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ABSTRACT

The bulletin was prepared as a guide for school administrators and teachers of industrial arts in the elementary and secondary schools of Mississippi. Chapter 1 discusses the philosophy and goals of arts education and defines terms used in the guide. Chapter 2 gives specific information pertaining to organizing and administering an industrial arts program. Emphasis is placed on desired qualifications for industrial arts teachers, inservice training for staff improvement, community involvement, suggested course sequences and objectives, student clubs, and budgeting and purchasing. Suggestions to the school administrator for planning an industrial arts program are discussed in chapter 3 in terms of mandated standards and codes. Chapter 4 covers suggested laboratory procedures emphasizing student involvement. Course outlines and lists of suggested projects designed to cover four areas of teaching (industrial crafts, the multifield concept, major-field concept, and mechanical drawing) are presented in chapter 5. Chapter 6 provides an introduction to modern industrial procedures by way of a student run corporate organization. A unit rotation chart, diagrams of an industrial arts multifield laboratory and class project storage rooms, a tools and equipment list, State assistance services, suggested forms and plans for a woodworking project are appended. (Author/NH)

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Industrial Arts Curriculum Series
Number 10.001

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FOREWORD

This bulletin has been prepared as a guide for school administrators and teachers of industrial arts in the elementary and secondary schools of Mississippi. It is the third revision of this Mississippi School Bulletin, the second revision having been made in 1966.

Industrial arts is universally recognized by leaders in education as a subject that is beneficial to all students. It has the responsibility of teaching the basic concepts of industry and technology to all students and aiding them in the discovery, development, and realization of their capabilities.

Industrial arts is activity oriented, using materials, tools, processes, and energies of industry to aid students in vocational, technical, professional, and consumer development. As such, it is able to reinforce, enrich, and make relevant much that is abstract by involving the student in real and meaningful experiences.

The Legislature, in its regular session in 1964, through House Bill No. 112, gave the director of vocational and technical education the responsibility for the administration and supervision of industrial arts in public schools of Mississippi. The 1972 amendments to the 1968 Vocational Act also specified that industrial arts was part of the total program of vocational education.

This bulletin is being released through the Vocational and Technical Division of the State Department of Education. We trust that it will be helpful in the improvement of present programs and as a guide for the initiation of new programs in the school systems of our state.

G. H. JOHNSTON
State Superintendent of Education

INTRODUCTORY STATEMENT

With the ever increasing need for more and expanded programs of industrial arts in our public school systems, the Vocational Division of the State Department of Education has revised Mississippi School Bulletin Number 147 and is distributing it to the public schools of the State.

The United States Congress, in the Educational Amendments of 1972 (P.L. 92-318), changed the definition of Vocational Education to include industrial arts in the Vocational Education Act of 1963 (P.L. 88-210) and amendments.

Industrial arts education encompasses those educational programs which pertain to the body of related subject matter organized for the development of understanding about the technical, consumer, occupational, recreational, organizational, managerial, social, historical, and cultural aspects of industry and technology. This includes learning experiences involving activities such as experimenting; designing; constructing; evaluating; and using tools, machines, materials, and processes which provide opportunities for creativity and problem solving.

Industrial arts provides unique experiences that further the discovery and development of each student's career potentials, technical abilities, judgment, self-reliance, and resourcefulness to succeed in the world of work.

It is hoped that school officials will use this publication in planning and developing programs of industrial arts to meet the needs of students in their school districts.

T. V. MAJURE, DIRECTOR
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ACKNOWLEDGMENTS

Grateful acknowledgment is expressed to the persons who gave of their time and efforts in the revision of this bulletin.

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And the many industrial arts teachers that contributed during the 1972 I.A. Clinic.

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CHAPTER I

INTRODUCTION

This bulletin is an attempt to update industrial arts philosophy, content and methodology for current or future practice in Mississippi. It is a blend of traditional programs involving woods, metals, drawing, etc., and contemporary programs, such as construction, manufacturing, transportation and communication.

The great value of industrial arts in the present day scheme of education is universally recognized. Through the years, it grew to be a phase of general education designed to develop certain habits, attitudes, and abilities desirable for all citizens. The old Russian plan of tool instruction, the German idea of manual training, the Swedish Sloyd System, and the old manual training period in America were all marks of progress in developing the industrial arts of today.

Manual training died because of its narrowness of scope and objective, and because it concerned itself too generously with tool skills and manipulative habits, forgetting such important factors as consumer values, individual differences, related technical information, and guidance information. The next phase was called manual arts. This movement migrated to America from England and was an outgrowth of the revolt against factory-produced items which were poorly designed with little or no aesthetic value.

Industrial arts as we know it today came into existence about 1905 when a need was recognized for the inclusion of technical and related information to supplement the skills being taught in the school laboratories and drafting rooms. Industrial arts, therefore, is the study of the materials, tools, processes, and products of industry and their impact on our technological society. Educationally, it is basic to students' needs and should be included in the school program of every boy and girl. Industrial arts provides an area of instruction which is an integral part of a well-rounded, comprehensive educational program. Through laboratory activities, it provides lifelike experiences which are consistent with the environment of the student. This does not imply, however, that industrial arts has as its objective the teaching of any indepth and specific vocation, but rather that it is a broad, basic exploratory program which has prevocational values.

An interesting blend of classroom study and laboratory activity makes industrial arts courses popular with students

Industrial arts has goals which are progressively more intensive and are cumulative in their effect as the student advances in experience and maturity. Through such a program the student:

1. Has the opportunity to explore several fields or phases in industry, such as electricity-electronics, drawing and planning, woods, metals, power mechanics, industrial procedures, problem solving, personnel management, environmental control, etc. He is able to formulate some idea of his aptitudes and his shortcomings, as well as his likes and dislikes, as a result of such exploratory experiences. He should develop a better understanding and appreciation of the world of work, as well as gain some insight as to how he may succeed in the highly industrial and technical society.

2. Gains a vast amount of consumer knowledge to help him make wise decisions in the selection, use, and care of manufactured items.

3. Enlarges his insight into some of the requirements of various occupations -- the physical requirements, educational requirements, remunerative values -- and is afforded the opportunity to be of service to his fellow man. All of this adds to a knowledge of making wise decisions concerning educational and occupational choices.

4. Grows in his attitude toward the importance of safety as it relates to industrial life, the school laboratory, home life, and all aspects of daily living.

5. Enhances his creative ability and learns the value of careful planning and the advantages to be gained by well-formulated, organized procedure.

6. Formulates good work habits. He learns to proceed in an orderly manner and to follow through to the successful completion of the task.

7. Develops worthwhile leisure time activities. This becomes increasingly important as people have more and more leisure time.

Industrial Arts Goals

The goals of industrial arts are formulated upon sound educational philosophy. When based upon this premise, the goals serve a three-fold

purpose in establishing objectives to be attained, guides for the selection of subject matter, and standards for evaluation of the program. The following goals are considered to be comprehensive for industrial arts and not the specific objectives for a particular course.

Goals

To provide a sound program of industrial arts, clear and realistic goals are essential. The goals of industrial arts education are to:

1. Develop in each student an insight and understanding of industry and its place in our culture.
2. Discover and develop talents, attitudes, interests, and individual potentials related to the industrial-technical field.
3. Develop skills in the proper use of tools, machines, and processes.
4. Develop problem-solving and creative abilities involving the materials, processes, and products of industry.
5. Provide students with an opportunity to make other school subjects relevant.
6. Develop an understanding of career opportunities and requirements.
7. Develop desirable personal-social traits.
8. Provide safety education.
9. Develop consumer knowledge.
10. Develop worthwhile leisure time activities.
11. Develop a sense of ecological responsibility.

