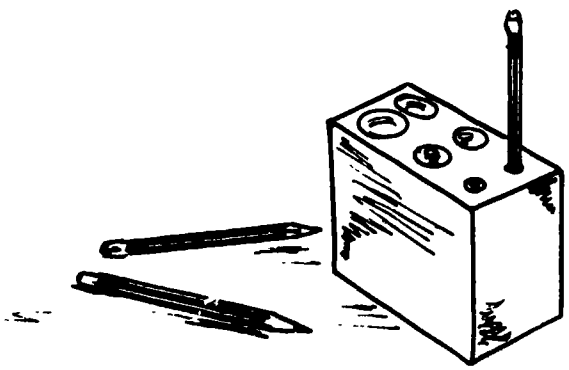
SUGGESTED ACTIVITIES

IA 3.5.1 Have students build a metric geoboard and then require that they model simple geometric shapes by placing rubber bands around the pins on the face of the board. (Activity Sheet IA 3.5.1) (ELS 1.5)

IA 3.5.2 Give students 7-ounce and 13-ounce claw hammers and have them estimate and determine the weight of each hammer. (ELS 1.7)

IA 3.5.3 Have students build model truss bridges and then estimate and determine the weight of objects that cause the bridges to collapse. (Activity Sheet IA 3.5.3) (ELS 6.3)

IA 3.5.4 Have students construct a penholder by drilling two holes each 1/4", 3/8" and 1/2" diameter in a 2" x 2" x 4" pine block.



ESSENTIAL LEARNING SKILLS

ELS 1.5 Recognize and use geometric patterns, relationships and principles to describe and classify.

ELS 1.7 Estimate and measure quantities.

ELS 6.3 Identify problems and approach their solution in an organized manner.

GOAL IA 3.6

The student develops an understanding of careers.

SUGGESTED ACTIVITIES

IA 3.6.1 Give students pictures of industrial work places and have them name the workers shown. (ELS 3.1)

IA 3.6.2 Give students pictures of people performing assembly line jobs and have them identify the worker by the activity or situation shown. (ELS 3.1)

IA 3.6.3 Provide students with a list, examples, and/or illustrations of tools used by production workers and have them match the tool to the worker(s). (ELS 3.1)

IA 3.6.4 Have students trace outlines of each other on butcher paper. Then have each one cut the outline out and draw the appropriate tools or uniform of the occupation they plan to follow. (ELS 3.1)

ESSENTIAL LEARNING SKILLS

ELS 3.1 Comprehend implied meanings of written, oral and visual communications.

GOAL IA 3.7

The student acquires and develops skills to manage personal resources.

SUGGESTED ACTIVITIES

IA 3.7.1 Have students find and report information on papermaking processes by locating and checking-out books and other circulating materials. (ELS 7.2)

IA 3.7.2 Have students organize themselves for the line assembly of ball point pens. (Activity Sheet IA 3.7.2) (ELS 5.4)

IA 3.7.3 Have students identify stressful situations they experienced during participation in classroom production activities. Ask them to suggest ways of minimizing stress in these activities. (ELS 7.4)

IA 3.7.4 Have students prepare a set of cards that ask clarifying questions about the safe use of tools. Divide the class into two teams and have the teams compete for right answers to the questions.

ESSENTIAL LEARNING SKILLS

ELS 5.4 Present ideas in understandable sequence on the topic selected.

ELS 7.2 Use resources beyond the classroom.

ELS 7.4 Practice appropriate and positive health behaviors to enhance learning.

GOAL IA 3.8

The student performs work in a safe manner.

SUGGESTED ACTIVITIES

IA 3.8.1 Have students name at least one safety rule for each basic hand tool found in the classroom. (ELS 7.4)

IA 3.8.2 Have students identify safe traffic flow during production activities by marking safety zones on the classroom floor. (ELS 7.4)

IA 3.8.3 Require that students describe the importance of following safety rules while using hand and power tools. (ELS 7.4)

IA 3.8.4 Tell students to help others be safe by reminding them of proper safety practices. (ELS 7.4)

ESSENTIAL LEARNING SKILLS

ELS 7.4 Practice appropriate and positive health behaviors to enhance learning.

Too often we give children answers to remember rather than problems to solve.

- Roger Lewin

sample

LEARNING ACTIVITIES

This section contains sample industrial arts learning activities. They are presented as examples for use in developing classroom learning experiences.

ACTIVITY SHEETS

This section contains activity sheets that expand 17 of the 96 activities suggested in the preceding sections. They are presented as examples to be used for planning and conducting elementary school industrial arts activities.

Activity Number	Activity Title
IA 1.2.3	Relief Printing Block
IA 1.2.4	Screen Stencil Printing
IA 1.3.4	Intaglio Printing
IA 1.7.2	Recycled Notepad
IA 2.2.2	Coin Operated Battery
IA 2.2.3	Solar Powered Light Meter
IA 2.4.2	Mousetrap Powered Car
IA 2.4.3	Model Wind Tunnel
IA 2.5.4	Rocket Nose Cones
IA 2.7.4	Model Rocket
IA 3.1.1	Mass Production of Model Trucks
IA 3.2.1	Flower Pot Production
IA 3.2.2	Robots
IA 3.2.3	Papermaking
IA 3.5.1	Geoboard
IA 3.5.3	Load Testing A Bridge
IA 3.7.2	Line Assembly of Ballpoint Pens

RELIEF PRINTING BLOCK

Relief printing is done by placing ink on a raised surface. The inked surface is then pressed against paper. The ink comes off on the paper in the shape of the raised surface. A fingerprint is an example of relief printing. When an inked fingertip is pressed against paper, only the high spots leave ink on the paper. The low spots of the finger tip do not leave ink on the paper as they do not touch the surface. Relief printing is used to produce materials such as packaging materials, pamphlets and catalogs.

MATERIALS/SUPPLIES

Blotters, string, vegetables, erasers, styrofoam, inner tubes, corks, cardboard, small pieces of wood, white glue, ink or paint, scissors and clean-up rags.

PROCEDURE

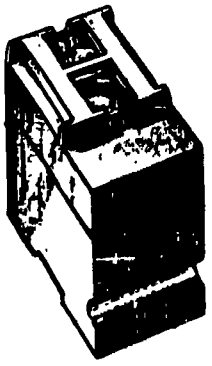
1. Cut blotters into interesting designs. Glue the designs to a piece of cardboard or wood. Apply ink or paint to the raised portion of the design and print it on paper.

2. Dip string in glue and arrange it in a pleasing design on a piece of cardboard. Apply ink or paint to the string and print the design.

3. Cut a design into a potato. Apply ink and print.

4. Carve a design in styrofoam meat containers with a pencil. Then ink and print

5. Try erasers, cork, sponges, bottle caps.



ACTIVITY SHEET IA 1.2.4

SCREEN STENCIL PRINTING

This process is often called silk screen printing. Nylon, organdy and wire are also used as screens. A stencil is made by hand or by photography. The stencil is stuck to the screen, where it blocks out places not to be printed. Ink or paint is placed on the screen and squeegeed across the screen. Ink passes through holes in the screen not covered by the stencil. This process is used to print words or designs on posters, signs, T-shirts, bottles and greeting cards.

MATERIALS/SUPPLIES

Butcher paper, screen and frame, ink, squeegee, paper, scissors, masking tape, ink solvent and clean-up rags.

PROCEDURE

1. Create a design on butcher paper.
2. Cut the design from the paper.
3. Tape cut design to screen.
4. Be sure all edges are taped.
5. Place a blank sheet of paper under screen.
6. Pour a small amount of ink across screen.
7. Squeegee ink across entire screen.
8. Lift screen and remove print.
9. Remove design and clean ink from screen.

ACTIVITY SHEET IA 1.3.4

INTAGLIO PRINTING

Intaglio printing is done by placing ink in a depressed (sunken) area and then pressing the inked surface against paper. The image to be printed is cut into a hard plate (often steel) to form a depressed image. Ink is then put into the depressed image. Excess ink is wiped off the surface, but ink in the sunken area remains. When paper is pressed against the plate, the ink is pulled from the depressed image onto the paper. The main intaglio processes are engraving and gravure printing. Products made by this process are paper money, wedding announcements, labels, letterheads, stock and bond certificates, and packaging materials.

MATERIALS/SUPPLIES

Plastic sheets 1/8" to 1/4" thick, scratch awl, ink, paper, sponge, scraps of wood, rubber mallet, clean-up rags.

PROCEDURE

1. Scratch a design into one surface of a plastic sheet.
2. Fill the sunken image areas with ink by pulling on an ink dampened sponge across the plastic sheet.
3. Wipe the excess ink off the surface of the plastic sheet. (Do not remove ink from the depressed areas.)
4. Place a blank sheet of paper on the image side of the plastic sheet and cover with a piece of wood. (Work on a hard, flat table.)
5. Strike the wood with a rubber mallet.
6. Remove the wood and print. Set print aside to dry.
7. Clean ink out of the sunken areas.

RECYCLED NOTEPAD

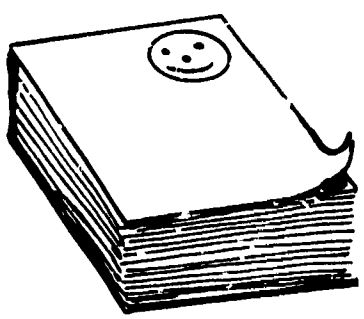
Everyone can do their part to conserve valuable resources. One way is to reuse old papers in notepads. Old ditto papers, tests, worksheets and similar discarded papers can be used for the notesheets. Cardboard or tagboard scraps make good backing for the pads.

MATERIALS/SUPPLIES

Used sheets of paper, cardboard or tagboard scraps, padding compound (rubber cement works well), scissors, heavy books or other objects to serve as weights, crayons, relief printing block or other marking devices.

PROCEDURE

1. Cut approximately 50 sheets of used paper to desired notepad size.
2. Print or draw a design on the blank side of each sheet.
3. Cut one backing sheet out of cardboard or tagboard.
4. Place sheets image side up on backing sheet.
5. Place book or weight on notepad.
6. Apply padding to one edge of pad.
7. Allow padding to dry.



COIN OPERATED BATTERY

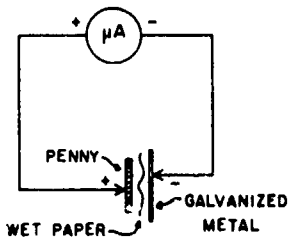
A battery is formed when two dissimilar metals are in contact with a liquid that is capable of acting chemically on the materials. This liquid is called an electrolyte. The electrolyte reacts on the metal to extract electrons and atoms. The voltage produced between the dissimilar metals depends on the properties of the metals. In this experiment a copper penny will be used for the positive (+) electrode and three other metals for the negative (-) electrodes.

MATERIALS/SUPPLIES

Meter - 0 to 250 microamperes with a 650 ohm movement, two 6-inch test leads with alligator clips on each end, blotting paper, vinegar, a penny, a nickel, pieces of galvanized metal and aluminum (2" x 2" each), experiment board or case.

PROCEDURE

1. Secure all components and make readily available to students.
2. Provide students with the electrical schematic given below.
3. Demonstrate the proper procedure to follow.
4. Have students place a piece of blotting paper moistened with vinegar (this is the electrolyte) between a penny and a piece of galvanized metal.
5. Have students use test leads to connect the meter across the "battery."
6. Tell students to record the meter reading. The amount of meter deflection is an indication of "battery" output. Record the meter reading.
7. Now have students replace the galvanized metal with a nickel and again record the amount of meter deflection.
8. Repeat the process using a piece of aluminum for the negative (-) electrode.
9. Finally have students identify factors that may have influenced the different meter readings.



ACTIVITY SHEET !A 2.2.3

SOLAR POWERED LIGHT METER

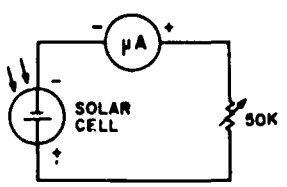
This activity demonstrates the conversion of light energy directly into electrical energy through a solar cell. A meter connected across the cell provides a visual readout for relative light intensity. The sensitivity of the circuit over a wide range of levels is adjusted by a variable resistor. The meter and variable resistor form a simple voltmeter across the solar cell. The resistor can be adjusted for voltage ranges of .16 to .12 volts and therefore poses no danger to students. This circuit is similar to those light meters found in cameras.

MATERIALS/SUPPLIES

Meter - 0 to 250 microamperes with a 600 ohm movement, solar cell #K-2 DA-40154 or substitute, variable resistor at 50K ohms, three 6-inch test leads with alligator clips on each end and an experiment board or small plastic container.

PROCEDURE

1. Secure all component parts and prepare an experiment board or container. (The circuit will need to be moved from place-to-place.)
2. Demonstrate the procedure for assembling the light meter.
3. Have students connect the circuit according to the electrical schematic shown below.
4. When students have correctly assembled the circuit, direct them to check the light levels at different points around the classroom and compare these readings with some obtained outdoors.
5. Require them to carefully record the various readings.
6. Then have students identify factors that may have influenced the results.
7. Next have them identify factors that may have influenced the different meter readings.



MOUSETRAP POWERED CAR

This activity will demonstrate one way in which a vehicle may be powered in order to move it from one location to another. Additionally, students will apply a number of simple machines such as the wheel and axle, lever, and screw as possible solutions to overcome friction and gain mechanical advantage.

MATERIALS/SUPPLIES

Mousetrap, wire 8" to 10" (8-14 gauge), empty thread spool, four wheels (1 1/2" to 4" diameter), two heavy gauge wires or dowel rods for axles, ball of string or fishing line, two wooden frames 1/2" x 3/4" x 12", six 3/4" wire brads, white glue, hack saw, hammer, long-nose pliers, side-cutting pliers and hand drill. (These are suggestions only. Individual student designs may require different resources.)