During the past two decades Mississippi has enjoyed a period of unprecedented industrial development, and indications are that this will continue. One of the very important contributions public education can make to the industrial growth of the state is to develop an "industrial consciousness" within its young people. This understanding and appreciation of industry is basic to the attitudes necessary for the establishment and growth of industry in any community. Industrial arts is that segment of the overall general education program designed to accomplish this purpose.

It should be realized that the elementary and junior high school present the ideal place in which to begin laying the foundation for the student's life work by providing broad exploratory experiences, factual information, basic tool techniques, and occupational information. The early acquisition of this knowledge is an essential factor in molding character traits and social habits and provides a realistic approach to effective guidance. Satisfying the early manipulative needs and creative desires of youth leads him into a more complete development of his ideals and ambitions and a realization of his responsibility to others. Given this opportunity, boys and girls will secure a broad educational foundation of practical, factual, and aesthetic values; and they will stand a far better chance of becoming useful citizens. Desires, aptitudes, and mental qualities vary so greatly that, unless youth are provided with a wide range of practical as well as academic subjects, many of them will become failures in life before they come to grips with the necessities of life.

Types of Programs

For the purpose of assuring a full understanding of the information included in this bulletin, this section is devoted to the definition and explanation of terms that might be confusing.

Industrial Crafts

Industrial crafts is defined as that area of industrial arts which provides for creative activity, as well as a study of industrial materials and products. For the purpose of this bulletin, industrial crafts is confined to activities such as leathercrafts, ceramics, plastics, woods, art metal, etc., and is recommended as being applicable and appropriate for beginning industrial arts activity at the elementary and lower junior high school levels. Industrial crafts activities seek to create interest, inform, inspire, and guide by bringing materials and fundamental processes of industry into the school life of the pupil. Projects and problems are employed which provide experiences and opportunity for the development of certain techniques, knowledge, appreciation, and fundamental skills. Such projects may be in the fields of leathercraft, hand woodcarving, toy making, ceramics, etc. The exploratory value of industrial crafts is stressed, and little emphasis is placed on acquiring skill. In this program there are opportunities for creative thinking and doing through individual and group activities.

Industrial crafts programs in Mississippi are confined to the elementary and lower junior high school levels. Such programs should be conducted according to the multi-field concept which will be described later. Industrial crafts programs should be composed of a minimum of four areas.

Additional units may be selected from the following list, as more than four units may be taught where they are practical and desirable. Craft areas which could be taught in the seventh grade include the following:

1. Leathercrafts
2. Plastics
3. Mosaics
4. Ceramics
5. Graphic Arts
6. Art Metal
7. Woodcrafts
8. Drawing (freehand)

The industrial crafts laboratory provides desirable activities which serve to enrich the elementary program, as well as to provide a more suitable beginning for industrial arts in the middle or junior high school. Such a program can be initiated and conducted in a minimum amount of space and at a minimum cost. It is recommended that, when taught below the seventh grade level, crafts be integrated with regular school courses and/or taught by the classroom teacher. A further discussion of this will be found in Chapter II.

The Multi-Field Concept

The multi-field concept (general shop) provides pupil experience in a number of different industrial activities carried on simultaneously in one room under the direction of one teacher. This type of activity is recommended as a sound approach to the basic industrial arts courses in the junior high school.

It is possible to include four or more units of work representing as many different areas of industrial activity, such as drawing and planning, metals, electricity, and woods. Every multi-field laboratory should include drawing and planning. Areas which may be taught in the eighth and ninth grades may be selected from the following list. One high school credit may be given if taught in the ninth grade or above. Students should be rotated through these areas as illustrated in Appendix A.

1. Basic Electricity-Electronics
2. Woods
3. Metals
4. Drafting
5. Power Technology
6. Industrial Crafts
   a. Plastics

b. Leather
c. Ceramics
7. Graphic Arts
8. Home Mechanics
9. Environmental Control

In addition to the basic industrial arts program described above, it is possible, if equipment is available, to provide advanced courses to small groups of students in the same laboratory. In this way, the needs of beginning and advanced students can be met. This plan is especially appropriate for the school that can have only one laboratory. A broad range of experiences can be provided at a comparatively low cost.

The Major-Field Concept

The major-field concept is one in which the subject experiences are confined to one major area of industry, such as metals, woods, applied electricity-electronics, or power technology. For example, a metals program should be composed of units of various phases of metalworking, such as welding, forging, sheet metal, and foundry work. In a woods program all units would be in the woodworking field, while the electrical program would be composed of units of an electrical area.

A major area of industry may be taught for the duration of a school year. However, some schools choose to use an alternate plan whereby two areas are taught for the duration of a semester each. An example of this alternate plan would be to teach electricity the first semester and metals the second semester.

Introduction to Modern Industrial Procedures

This concept, sometimes referred to as "Interpretation of Modern Industry," enables the student to obtain a complete overview of industry. This involves forming a corporate organization, designing and developing a product, financing the organization through the sale of stock, mass producing and marketing the product, declaring a profit or loss, and finally disbanning the corporation.

It is suggested that this study of modern industrial procedures be included at either the eighth or ninth grade level. This industrial arts program is explained in Chapter VI.

CHAPTER II

ORGANIZATION AND ADMINISTRATION OF AN INDUSTRIAL ARTS PROGRAM

The purpose of this chapter is to give specific information pertaining to organizing and administering an industrial arts program. As a starting point, it is important that the school administrator review the fact that the industrial arts program offers unique opportunities to enrich the total school curriculum offerings by providing for the development of understanding, skills, and attitudes needed by all pupils in today's technologically oriented society. The program is not designed to be a substitute for specialized vocational training or terminal vocational education. On the other hand, the objectives of the industrial arts program are in complete harmony with the basic understanding, skills, and attitudes needed to accelerate the industrial development of our state.

The Teacher

Great stress must be placed on qualifications of the industrial arts teacher. There are many problems of administration, instruction, and supervision that are unique to this field. In addition to having an educational background and professional stature comparable to that of other teachers in the school, the industrial arts teacher should have the following special qualifications:

1. A genuine interest in things mechanical

2. Good muscular coordination and a wholesome attitude toward work

3. A high degree of skill in at least one major industrial arts area and proficiency in several others.

4. A wide range of up-to-date information concerning tools, materials, processes, products, and problems of occupational life in industry

5. Ability to distinguish between poor design and good design in industrial products and to design products that are structurally sound and aesthetically pleasing

6. A sense of neatness and orderliness with respect to laboratory housekeeping and layout.

Certificate Requirements

Industrial arts teachers are required to hold a standard Mississippi Secondary Teacher's Certificate with an endorsement to teach industrial arts. In addition to the courses required in general education and professional training for all secondary school teachers, the industrial arts teacher must have the following courses to meet endorsement requirements:

	Semester Hours	Quarter Hours
Woods	6	8
Metals	6	8
Graphic Science	6	8
Electricity-Electronics	6	8
Industrial Arts Multi-Field Procedures	3	4
Electives such as graphic arts, power mechanics, crafts, and other courses based upon the needs of the student	3	4
TOTAL	30	40

Teacher Supply

Although the number of industrial arts teachers is increasing each year, the supply is not yet adequate to meet the demand brought about by new programs being established in our public schools and the demand for industrial arts teachers in several other vocational and industrial areas. Teachers who hold a Class A Certificate can qualify to teach industrial arts by satisfying endorsement requirements as listed in **Mississippi School Bulletin 130**. A permit to teach industrial arts may be issued prior to completion of endorsement requirements. It is strongly recommended, however, that permit teachers be required to have a minimum of 15 semester hours credit in industrial arts, with 6 semester hours being in principles and methods courses, before they are employed to teach industrial arts. It would not be possible for the teacher who is not well versed in the principles and methods of industrial arts to successfully operate a program which would satisfy the purposes of the school.