PROCEDURE

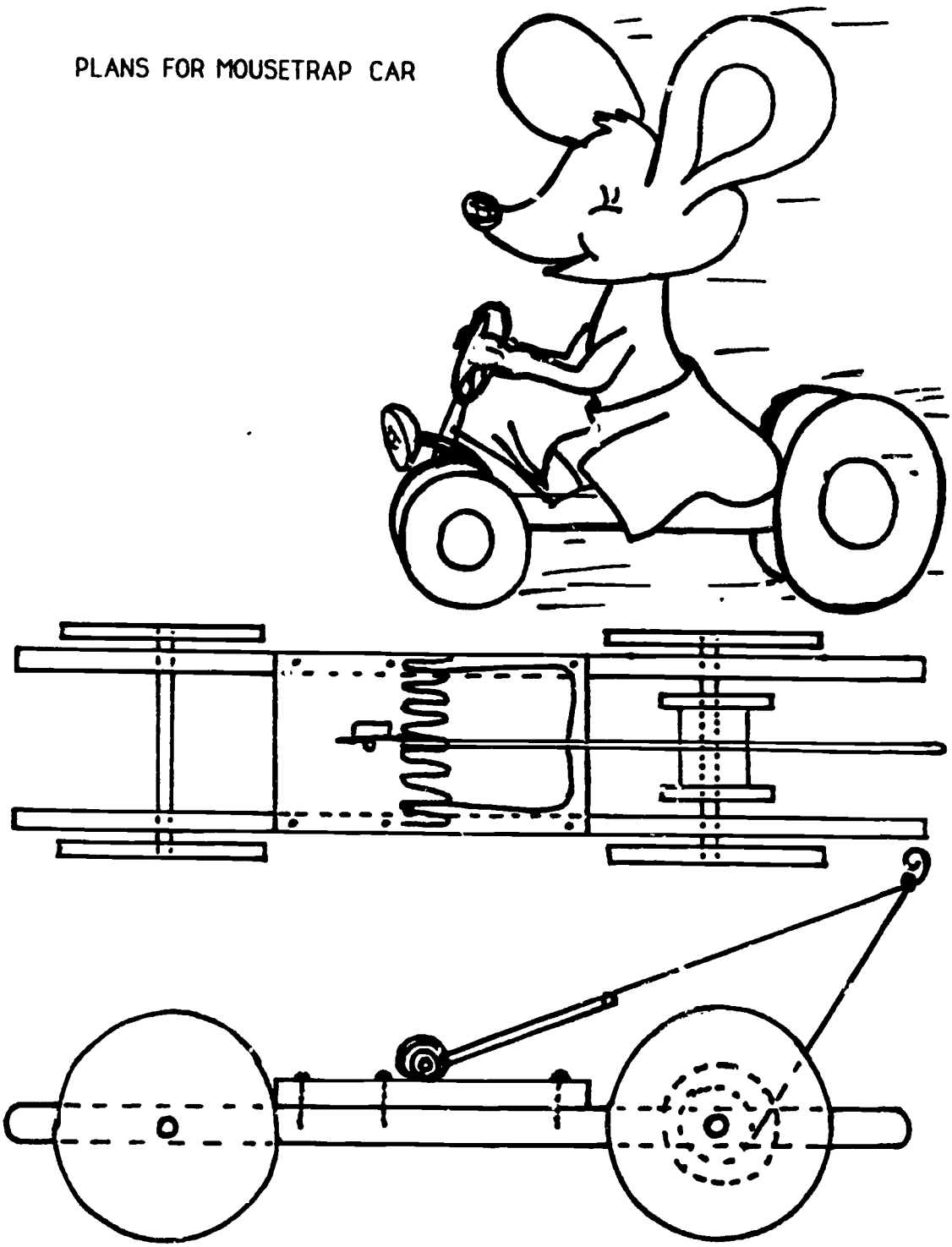
1. Have students prepare their own car designs based on the accompanying diagrams. (Encourage students to modify the basic design.)

2. The basic construction procedure follows:

   a. Cut two side frames to desired length.
   b. Drill two holes in each frame for axles.
   c. Nail mousetrap to frame.
   d. Cut two axles to length.
   e. Drill axle holes in each wheel.
   f. Assemble front axle and wheels in frame.
   g. Assemble rear axle, spool and wheels in frame.
   h. Cut metal rod to length and attach to mousetrap spring.
   i. Tie string to end of metal rod and around spool.

3. Then have students test and modify their cars.

PLANS FOR MOUSETRAP CAR



ACTIVITY SHEET IA 2.4.3

MODEL WIND TUNNEL

Students can research the fundamentals of aerodynamics with the aid of a model wind tunnel. The classroom constructed tunnel can be easily made by students using readily available materials. The completed wind tunnel can be used to test the aerodynamic qualities of model cars, model rocket nose cones, model airplane wing sections and many other student constructed objects.

MATERIALS/SUPPLIES

Cardboard mailing tubes or tubes around which carpets have been rolled, fine tooth hand saws, scissors, duct tape, clear flexible plastic sheets, hair dryers or other blower devices, straight pins, small cloth streamers and pine boards (6" x 30").

PROCEDURE

1. Have students cut a cardboard tube to length (about 24" long).
2. Cut a viewing window opening in the tube (about 4" x 6").
3. Cut a piece of clear flexible plastic sheet (5" x 7") for the viewing window.
4. Use duct tape to fasten the cardboard tube to the pine board.
5. Tape a hair dryer nozzle to one end of the tube. Carefully seal all openings.
6. Place an object (model car, nose cone, etc.) into the tunnel. Insert the object through the viewing window opening. Fasten streamers to the object and fasten the object securely in place.
7. Tape the Plexiglas sheet over the viewing window opening. Be sure all the edges are securely fastened.
8. Turn the blower motor on and observe activity through the window.
9. Injection of smoke into the test chamber provides increased opportunities to observe aerodynamic qualities.

ACTIVITY SHEET IA 2.5.4

ROCKET NOSE CONES

Rocket nose cones are made in a variety of sizes and shapes. The function of a rocket determines the nose cone design. When a high rate of speed is desired the design of the nose cone must minimize resistance or drag on the rocket. When a rocket's payload is a communications satellite, high speed is not extremely important and a different nose cone design is used. A flat nose cone shape presents the greatest amount of drag.

MATERIALS/SUPPLIES

Small pine or balsa blocks, wood files, surforms, sandpaper, bench vises, clamps, wind tunnel (build in Activity Sheet IA 2.4.3), streamers and pins for use in wind tunnel experiments.

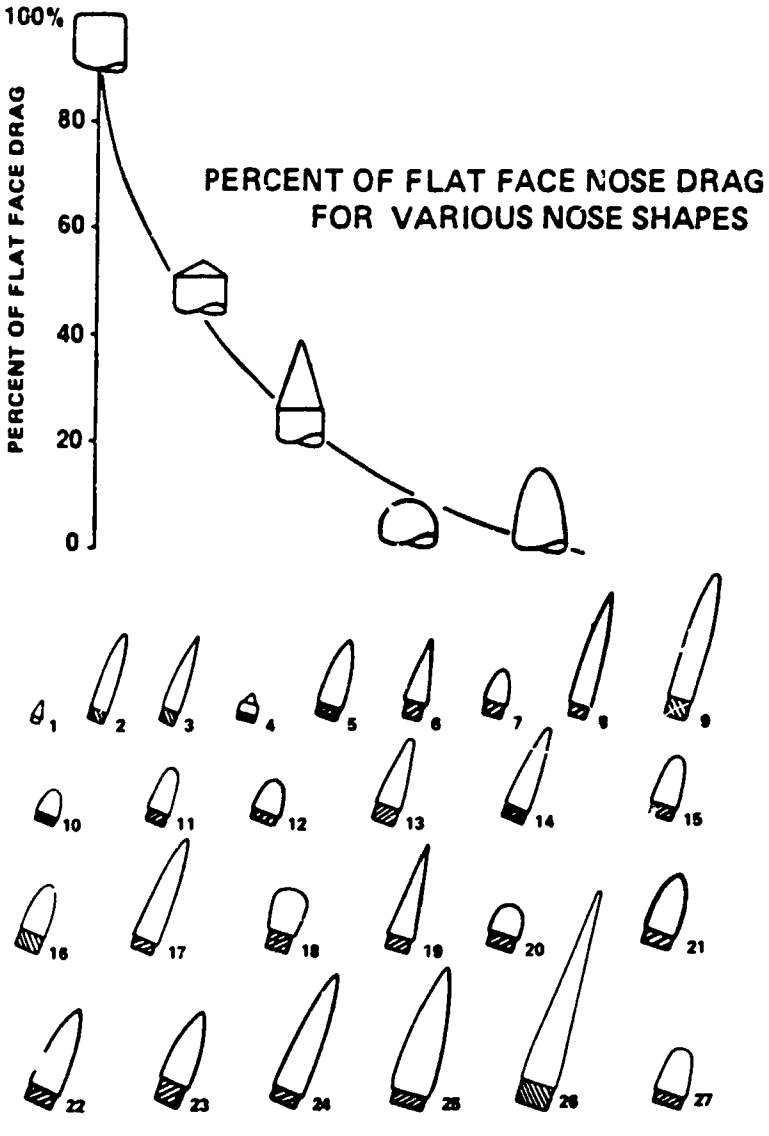
PROCEDURE

1. Have your students study the chart comparing percent of flat face nose drag for various nose shapes and then select from a chart of various nose cone shapes the one that would have the least resistance or drag.

2. Now have each student select one nose cone shape and form a small block of pine or balsa to that design.

3. Then have each student attach streamers to their completed nose cone and test it in a wind tunnel. (Activity Sheet IA 2.4.3)

4. Have students record, compare and report their observations of the behavior of different nose cone designs.



NOSE CONES

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MODEL ROCKET

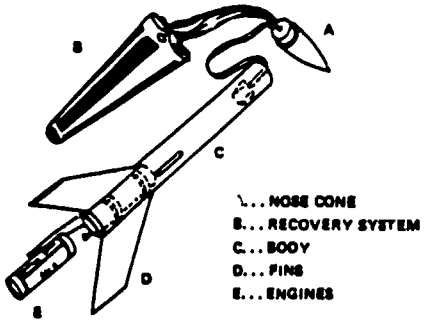
People and things can be moved from one place to another through space using rockets. All rockets include a body, fins, nose cone, and recovery system. Some rockets also include payloads and internal guidance systems. The body or capsule houses the engines, operating gear and payload. The guidance system steers and otherwise controls the flight of the spacecraft. These components can be illustrated through construction of a model rocket.

MATERIALS/SUPPLIES

Dowel rod - 1" diameter for body, small pine or balsa blocks for nose cones, stiff tagboard for fins, wood files, surforms, sandpaper, white glue, hand saws, paint and brushes, clean-up rags.

PROCEDURE

1. Have students research rocket designs and develop plans for construction of a model.
2. Measure, layout and cut the rocket body from a dowel rod.
3. Shape a nose cone from a pine or balsa block.
4. Layout and cut fins from heavy tagboard.
5. Assemble rocket component parts.
6. Decorate the rocket with paints.



ACTIVITY SHEET IA 3.1.1

MASS PRODUCTION OF MODEL TRUCKS

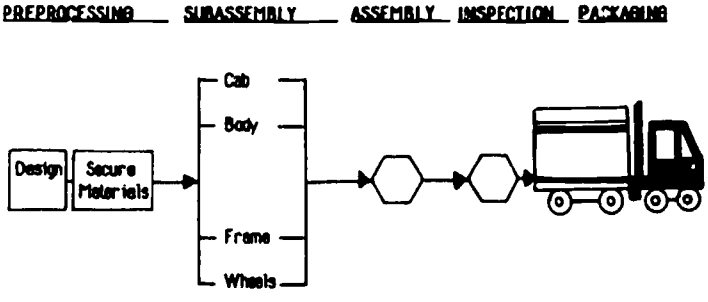
Mass production of vehicles requires the combination of parts with others into subassemblies (smaller units that are combined with larger units). This is called assembly. Vehicular assembly requires a materials handling system in which all parts of the vehicle must flow together at the right time and at the right place. This is called a line assembly and consists of subassembly, assembly, inspection and packaging.

MATERIALS/SUPPLIES

Random lengths of pine lumber, precut wheels, wood screws, nails, white glue, layout and measuring tools, hammers, saws, surforms, paint, brushes, clean-up rags.

PROCEDURE

1. Have students research a model truck design and then develop working drawings.
2. Determine how many units will be built.
3. Have students organize the assembly line and assign jobs to each person. Be sure each student has a job.
4. Emphasize that assembly flows through subassembly, assembly, inspection and packaging.
5. Then have students begin production.



FLOWER POT PRODUCTION

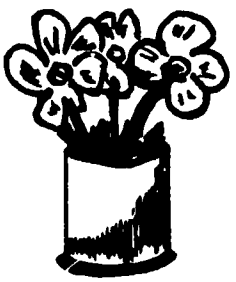
Manufacturing requires that materials be formed and separated to make components (parts) or simple one-piece products. Some parts are combined with other parts into subassemblies (smaller units are combined into larger units) or into finished products. Combining parts is called assembly. Assembly may be viewed in two ways: 1) those combining processes, especially bonding and mechanical fastening, that are used to put parts together into subassemblies or final assemblies or 2) a materials handling system in which all parts of a product must flow together at the right time and at the right place.

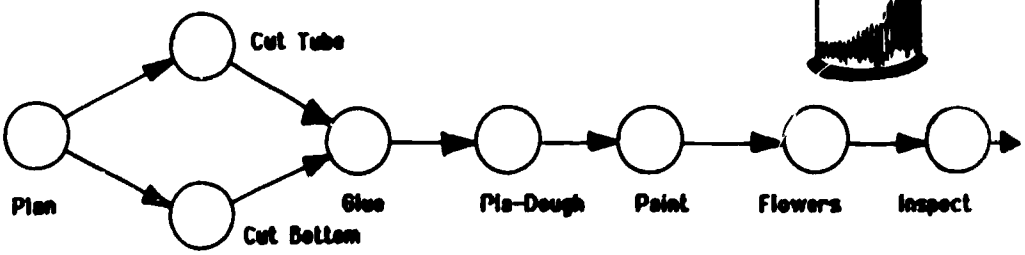
MATERIALS/SUPPLIES

Cardboard mailing tubes, assorted pieces of tagboard or poster board, florist clay or Pla-Dough, plastic or dried flowers, waterbase paints, brushes, scissors, white glue, fine tooth hack or coping saws and clean-up rags.