The industrial arts teacher with the proper educational background will be able to conduct a variety of industrial arts activities. He should be able to conduct classes in both the multi-field laboratory and the major field laboratory, conduct classes in mechanical drawing, provide consul-

tive services for industrial arts programs in the elementary school, and serve as advisor to industrial arts clubs. Ideally, he would also be qualified to teach modern industrial procedures as described in Chapter VI.

Continuous School Improvement

Continuous school improvement is mandated by the change of pace in our highly technical industrial society. At least 50 percent of the occupations in our economy have come into existence within this century. The school administrator is the key person in motivating school improvement. It is his responsibility to interpret pupil needs and to continuously adjust and improve the ability of the school to meet these needs. The quality of instruction depends on the competency of the teaching staff and the provisions which are made for the staff to keep abreast of developments in the field.

In-service training is the accepted basic approach to staff improvement. The industrial arts program must also have a continuous flow of fresh ideas and knowledge of new materials that teachers obtain through participation in professional organizations and from visits to other schools. The industrial arts teacher needs to keep informed about the materials, processes, and methods of industry by keeping in close contact with industry. The alert school administrator will recognize the value of these activities and encourage the participation of his staff in them. He should also provide leadership to the staff in the development of evaluation techniques which may be used as a basis for instructional improvement in all areas. From time to time workshops and clinics are held by the State Department of Education and by universities. All teachers should be encouraged to attend these in-service programs.

Interpreting the Program

Interpreting the industrial arts program to the school and the community is an important area of administration. The kind of environment in which the program will function depends upon the degree to which the purposes and needs of industrial arts are understood and accepted. The industrial arts laboratory can be made one of the "show places" of the school. Displays at school and appropriate places in the community serve useful purposes.

The administrator should keep in mind that the principal challenge of industrial arts at this time in the State of Mississippi is to vest in our young people an understanding of and appreciation for the methods, materials, and products of industry and its place in our culture. The continued and stable economic development of the State will depend upon the ability of its citizens to provide an environment favorable to industrial growth and development.

Course Sequence and Credit to Be Given

The course sequence and credit listed below take into consideration the growth characteristics of the pupils to be served. This list is in harmony with research findings and parallels successful experience in many schools over a long period of time.

Industrial arts programs are flexible and can be designed to fit a particular need for any school system. The industrial arts program is designed to enhance the total school curriculum and can be added with little disruption in scheduling. The length of class period is equal to that of regular classes.

Bulletin No. 171 (Standards for Accreditation of Elementary and Secondary Schools) contains minimum requirements for all course offerings and should be referred to before attempting to establish a new industrial arts program.

Industrial Arts -- Grades K-6

In the elementary grades, industrial arts consists primarily of activities which involve constructive endeavors with material objects. These construction activities, coupled with experiences of a related nature, lend themselves to acquainting young people with the industrial world in which they live. It is possible to isolate two purposes of elementary industrial arts which work toward the realization of this goal. First, the program involves manipulative and related experiences which enrich the broad units of learning in the elementary school. Secondly, it provides an excellent vehicle for creative expression in a great variety of materials.

At this level industrial arts is taught by the regular classroom teacher with the aid of an industrial arts consultant. Upper level (5th and 6th grade) elementary courses may be taught in a regular industrial arts facility with industrial arts teachers.

Objectives:

1. To help children understand the part of their physical environment that is provided by technological development.

2. To develop attitudes and understandings of how technology influences society

3. To reinforce and vitalize the curriculum and make general educational experiences more meaningful to the student.

4. To develop an understanding of why man works, his wide choice of employment opportunities, and an appreciation of the dignity of work.

General Industrial Crafts — Grades 7-8 (Recommended for Grade 7)

This type of course provides a wide range of exploratory activities in a wide variety of areas such as those listed in Chapter I. It may be scheduled as a regular multi-field laboratory course or rotated for part of a year with other subject areas such as: music, art, science, home economics, or occupational orientation.

Objectives:

1. To discover and develop students' talents.

2. To stimulate creative and problem-solving traits.

3. To impart occupational information

4. To develop worthwhile leisure time activities.

Multi-Field Concept — Grades 8-9

Industrial arts for junior high or middle school boys and girls has as its primary function the provision of industrial experiences of an exploratory or orientational nature. It differs from the elementary industrial program by its movement away from an emphasis upon enrichment units toward well-organized separate classes held in laboratories and taught by competent industrial arts instructors. Such courses offer a range of activities to enable youth to develop a clearer understanding of industrial materials, processes, and organization, and to explore individual aptitudes and aspirations. Its mission then is two-fold: it **introduces** students to the world of industry and technology, and it **guides** them in terms of vocational avocational interests and abilities.

This is the basic course, the core of the industrial arts program and a prerequisite to advanced courses. If this course is taught at the high school level, it carries one unit of credit, and a minimum of 275 minutes per week in class is required.

The multi-field laboratory offers the student exposure to many different areas of industrial arts

Objectives:

1. To provide opportunity for all students to explore the world of work.

2. To provide opportunities for exploration of industrially related avocational pursuits and hobbies.

3. To improve the competence level of the student in regard to choosing, buying, and using the goods and services of industry.

4. To explore breadth rather than depth of skill and understanding.

5. To provide safety education.

6. To develop skills in the proper use of tools, machines, and processes.

7. To provide students with an opportunity to make other school subjects relevant.

Cooperation is the key to success in many of the laboratory activities.

Major-Field and/or Introduction to Modern Industrial Procedures Grades 9-12

The effective senior high school industrial arts program includes advanced courses which reflect a broad spectrum of industries. A knowledge of how basic manufacturing principles apply to industries where production techniques and materials differ radically shows students how technology affects all people. New methods in transportation, communication, and manufacturing, and the development of new ways of generating energy constantly affect the lives of all. The application of this new technology necessitates constant reevaluation of curricular materials in industrial arts to keep abreast of the changes.

Mechanical Drawing Grades 9-12

Mechanical drawing is the universal language of industry. The ability to describe the shapes and sizes of objects through drawings and to interpret drawings made by others is helpful to anyone, regardless of his occupation. Without a knowledge of drafting and blueprint reading many of the better jobs in industry would be closed to workers. In this age of industrial technology, mechanical drawing is important in the education of both producers and consumers.

Mechanical drawing being taught as a unit course in high school.

It is recommended that mechanical drawing be taught as a unit course in the upper high school grades. In addition to this, mechanical drawing may be taught as one of the units in the multi-field laboratory. Another acceptable method is to introduce it during the orientation period and then to continue its teaching on an integrated basis with other activities in the class.

Objectives:

1. To teach the student to express himself clearly and accurately in the language of industry and technology.

2. To develop in the student the ability to think in three dimensions, to visualize quickly and accurately, and form clear mental pictures.

3. To provide occupational information concerning the broad range of drafting and engineering careers.

Industrial arts courses in grades 9-12 will carry one unit of credit per year, or one-half credit per semester. Some examples of unit industrial arts courses are as follows:

General Woods

General Metals

General Electricity-Electronics

Power Technology

Mechanical Drawing

Introduction to Modern Industrial Procedures

Some flexibility in grade placement is provided in these recommendations to help the individual school or school system adapt the program to the local situation. A school that can offer only industrial arts may approach the problem of grade placement somewhat differently from the school offering both industrial arts and vocational courses. In all cases, it is recommended that the industrial arts program be considered as the first step.

The ratio of men and women employed by industry continues to change as industry employs more women to do jobs that require a back-

ground of industrial training. Furthermore, both the machines of the business world and the appliances of the home are operated chiefly by women. It is imperative, therefore, that the school administrator consider industrial arts as being of equal importance to boys and girls.

The industrial arts curriculum is designed to provide unique specialized understanding, skills, and attitudes which are essential to effective living in an industrial economy. Industrial arts, therefore, assumes a position of importance in the general education program which equals that of the traditionally accepted subject matter areas.

In the light of these concepts, it becomes apparent that industrial arts is designed for all students and should not be designated as being for any particular group or class of students. It is important that the school administrator premise the establishment of the high school major area program on these principles:

1. To adequately provide for basic instruction to meet the needs of a cross section of students. For example: (a) for the student who chooses to explore more deeply the avocational, cultural understanding, and consumer aspect of American industry; (b) for those students planning to pursue advanced study and courses in the areas such as vocational or technical programs, applied science, and industrial education; and (c) for the reluctant learner, the slow learner, the potential dropout, the culturally deprived, or those who will be entering the labor force before graduation or immediately thereafter.

2. To provide practical situations to simulate the industrial and technical world of work and provide understandings of the competitive nature of industry and business.

Environmental Education — (To be taught at all grade levels)

There is a growing need to provide at least a minimum awareness of "environmental literacy" to all persons in our society, to instill in them both a feeling of urgency to protect or improve the environment, and the knowledge of how they can help in the course of their daily living. This "environmental literacy" is particularly needed for young people in school.

Industrial arts has an opportunity to contribute to solutions in the very critical area of ecology. As the importance of the preservation of the planet is sensed, industrial arts can be seen as being directly involved, especially if the school itself accepts its environmental responsibilities. Industrial arts, if it is to function as the interpreter of technology for the American schools,

must be concerned with the impact and consequences of technological advancement, not only for man himself, but for the survival of the planet on which he depends for existence.

Objectives:

1. To stimulate awareness and increase student sensitivities to the problems of solid waste disposal, as well as resource recovery.

2. To acquaint students with solid wastes as the "new resource" material and to familiarize them with the composition, identification, energy capabilities, and economic value of solid wastes.

3. To draw attention to the nature and extent of the problems and issues caused by solid wastes disposal: societal, personal, cultural, environmental, health, safety, survival, economic, technical, planet depletion.

4. To acquaint students with the new technology of solid wastes recovery: principles, systems, operations, limitations, application.

5. To involve the students in the search for better ways of solid wastes disposal, minimization, recovery, recycling, and reuse. They should become involved through study, research, experimentation, and design and development of pertinent ideas.

Activities:

It is suggested that environmental activities be included in the industrial arts programs at all levels. The following examples of activities might be conducted. The number of activities that can be performed is limited only by the teacher's imagination.

1. Community planning — Lay out to scale a small town or community showing the most efficient location of waste disposal systems and utility lines, and the best garbage pick-up and disposal method for that particular community. This could be a good project for a drafting class.

2. Recycling — Collect aluminum cans and melt them into ingots by use of a ceramic kiln or gas furnace. Weigh the ingots and figure the cost of recycling the value of ingots.

3. Construct and tastefully paint trash receptacles for the campus and community.

Activities of this nature are also ideal for student industrial arts club projects.

Students should be taught that the same technology which contributed, through misuse, to our ecological problems can be redirected, through human initiative, to correct these environmental ills.

Industrial Arts Student Clubs
American Industrial Arts Student Association (AIASA)

For many years industrial arts teachers have expressed a genuine interest in sponsoring school industrial arts clubs. There are many clubs in existence today operating on a local basis. Some are a part of the school club program and, therefore, meet regularly during scheduled periods. Others must find time to meet after school hours.

There have been a variety of purposes and objectives underlying the existence of these clubs. Some clubs are social in nature, while others undertake service-oriented projects.

Every industrial arts teacher should recognize the value of club activities and take advantage of the opportunity to provide an extra service to his students. At the same time, these activities provide an opportunity to promote the industrial arts program within the school and community.

Many potential club members of the American Industrial Arts Student Association ask the question: "What are the advantages of joining?" All persons, students and faculty advisors alike, should stress the following advantages of national affiliation:

1. AIASA is the national association. It works full time to create a positive national image of the industrial arts students.

2. AIASA brings together industrial arts students from all over the nation into one club.

3. AIASA is the only national organization representing industrial arts students. It is sponsored by the American Industrial Arts Association, the association that represents the industrial arts teachers of the United States, its possessions, Canada, and many foreign countries.

Any teacher who desires assistance in organizing an industrial arts club may obtain help from the State Supervisor of Industrial Arts Education or write directly to the Executive Secretary of the American Industrial Arts Association, 1201 16th Street, N.W., Washington, D. C. 20036. The following are community service activities that could be adopted as club projects:

A. Sponsoring safety campaigns
B. Sponsoring fire prevention activities
C. Repairing Christmas toys in cooperation with local civic clubs
D. Helping with clean-up drives
E. Marking house numbers on street curbs
F. Sponsoring community fair exhibits
G. Refinishing city library furniture
H. Rebuilding city park playground equipment

Many more activities could be added to this list.

Budgeting and Purchasing

The industrial arts program must have adequate and continuing financial support if the program is to achieve the expectations of the school and community. The initial budget for consumable supplies and materials should be large enough to provide supplies in sufficient quantities to avoid frequent and more expensive small lot purchases.

The amount of the budget might be determined by allowing $15.00 for each student who is to be enrolled in the program. This budget should support a revolving fund from which supplies can be purchased and into which money collected from students can be deposited. Each annual budget should restore the revolving fund to its original amount. The amount required to do this would represent the net annual cost to the school.

It is necessary for the instructor to handle school or student funds, and great care should be exercised in the keeping of adequate and complete records. It should be possible to account for the funds at any time.

References to quality and name brands of tools, materials, and supplies are made elsewhere in this bulletin. Simply for the sake of emphasis, it is recommended that all tools, materials, and supplies be checked carefully against the specifications recommended. When help is needed by the administrator and/or purchasing agent in this matter, the aid and cooperation of only those people who are qualified to give such information should be sought. Experience has shown that name brand products are usually of high quality and generally are the most satisfactory and economical in the long run.