PROCEDURE

1. Have students study the entire production process and decide: size and color of pots, how many will be produced, who will do what jobs, etc.
2. Cut mailing tubes to length.
3. Cut pot bottom from tagboard slightly larger than diameter of tube.
4. Glue bottom to mailing tube.
5. Insert florist clay or Pla-Dough in bottom of pot.
6. Paint pots.
7. Insert plastic or dried flowers into pot.
8. Inspect product for defects.





ACTIVITY SHEET IA 3.2.2

ROBOTS

A robot is a mechanical arm or manipulator that is capable of moving parts, objects, tools and special devices by means of preprogrammed motions and points. The robot's basic features are: the manipulator or mechanical arm, the controller (computer), joints that allow the arm to move, and effectors (similar to human hands) for grasping objects, sensors that are the robot's eyes and ears, and a base that provides stability.

The automobile industry is the primary user of robots accounting for 25 percent of all U.S. installations. Manufacturers of consumer appliances such as dishwashers and washing machines are the second largest user group. Robots are primarily used for machine loading/unloading, parts handling and positioning, welding, spray painting and inspection.

MATERIALS/SUPPLIES

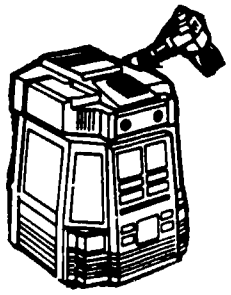
The Elami Jr. educational robot is a supplemental teaching tool available from American Robotics (for ages five and up). Elami helps students discover how robots actually hear, see and remember.

PROCEDURE

1. Introduce students to the robot's basic components by using terms from the following vocabulary list to label the accompanying illustration.

   - joints, - base, - arm - controller, - end effector, - sensor

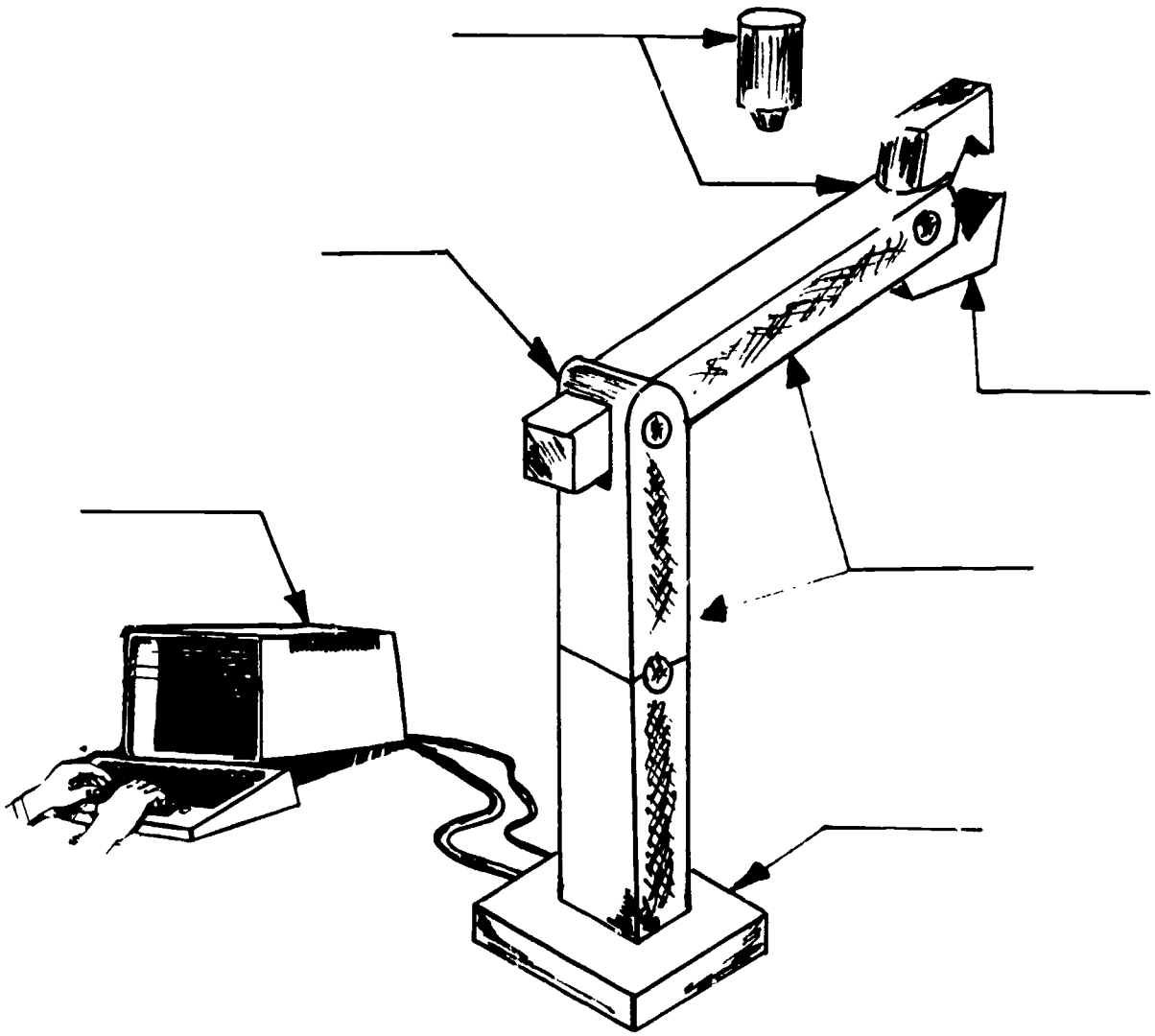
2. If available, use Elami or other teaching robots to demonstrate the principles of robotics.



VOCABULARY

Check your understanding of the robot's basic components by using the terms from the following vocabulary list to label the following diagram.

- joints - base - arm - controller - end effector - sensor



ACTIVITY SHEET IA 3.2.3

PAPERMAKING

The basic process of making paper has not changed in more than 2000 years. The process involves two stages: the breaking up of the raw material in water to form a suspension of individual fibers; and the formation of felt sheets by spreading this suspension on a porous surface, through which excess water can drain. Oregon's paper mills use this basic process to manufacture their products.

MATERIALS/SUPPLIES

Seven-quart canner or large vessel, pulp from a mill or half box of tissues, deckle and mold, paper towels, electric iron, egg beater or large wooden spoon, heavy books or weights, five percent glue size solution.