CHAPTER III

SUGGESTIONS TO THE SCHOOL ADMINISTRATOR FOR PLANNING AN INDUSTRIAL ARTS PROGRAM
(Standards and Codes)

Size of Laboratory

The total area in a multi-field laboratory should be determined on a basis of 100 square feet of floor space for each pupil. Excluding auxiliary areas such as the office, finish room, storage room, and project storage rooms, a minimum area of 2,400 square feet for pupil activity should be allowed for each laboratory. This figure is based on the assumption that laboratories will be planned to accommodate a maximum of 24 pupils. For a suggested floor plan of the laboratory, see Appendix B.

It is obvious that a woods laboratory would require more floor space than an electronics laboratory. The size of special type laboratories should be based on an analysis of the courses to be taught and the kind, size, and amount of equipment needed. Further, a tentative floor plan should be made to arrive at the space relationship of the various equipment items and activity centers.

The above suggested layout and dimensions have proved to be quite satisfactory for most industrial arts programs over the past years. From time to time it becomes necessary to use an alternate layout due to building renovation or activities to be performed. In this event the office of the State Supervisor of Industrial Arts Education should be called for assistance.

Shape of the Facility

The shape of a laboratory is important. The ratio of length to width should range from one and one-half to one to not more than two to one. Long, narrow laboratories should be avoided as they do not lend themselves to effective orientation of machine tool equipment or to efficient space utilization. In schools housing only one laboratory, this situation can be avoided by placing the industrial arts facility at the end of a wing where it is possible to take advantage of the width of the entire wing. Any shape that does not allow an instructor full visibility of the entire area at all times should be avoided.

Location of Industrial Arts Facilities

Industrial arts laboratories should be located on the ground level whenever possible. This makes it convenient to have an outside entrance

through which to move large items of equipment. It is desirable, also, since vibrations and noise in rooms on the ground level will not penetrate to other classrooms. In large schools it is recommended that a separate wing or the end of a wing of the main building be used for industrial arts laboratories and related subjects. Experience has shown that industrial arts facilities are constantly being enlarged to accommodate unforeseen increases in enrollment. Facilities should, therefore, be located so that future expansion may be made with minimum of alterations and without destroying the harmony with building design and fenestration. Consideration should also be given to the position of the laboratory in relation to the mechanical drawing and art rooms. This is particularly important in a large school having several industrial arts laboratories.

Architectural Details

Floors

Floor materials are recommended as follows: trowel-finished concrete floor with hardener and color added. Ceramic tile is recommended for rest rooms.

Walls

The lower portion of the laboratory walls, up to a minimum height of five feet, should be made of a durable hard-surfaced material which can be easily cleaned. It should have a pleasing color and texture. Glazed brick, glazed tile, liquid plastic or epoxy enamel are satisfactory materials for this purpose.

In the situations where a separate wing of the building is devoted to industrial arts, good quality concrete masonry is satisfactory providing it is properly sealed and painted. The walls above a wainscot or wainscot height should be treated with a non-glare material. The lower portion of the walls should be free from obstructions and projections to allow efficient placement of benches, machines, and cabinets. At least one, or preferably two, full height walls should be reserved for the mounting of chalkboard, tool panels, bulletin boards, and display shelves.

Ceiling

The ceiling height of laboratories and similar areas measured from the floor to the principal plane of the ceiling should not be less than 14 feet. Materials with high sound absorption characteristics and light reflection qualities should be used for ceilings. Classroom ceilings should be ten feet from the floor level.

Windows

The area of glass windows should equal 20 percent of the floor area unless the area is air-conditioned. Glass areas should be placed and arranged to minimize brightness differences. Direct view of the sky and bright exterior surfaces produce glare and should be avoided. Light-directing glass brick extended from vision-strip windows to the ceiling is sometimes used for decreasing the glare produced by the traditional window treatment. In the rooms having windows on three sides, the glass area should be reduced. This can be accomplished by the use of high windows or light-directing glass brick.

Acoustical Treatment

Materials which provide maximum sound absorption should be used on the ceiling. It is good to have the upper portion of the side walls treated with materials selected to satisfy the requirements of the room. Acoustical materials should be capable of being stained and restained without losing their acoustical properties.

Heat

Unit blower heaters are recommended. Heat, thermostatically controlled, sufficient to maintain a temperature of 68 degrees five feet above the floor with a variation not to exceed five degrees between this level and the floor, should be provided. Since the industrial arts department is likely to be used for night school programs, it is desirable to have the control of the heat designed and located so as to permit heating it independently of the rest of the building.

Illumination

Sufficient artificial illumination is necessary so that at least 50-foot candles of light reach both vertical and horizontal surfaces at bench height throughout the room. Additional light, up to 100-foot candles and even more in special cases, is needed for such laboratory activities as crafts, graphic arts, machine operation, and mechanical drawing. Individual supplementary lighting is economical for these areas. In all cases, the light provided should be adequate to take care of the illumination at night as well as during the day. It should approach the effect of daylight and be as free from shadows as possible.

Switches that control all general lighting in the laboratory should be conveniently located. All lights for any given area should be controlled within the laboratory. Areas of control should be small and should parallel windows so that lights in the dark side of the room are separately con-

trolled from those nearest windows. Light switches and convenience outlets in finishing rooms should be vapor-proof for safety.

Ventilation

It is recommended that the laboratory be air-conditioned and that adequate facilities be provided for dust elimination. If a laboratory is not air-conditioned, fans will become mandatory. One or more exhaust fans of sufficient size should be placed in the laboratory where there is not an air-conditioner, and these fans should have the capacity to exchange the air every three to five minutes. An exhaust fan must be installed in the finish room.

Flexibility of Equipment in the Industrial Arts Laboratory

Careful planning when estimating the needs for a program will eliminate, to a great extent, the necessity of making changes or additions. However, as in all educational institutions, changes are not only necessary but desirable in order to meet pupils' needs and interests in a changing environment. These are some factors that provide flexibility:

1. Supplying sufficient 110 to 220 volt electrical outlets in walls and floors for present and future semi-portable and portable machine tool equipment.

2. Using comparatively short benches rather than unusually long ones; for example, two six-foot benches instead of one twelve feet long.

3. Installing gas and water outlets through or along the wall rather than through the floor in central portions of the laboratory.

Electrical Outlets

Floor plans including equipment layouts should be made far enough in advance to determine the location of electrical outlets in the final building plans. Service for both 110 and 220 volts is desirable as some equipment items require 110 volts and others operate more efficiently on 220 volts. There should be a 110-volt outlet every eight feet in the laboratory walls and one every ten feet in the mechanical drawing room. The 220-volt outlets should be single phase and located every 16 feet for machines and for whatever expansion may be done in the future. Three phase should be provided where needed.

Types of Outlets

Overhead cables should be run to machine areas not served by wall receptacles. Vapor-proof outlets should be installed in the finish room. Special heavy duty outlets should be provided for kilns and electric arc and spot welders. Wire of sufficient amperage capacity should be specified.

Electrical Service Control Panel

The switch panel should be mounted flush with the wall in a convenient place inside the laboratory. It should contain a master switch located in or near the instructor's office through which all the power circuits can be controlled.

Gas Supply

At least two gas outlets should be provided in the laboratory by a gas line brought through the floor or through the wall near the place where the furnace units and other equipment requiring gas are to be installed. The main supply pipe must be adequate for maximum consumption. A gas connection installed on the wall provides more flexibility than one located in open laboratory areas.