PROCEDURE

1. Fill canner three-fourths full of warm water.
2. Place paper pulp (about the size of a golf ball) in the water; or
3. If pulp is not available, tear up 30 double sheets of tissue and put in the water.
4. Stir the pulp or tissue until it is thoroughly dissolved in the solution.
5. Beat the solution for a few minutes with an egg beater.
6. Fit the "deckle" over the "mold" and at an angle of about 25 degrees from the horizontal, scoop into the pulp solution.
7. Raise the mold horizontally so pulp on the screen is level with pulp in the canner. Rotate the mold horizontally with a circular motion several times.
8. Lift the mold straight-up and let suction help drain water out. Quickly lift the deckle off the mold.
9. Gently press mold, face down, in a rolling motion on a damp paper towel.
10. Beginning at one corner, raise the mold. The sheet will cling to the wet paper towel and leave the mold.
11. Place another damp paper towel on the top of the sheet and then place several heavy books or weights on the wet sheets for several minutes.
12. Remove the weights and damp cover sheet.
13. Place the paper on a hard surface and cover with a dry paper towel and press dry with an iron.
14. Immerse the dry paper in a five percent glue size solution. Sizing will prevent ink from running in the sheet, harden the surface and bind the fibers more firmly.

ACTIVITY SHEET IA 3.5.1

METRIC GEOBOARD*

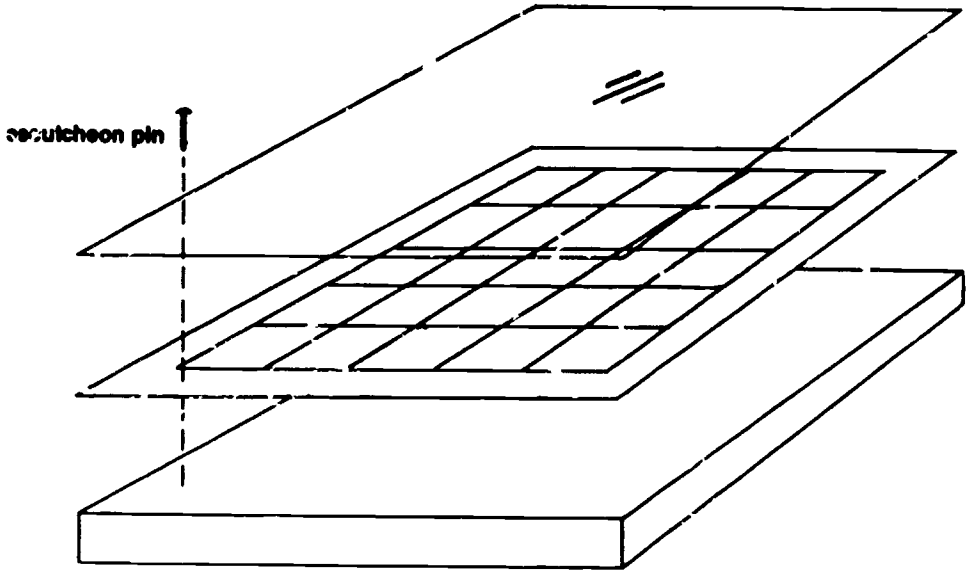
Simple geometric shapes can be modeled using a student constructed geoboard.

MATERIALS/SUPPLIES

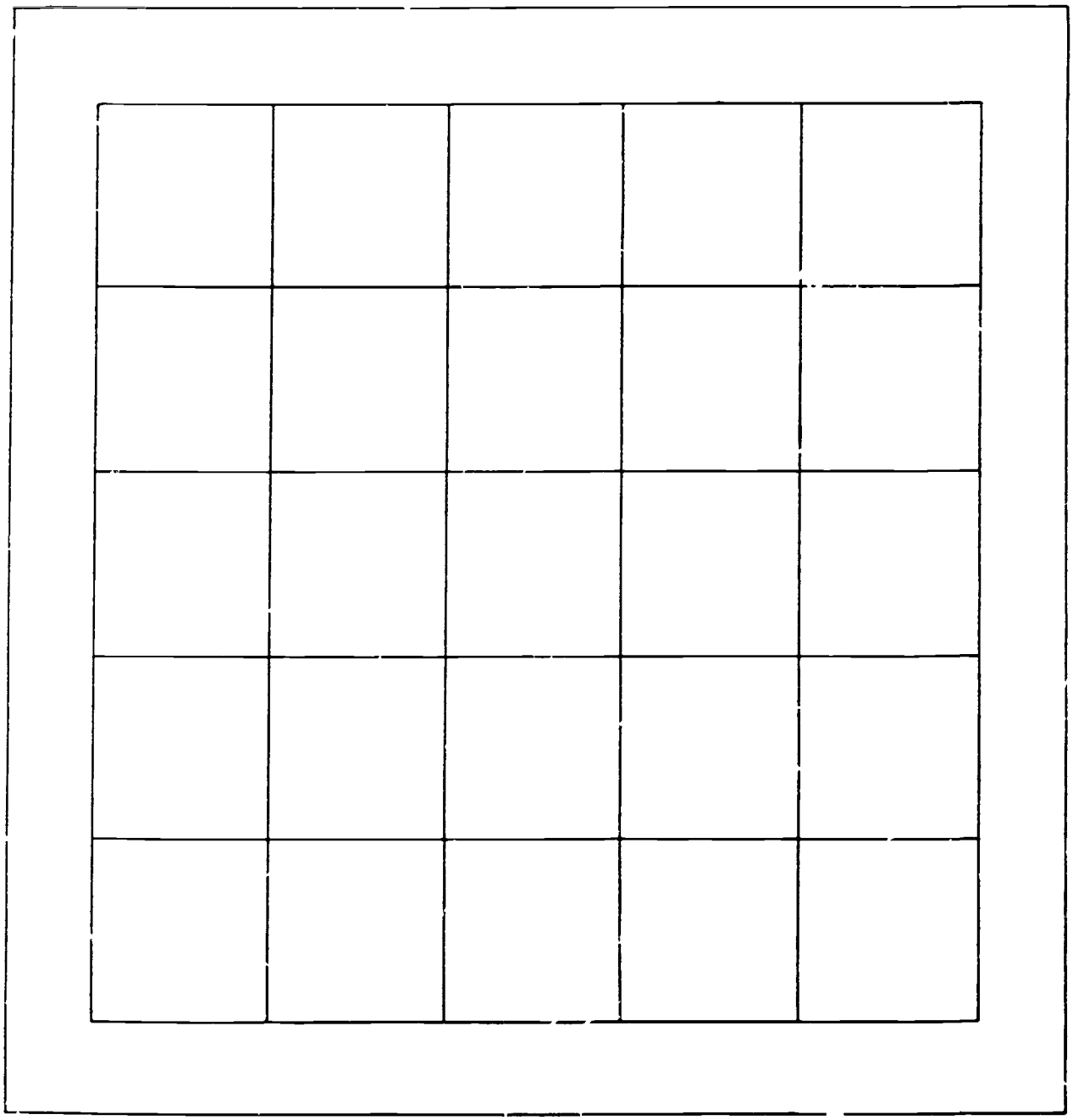
One pine board, 180 mm x 180 mm x 13 mm, one piece of clear contact film, 180 mm x 180 mm, 36 brass-plated escutcheon pins, 19 mm x #16, one geoboard facesheet (shown on opposite page), rubber cement, hand saw, tack hammer, bench vise or wood clamps, surform plane, scale and try square.