Compressed Air

It is recommended that the laboratory be equipped with an air compressor of suitable size for spray painting and other utility needs.

Sinks and Drains

Where the laboratory is large, the sink should be a minimum of five feet long and should have three faucets. It is advisable to install the sink on the wall to preserve floor space. Additional sinks should be provided for areas of work requiring the use of water. An extra large trap should be installed under each sink in order to prevent wax, grease, paint, plaster of paris, cement, and other injurious materials from being washed into the drain pipe.

Rest Room Facilities

Due to the increased number of girls enrolled in industrial arts, consideration should be given to providing separate rest room facilities for both boys and girls.

Drinking Fountains

A drinking fountain is standard equipment in every laboratory. The most suitable place for installation is near the sink.

Display Cases

It is suggested that laboratories be provided with a recessed display case equipped with doors and indirect lighting fixtures. A satisfactory location for this case is in the wall near the outside classroom entrance. It is also good practice to provide a display case for the industrial arts department in a prominent place in the main building.

Doors

Generally, one inside entrance is sufficient if an outside entrance is provided. If there is no outside entrance, two inside doors are necessary in large laboratories. At least one should be of sufficient width to accommodate large equipment and supplies. An outside entrance should be provided for laboratories. The outside doorway should be at least ten feet wide and located not less than seven feet from the corner of the laboratory, preferably on the long side. In addition to this there should be one regular size outside door. When there is a need for a double door with a mullion, the mullion should be removable.

Tool Storage

Panels mounted on the wall are recommended for hand tool storage. These panels should be readily accessible to the areas they are to serve. Tools mounted in these panels may be protected by enclosing them with hinged covers in the form of wings deep enough to clear the ordinary tools.

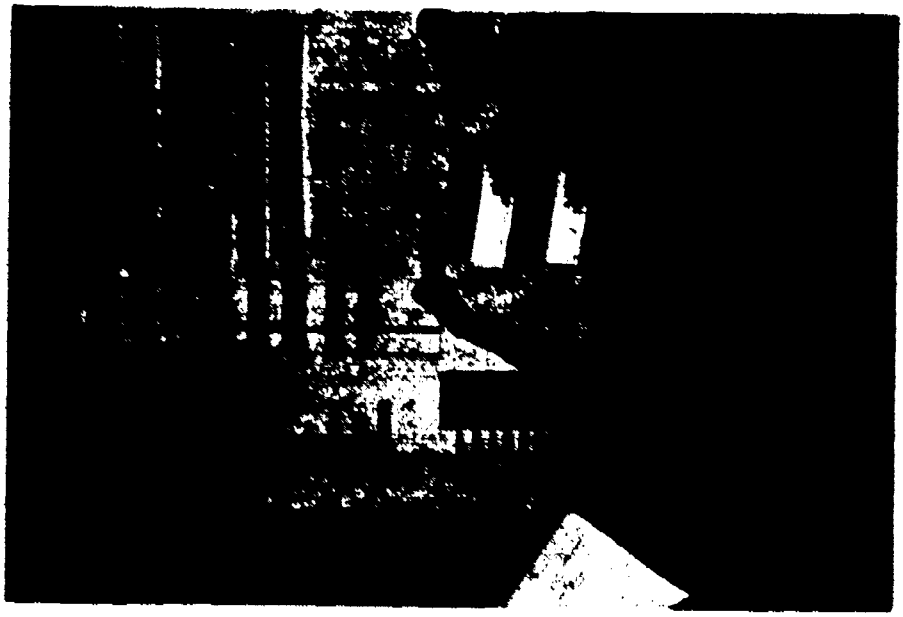
Color

The color of walls and equipment has measurable effect on the occupants of a room. The wall color and equipment should be in accordance with modern industrial practices. The upper portion of the walls should have a reflectivity of approximately 65 per cent. In any treatment of walls and ceilings, care should be exercised to avoid harmful glare.

Partitions

There should definitely be a floor to ceiling partition between the laboratory and the drawing room. Solid partitions which restrict visibility

within a laboratory are not generally recommended because they decrease flexibility of equipment use, make supervision of pupils difficult, and add to the problem of maintaining a neat and orderly room. If partitions are necessary, they should be nonbearing and constructed so that they may be readily removed or rearranged if necessary. Electrical wiring and other services should not be permanently installed in these partitions.



High quality tools and well-arranged panels affect the attitude of students.

Storage of Equipment and Supplies

Provision should be made in each laboratory for storage of supplies and equipment. Recessed wooden cabinets with adjustable shelves are desirable, but movable steel cabinets may be used for the same purpose if flexibility is a major consideration. Cabinets for the storage of paints and other inflammable materials such as gasoline or benzene should be made of steel or other fireproof materials. A project storage room, which can be locked, should be built for each class as shown on the floor plan in Appendix B-1. The importance of providing separate project storage space for each class cannot be overemphasized.

Storage Racks

Storage racks from woods and metals are necessary in laboratories where these materials are used. The plan suggested in Appendix B pro-

vides for materials of this kind to be stored over the storage room, office, project storage room, finish room, and rest room to conserve floor space. Access to overhead storage should be afforded by a permanently constructed ladder or stairway.

Proper planning should include overhead storage for wood and metal.

Bulletin Boards

A general bulletin board with an area of approximately 24 square feet should be placed near the entrance of the laboratory, the tool center, drinking fountain, or wash sink. Additional smaller bulletin boards convenient to various work centers are desirable.

Chalkboards

Portable chalkboards should be provided in the teaching center of all laboratories and classrooms. It is recommended that a minimum of 20 square feet of chalkboard be installed. When 20 square feet of surface is not available, vertical sliding panels or book-type boards should be considered.

Library and Planning Center

The library and planning center should be centrally located and in the teacher's view at all times.

Students do [illegible] work and planning projects at planning center

Fire Protection

Appropriate fire extinguishers of sufficient capacity should be hung on the wall adjacent to fire hazard areas. These extinguishers should be placed away from direct sources of danger but convenient to the area.

Safety

Safety should be given first consideration in facility planning. As it is desirable that all portions of the laboratory be easily visible to the instructor, interior walls or partitions should be half glass. Power machines should be placed so that students are not in the line of danger. Added protection is given by surrounding these machines with a safety zone outlined with paint on the floor. Aisles of [illegible] should be provided between benches and machines and in areas in front of panels and storage lockers. Special safety zones should be allotted to areas where metal pouring, welding, heat treating, etc. will be conducted.

Tools and supplies should be located as near to work areas as would be practical to reduce travel and interference. Placement of machines with related tools [illegible] of operations [illegible].

[illegible]

Classroom and/or Mechanical Drawing Room

Generally the drawing room can be used as an industrial arts classroom.

Floor Plan

For a suggested floor plan and furniture arrangement see Appendix B.

Lighting

One hundred foot candle power of light at table top level is recommended as a minimum for a drawing room.

Electrical Outlets

There should be a 110-volt outlet every ten feet in the classroom walls.

Floors

Vinyl asphalt tile or carpet is recommended for classroom and office.

Selection of Instruction Equipment

The selection and purchase of equipment for industrial arts programs require careful thought and study. Even under the best conditions equipment purchases are likely to be the result of compromise among the industrial arts teacher, the school administrator, the equipment dealer, and possibly certain state officials. An intelligent determination of what to purchase will be less difficult after thorough consideration is given to the following five factors affecting equipment selection: exact character of program; activities to be taught; plan of instruction; size of classes and grade levels; and available funds. In no case should quality be sacrificed for quantity. Complete equipment lists are available from the state supervisor's office with current costs and floor layouts.

Character of Program

The exact character of the program refers to the educational philosophy of the course under consideration. In recognition of industrial arts as an integral part of the total educational process, it follows that the equipment chosen should make possible the meeting of these educational goals. These goals can be met quite well if the equipment chosen contributes to the development of the understanding and appreciation of industrial materials, processes, and products.

Activities to Be Taught

Before an intelligent selection of equipment can be made, the activities for a particular area to be taught must be determined. They may include metals, mechanical drawing, woods, electricity-electronics or any other combination of areas which are included in the broad industrial arts curriculum.

Plan of Instruction

Another factor to be considered before making a list of equipment is to determine the plan of instruction to be followed. This includes determination of the type of program, such as multi-field laboratory for many areas or major-field concept for more specific areas.

Sizes of Classes and Grade Levels

Another factor to be considered is the size of classes and ages of students. Important factors affecting the size of the class will be the floor space available and the area to be taught. If the floor space is limited, the industrial area to be taught must be carefully chosen because some types of programs require more floor space per student than others.

Available Funds

It is always pleasant and easy to think in terms of ideals, but the very practical problem of funds causes many compromises, concessions, postponements of purchaes, or even abandonment of plans. Here again it is emphasized that quality should not be sacrificed for quantity.

In recent years manufacturers of equipment have given attention to the production of lighter machines for industrial arts use. (These are not to be confused with economy home shop models.) Many of these machines now possess the quality features of production-type machines. These lighter machines are proving satisfactory for industrial arts use because they are adequate for teaching purposes, well guarded, and the cost is less than that of standard production type power equipment.

Costs

The administrator is concerned primarily with four costs in beginning an industrial arts program: tools and equipment, initial supplies, replacement of supplies, and tools and equipment maintenance. Where there is a limited amount of funds for machine and hand tools, first attention should

be given to the purchase of a sufficient quantity and good quality of name brand hand tools. A suggested list of tools and machines is included in Appendix C as a guide for the administrator and industrial arts teacher.

Another aspect of the industrial arts program to be considered is the initial stock of supplies. The administrator should allocate a minimum of $15.00 per student. The handling of this cost is done in many ways and is treated thoroughly in Chapter II of this bulletin under "Budgeting and Purchasing."

The administrator or purchasing agent must be alert when submitting items for competitive bids. Carefully written specifications must be included to insure a good quality of tools and equipment. It is desirable to specify the name brand after each item listed for bids, stating that each item substituted must be equal to or better than the brand name specified. A qualified person should be consulted before final bid acceptance. To assist the administrator and teacher in locating supplies and equipment, a list of distributors can be supplied by the industrial arts supervisor in the State Department of Education, Vocational Division.

Sources of Additional Information

Those interested in initiating new industrial arts programs will find certain individuals and departmental agencies of tremendous value in the necessary planning. Any individual with knowledge or experience relative to industrial arts education might well make contributions as a consultant. Architects, builders, engineers, State Department of Education personnel, heads of departments of industrial education in colleges and universities, local industrial advisory committess, or others with special knowledge and talent often aid in this capacity. The services of the following personnel of the State Department are available: State Supervisor of Industrial Arts, State Arthitect in the Department of Buildings and Transportation. (See Appendix D.)

Procedure for Initiating New Program

The purposes and objectives of industrial arts should be clearly defined and thoroughly understood before attempting to plan the industrial arts program. It is most important that decisions be made relative to the following before attempting to plan physical facilities.

1. Areas of instruction to be offered
2. Ages and grade levels of students

3. Predicted enrollment
4. Availability of instruction to boys and/or girls
5. Size and number of classes

After decisions are reached concerning the above, the following step-by-step procedure is recommended.

1. Secure services of a qualified consultant from the State Department of Education and/or colleges and universities which have industrial arts departments.

2. Determine the types of programs to be developed such as multi-field or major-field concept.

3. Reach definite decisions relative to the number of boys and girls to be served, the time available for instruction, the ages and grade levels of students, and the size and number of classes.

4. Become acquainted with current codes and standards for school facilities.

5. Prepare preliminary specifications in the form of a check list.

6. Visit established well-planned facilities in other schools for the purpose of seeing programs in action, making a study of laboratory layout and physical features, and obtaining advice from administrators and industrial arts teachers as to advantages and disadvantages of the physical features of laboratories being visited.

   Note: The State industrial arts supervisor will be able to recommend appropriate programs for visitation. It is strongly recommended that the State industrial arts supervisor and the architect be included in the visiting party.

7. Hold preliminary conference with the State Supervisor of Industrial Arts, the State department architect and the designated building architect to discuss such things as educational activities, standards, building design, space considerations, and cost limitations.

8. Compile a list of equipment, tools, and supplies.

9. Decide upon principal laboratory areas, facilities, and auxiliary rooms which will be needed. Be sure to include such things as

special electrical layouts for electrical areas, machine tool electrical outlets, portable tool electrical outlets, circulating fans, heat, light, ventilation, project storage, finish room, toilet facility, and supply storage.

10. Prepare a preliminary floor plan in consultation with the building architect and the State industrial arts supervisor. Show location of principal areas, facilities, auxiliary rooms, machines, and equipment.

11. Prepare a detailed description of the facility (specifications) which will explain and supplement the floor plan. Present this to the architect.

12. Prepare and present to the architect detailed sketches of built-in equipment such as supply cabinets, wall panels and student project storage rooms.

13. Assist the architect by providing information during the final planning and construction.

CHAPTER IV

SUGGESTED LABORATORY PROCEDURES

Activities in industrial arts provide opportunities for students to participate in class management. When classes are small, the teacher can take care of all necessary details. As classes are increased in size and the activities are increased in keeping with the objectives, the operation of the laboratory becomes more complex. It is therefore, very important for pupils to share in the management of the class.

Class Organization

An organization chart, displayed in a prominent place in the laboratory, should show the rotation of students from area to area during the school year. (See Appendix A.) At the first class meeting, each member of the class should be assigned to a group and will remain in this group throughout the school year. This divides the class into as many groups as there are areas in the course. Each group is assigned to the respective areas as represented on the chart, and by referring to this chart each student can locate the area in which he is to participate. Student rotation from area to area within the class should be made in accordance with the time alloted. A plan of this type is used primarily in the multi-field laboratory.

Student Forms and Records

Efficient laboratory organization and administration are impossible without the use of records and at least a few basic forms. Each industrial arts class should have a filing cabinet and an assortment of well planned forms. Some of the more important of these forms are discussed below.

Material Requisition Card

This is usually an individual card form catalogued alphabetically by student name in a file. The student should be required to provide most of the data entered on the card. In this way the cards serves not only as a record of the quantity and quality of his performance, but as a cost accounting system through which the student learns the values of the materials used and how to calculate the cost of production. (See Appendix E.)

Student Plan Sheet

Planning is one of the most educationally worthwhile activities that can be carried on in the industrial arts class. A standard form will facilitate the preparation, checking, and use of the activity plans. The gathering of information, sketching, estimating, and planning the procedure to follow and which tools and equipment are to be used should be as much a part of every activity as the actual construction work. The use of the activity plan will require definite class instruction during orientation and class supervision by the instructor during the course. (See Appendix F.)