PROCEDURE

1. Measure, layout and cut board to size.
2. Smooth edges with surform plane.
3. Cut out facesheet on outside borderline.
4. Adhere facesheet to board with rubber cement.
5. Cut clear contact film to size.
6. Cover facesheet with clear contact film.
7. Insert one nail at each intersection (36 nails) so that 1 cm of each nail extends above the surfaces of the board.
8. Now create simple geometric shapes by placing rubber bands around different nail heads.



GEOBOARD FACESHEET



*Adapted from Wood'N Metric Handbook, West Virginia Department of Education, 1979.

ACTIVITY SHEET IA 3.5.3

LOAD TESTING A BRIDGE

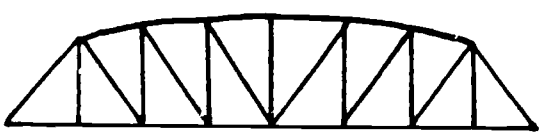
Industrial materials and products must perform according to specifications. In order to assure proper operation and safety for the consumer, industrial materials and products are subjected to rigorous tests. This activity will enable the student to simulate a materials load test by building a model truss bridge and then loading it to the breaking point.

MATERIALS/SUPPLIES

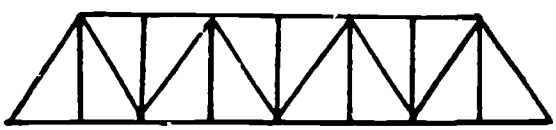
Balsa sticks, white glue, ruler, tagboard, exacto knife, objects of varying weight for use in loading the bridge, scale, clean-up rags.

PROCEDURE

1. Draw full scale plans of the bridges to be built.
2. Cut trusses, posts and piers to size.
3. Glue ends of trusses and posts.
4. Lay trusses on plan.
5. Glue trusses together for side one. Repeat for side two.
6. Set sides upright and connect with crossties.
7. Cut a piece of tagboard for the roadway and glue in place.
8. Glue the bridge onto the piers and set aside to dry.
9. Estimate the weight of each object that will be used to test the bridge's strength.
10. Place the objects, one at a time, on the bridge until it collapses.
11. Weigh the objects that caused the bridge to collapse.
12. Compare student estimates with actual weights.



PRATT TRUSS



WARREN TRUSS

ACTIVITY SHEET !A 3.7.2

LINE ASSEMBLY OF BALLPOINT PENS

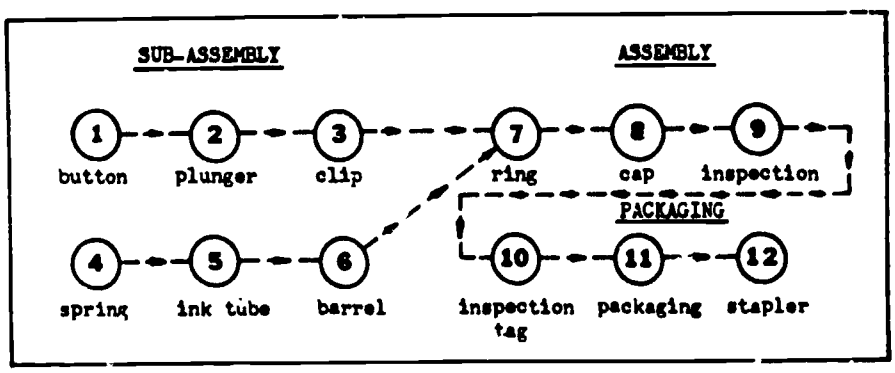
Combining parts (assembly) is an important part of manufacturing. The assembly process brings all of the parts and subassemblies together for each product. These parts and subassemblies must be combined so the product will operate as specified. The assembly line requires a continuous supply of parts at points where they are needed. People and machines must work together to position and fasten these parts and subassemblies.

MATERIALS/SUPPLIES

Ballpoint pens (100 take apart type), 100 plastic sandwich bags, 24 paper plates, 100 sticky backed labels, 10 inspection stamps and ink pads, 24 placards, 10 desk staplers.

PROCEDURE

1. Disassemble the pens placing component parts on appropriately numbered paper plates, #1 button, #2 plunger, #3 .... (Students can help with this task.)
2. Set up two assembly lines at opposite ends of the room.
3. Divide the class into two teams and explain that they will compete with one another in this activity.
4. Explain that assembly flows through subassembly, assembly, inspection and packaging. Refer to the flow-process chart below.
5. Demonstrate the proper assembly, inspection and packaging procedures.
6. Allow time for students to organize for this activity.
7. Make sure each student has an assigned task.



Mankind owes to the child the best it has to give.

- U.N. Declaration

RESOURCES

Many resources are available to develop and present industrial arts experiences to elementary school students. A few resources appear on the following pages.

MICROCOMPUTER SOFTWARE

* Welcome Aboard: A Muppet Cruise to Computer Literacy. The program is designed for use with the Apple IIe and IIc computers and available at most computer stores. Designed for children, the program opens with Kermit the Frog welcoming the user to the exciting world of computer. The student becomes the computer operator on board the SS Microchip and helps the Muppet crew keep everything shipshape. Five important computer applications are explored.

  * At the bridge, the student helps Captain Kermit in programming the ship's course.

  * In the Salon de Beaute, the student helps Miss Piggy find a perfect hairdo and gets a taste of computer-aided design (CAD).

  * While in the message center, the student will use word processing and electronic mail applications.

  * The student will also use the database manager to help Fozzie Bear sort through his nearly bearable jokes.

  * In the gameroom time is allowed to match wits against an arcade-style computer game.

* The Paper Airplane Construction Kit. The kit is a product of Simon and Schuster and available through computer stores everywhere. An easy-to-use program, the kit has blueprints for an entire fleet of pull-page paper airplanes. It contains a library of aeronautical insignia for everything from the Spirit of St. Louis to the Space Shuttle. Students can create an infinite number of different airplanes, then print, cut, fold and make aviation history. The kit is also available in book form.

* Turbo Turtle. This Apple program teaches elementary school children the Logo programming language. Children write instructions to move the turtle cursor around the screen; the turtle leaves tracks creating graphic designs. They start by using the turtle to draw simple geometric shapes, then move on to more complex programming tasks.

ROBOTICS

* Robotic Computing Kits for the Apple II and Commodore Computers. The kits are manufactured by Fischer America, Inc. and sold in computer stores and hobby shops everywhere. Ten robotic, automated devices and graphic unit projects can be built with one kit. They provide an ideal way to introduce children to robotics and computer control. Projects include:

  * Traffic light with pedestrian button.
  * Machine tool that simulates actual workstation.
  * Materials lift.
  * Aerial rotor.
  * Towers of Hanoi.
  * Teachable robot.
  * Graphic panel.
  * Plotter.
  * Solar cell tracking.

  Each project is based upon actual robotic and automated devices used in business and industry.

* Sensor Robot Electronic Project Laboratory. This kit is available through Radio Shack stores and includes everything needed to build 20 projects. Built-in sensors respond to light, sound, magnetism and moisture. Projects require no soldering and are safe for children.

* Elami Jr. Educational Robot. Developed by North American Robotics, Elami Jr. is available through selected electronic and hobby stores. Elami is an educational robot designed for children ages five and up. It can be used to orient children to computers, programming and robotics. Elami contains a memory chip for digitized speech and is programmed by a talking keyboard. The battery-powered robot has mobility in two speeds and features infrared and bumper sensors.

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ENERGY — POWER — TRANSPORTATION KITS

* Aeronautical Laboratory Kit. The kit is available through Radio Shack stores and helps teach the history and principles of flight. Some of the more than 100 projects include:

  * Helicopter.
  * Flyable model airplane.
  * Helium balloon.
  * Reusable rocket.

  The kits include instruction manuals, and projects require no soldering. All activities are safe for children.

* Microcomputer Trainer. The trainer is available through Radio Shack stores. The trainer is solderless and covers assembly language programming, binary and hexadecimal math. It features a central processing unit and hexadecimal input keyboard, seven preprogrammed games, built-in audio amplifier and speaker. The trainer also comes with a 180-page programming manual.

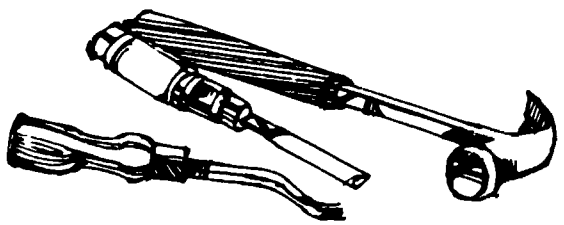
* Electronic Project Kits. These kits are available from all electronic and hobby stores. Most kits require no soldering and use battery or solar energy for power. Sample laboratory projects include solar powered radios, light activated alarms, magnetic noise detectors, electric motors and radio transmitters.

BASIC HAND TOOLS

Quantity	Descsription
2	Saw, crosscut panel, 16 inch.
2	Saw, hack, 10 inch.
1	Saw, keyhole.
2	Saw, coping.
6	Hammer, claw, 7 ounce.
2	File, half-round, 8 inch.
1	File card.
6	Pocket surform and blades.
6	Clamp, 4-inch opening.
6	Clamp, 2 1/2-inch opening.
4	Try square, 6 inch.
1	Brace, ratchet bit, 8-inch sweep.
1 ea.	Bits, dowel, set 1/4, 3/8 and 1/2 inch.
1 ea.	Bits, 3/4 and 1 inch.
1	Drill, hand.
2	Pliers, side cutting.
2	Pliers, combination, 6 inch.
6	Screwdrivers, 4-inch standard.
4	Screwdrivers, 4-inch Phillips.
4	Scratch awl, 6 5/8 inch.
2	Vises bench.
6	Rules, bench, 12 inch.

BASIC HAND POWER TOOLS

1	Drill, power, 1/4 inch.
1	Saw, vibrating sabre.
1	Sander, vibrating.



RESOURCES

BOOKS

American Council for Elementary School Industrial Arts, Safety for Elementary School Technological Activities (Washington, DC: American Industrial Arts Association, 1983).

Bame, A. and Cummings, P., Exploring Technology (Worcester, MA: Davis Publications, 1980).

Fales, V., et al., Manufacturing (Bloomington, IL: McKnight, 1980).

Gerbracht, C. and Robinson, F., Understanding America's Industries (Third edition, Bloomington, IL: McKnight, 1983).

Heiner, C. and Hendrix, W., People Create Technology (Worcester, MA: Davis Publications, 1980).

Minton, B. and Minton, G., Elementary School Learning Package (Worcester, MA: Davis Publications, 1981).

Scobey, Mary Margaret, Teaching Children About Technology (Bloomington, IL: McKnight, 1968).

Wright, T. and Jensen, T., Manufacturing (South Holland, IL: Goodheart-Wilcox, 1983).

INDUSTRIAL ARTS TEACHERS

Industrial arts and vocational teachers at other schools within your district can help you design and implement elementary level industrial arts activities. Community college vocational instructors can also provide valuable assistance. Industrial teacher educators at Oregon State University will also provide help with such activities.

STUDENT ORGANIZATIONS

The American Industrial Arts Student Association AIASA (pronounced i - a - sa) is a national organization for students who are presently enrolled in or who have completed industrial arts courses. Student members are looking for ways to develop their leadership and technical abilities. Contact your middle or high school industrial arts program to determine whether or not there is an active chapter in your district.

Still another student organization can lend assistance to your efforts. The Vocational Industrial Clubs of America (VICA) provide students with opportunities to assume leadership and demonstrate technical competence. Your high school vocational teacher can tell you of an active local chapter.

For additional help in locating an AIASA or VICA chapter, call your state industrial arts specialist.

ADVISORY COMMITTEES

High school industrial arts and vocational programs use advisory committees to stimulate citizen participation in their activities. The committee acts as a liaison between the school and the community by providing advice and assistance to the teacher. These committees are often interested in helping teachers at all grade levels. Contact your high school industrial arts or vocational teacher for more information about their advisory committees.

PARENT/COMMUNITY SERVICE ORGANIZATIONS

Successful elementary industria. rts programs are an integral part of the community in which they exist. urther, they reflect the technological aspects of that community. If this reflection is to be accurate, close cooperation between the program and the community is essential. One of the best means of providing for this cooperation is through service organizations. Try contacting some of these organizations for assistance: Parent Teachers Association, Lions International, Kiwanis, Rotary and Retired Citizens. You will find members ready and able to assist with design and implementation of elementary industrial arts activities.

BUSINESS/INDUSTRY/LABOR

Elementary school industrial arts activities reflect the application of technology in the community. To ensure an accurate representation, close cooperation between the program and local business, industry and labor is essential. One way of providing for this cooperation is to seek assistance from local business, industry and labor leaders. For example, ask contractors, carpenters, electricians and loan officers for help with construction activities. Seek assistance from local industrialists when your children engage in a mass production activity. Your Chamber of Commerce office can help you identify individuals/organizations that can be of assistance.

CAREER INFORMATION SOURCES

Both the Oregon State Employment Service and private employment agencies are excellent sources of career information. Check your telephone directory for assistance in locating the nearest office. The Oregon Occupational Information Coordinating Council (OOICC) located in Salem provides much valuable career information. The Career Information System (CIS) provides both computer assisted and manual access to career information. See your school's guidance director for assistance in locating these and other sources.

High School Industrial Arts

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— WE BELIEVE —

- Education prepares people to function as productive and contributing members of society,

- Society is highly technological,

- Technology is the application of science and of technical advances in industry,

Industry uses technology to produce goods, services and information,

- Industrial arts education is the study of industry and technology,

All students will benefit from participation in industrial arts programs.