Progress Chart

For every class the instructor should make a progress chart showing the instructional elements to be learned over a stated period of time. Each student's name should be listed on the chart and posted in full view of the entire class. This makes a convenient method of recording the progress of each student and provides an opportunity for students to compare their achievements with other members of the class. Basic forms should be covered with acetate, and the students' names and the activities should be added by using a grease pencil. At the end of the semester, the chart is wiped clean and is ready for reuse. (See Appendix G.)

Inventory Records

Each industrial arts teacher is responsible for the equipment and supplies in his laboratory. He should, therefore, maintain inventory records. (See Appendix H.)

Equipment inventories are best made by separating tools and machines into separate subject area groups — woodworking, metalworking, etc. At the beginning and close of each school year the instructor should make a physical inventory of all equipment and compare this with the inventory record.

Supply inventory should also be made by subject area groups. These inventories should be of the perpetual type. Once such inventories are in operation it is not difficult to keep them up-to-date.

When accurately prepared, inventory records will facilitate the teacher's work during the school year, assist in justifying needed supplies and essential replacement of equipment, and provide the school authorities with factual information as to the amount and condition of the shop equipment.

Class and Individual Instruction

Due to the very nature of industrial arts and because of the great differences in individual abilities, the rates of progress among pupils may be so varied that effective class or even group instruction is impossible. Where instructions or demonstrations are of a general nature, group instructions may be practical. However, in order to provide fundamental instruction to every pupil at a time when he can definitely associate it with the project, individual instruction must be practiced. This can be accomplished through a systematic use of the four basic types of instruction sheets which will have the added value of giving the pupil experience in searching out information. The teacher should not, however, permit the course to be stereotyped or overburden himself with clerical work. He should be free during the class period for class management and demonstration or to give individual help.

Individual instruction being given in the midst of group activity.

The Demonstration

A well-timed and skillfully executed demonstration has a good psychological effect because it eliminates the element of doubt on the part of the student as to whether or not the job can be done. It also increases his

desire to emulate the instructor's performance and helps to clear up what might otherwise be vague or meaningless.

There are three types of demonstrations used in industrial arts: the class demonstration which is used to give instruction that is needed by all members of the class at the same time; the group demonstration which is used to give instruction to a small group of students, all of whom are in need of the instruction at or near the same time; and the individual demonstration which is used to give instruction to a single student concerning some operation or problem with which he needs help.

The teacher should possess sufficient skill so that students will feel a respect for him as a craftsman. He should use the same tools and materials that the students will use. The demonstration should be prepared carefully in advance and presented at a time when the students are ready for it. The students should immediately have an opportunity to apply the principles involved in the demonstration. If too much related information accompanies a demonstration, its value will be lost. The teacher should follow his demonstration by close observation and supervision to see that the correct practices are developed.

Instruction Sheets

The nature of the industrial arts multi-field laboratory requires that a wide variety of assignments in a number of industrial areas be in progress at the same time. This condition defeats the possibility of the teacher's giving the necessary individual attention and instruction to each pupil. Instruction sheets (information sheets, assignment sheets, operation sheets, project sheets) aid the teacher in overcoming this difficulty and make it possible for him to keep all pupils constructively occupied at all times. The student is enabled to proceed with his assignment with minimum teacher instruction. This serves to increase the pupil's sense of responsibility and self-reliance and provides the opportunity for him to apply his own ingenuity in the solution of problems involved in his assignment. The individual instruction sheet also compensates to a great degree for individual differences in that it allows the pupil to proceed at his own pace. Instruction sheets supplement the information found in the textbooks. (See Appendix I.)

Related Information

It is difficult to determine the amount of related information which should be taught in any given course. The amount will depend upon several factors: the subject being taught, the amount of related material available, the time available, the age and interest of the group, and capability and resourcefulness of the teacher.

In any event, related information in appropriate amounts is an essential phase of industrial arts and should not be overlooked by the teacher. It should be pointed out, however, that good judgment must be exercised in determining the amount and kind of related instruction given. Too much will serve to dull the student's enthusiasm, for he may be primarily interested in the laboratory activities. On the other hand, a lack of appropriate emphasis will weaken the program. It should be remembered that a comprehensive industrial arts program is not synonymous with "thing making." Rather, project construction is a means by which the objectives of industrial arts are attained.

It should be mentioned that there is a wealth of industrial arts textbooks and materials available. Due to the constant development of books, it is impractical to attempt to provide a listing of books in this publication. A current listing of textbooks and many other related materials can be obtained from the office of the State Supervisor of Industrial Arts.

Related instruction is an important phase of all industrial arts courses.

It should also be noted at this point that it is the responsibility of the industrial arts teacher to provide information about careers and occupations. Some time should be set aside during the school year to provide this instruction.

Safety and First Aid

The teaching of safety and instilling safety habits in students is a major responsibility of the industrial arts teacher. To prevent accidents, it is imperative that adequate supervision be maintained at all times. It is necessary that the teacher give adequate machine operating instructions to all

Safety instructions are a vital part of all machine demonstrations.

students permitted to use machines; provide safety guards for all machines; schedule periodic safety discussions; make available safety charts, signs and facts; require learners to secure operating permits from the teacher; pass a safety test which is to be kept on file; ban conversation by or to the operator of a machine; forbid horseplay in all areas of the laboratory; and encourage the wearing of suitable clothing for safe operation of machinery. In every industrial arts laboratory a first aid kit containing the following items should be available at all times: band aids, cotton balls, merthiolate, adhesive tape, disinfectant, gauze, and eye wash. First aid supplies should be under the direct control of the teacher and should have a special place in the supply room or perhaps in the teacher's office. A perpetual inventory should be maintained to assure having appropriate supplies when needed.

It is strongly suggested that each industrial arts teacher discuss with his immediate supervisor, usually the building principal, the possibility of accidents and the procedure to follow in the event they occur. Together they should agree on a plan of procedure to follow in the event of an acci-

dent resulting in an injury within the laboratory. In cases where a school nurse or a first aid station is available, the industrial arts teacher should coordinate his efforts with theirs.

The instructor should not leave the classroom except in an emergency. If he should have to be out, power to all machines should be turned off so that they cannot be operated during his absence.

The major causes of accidents may be classified under the following headings:

Conditions of the Room and Equipment

Overcrowded conditions

Poor housekeeping
Dull tools and machines

Unguarded belts, pulleys, gears, leadscrews, cutters, switches, etc.

Failure to use pushers, jigs, or guards

Improper location of machines

Poor lighting

Lack of storage space

Inadequate eye protection

Inefficient Instruction

Lack of safety consciousness

Lack of student discipline

Overtime work without supervision

Improper attitudes

Failure to check faulty machines and hand tools

Tests and Testing

The most satisfactory form of test for measuring informational achievement in industrial arts is the objective test. This type of test enables the teacher to cover a wide range of material in a minimum amount of time and can be easily administered and scored without involving the personal judgment of the teacher. However, the alert teacher will at all times make an effort to allow the student to express himself in writing by giving a small percentage of discussion questions. Performance tests also have value in the industrial arts program.

Daily Class Procedure

The teacher should establish some definite procedure for the students to follow each day in the class. A sheet containing this information might be given out during the first or second meeting of the class, thereby removing all doubt as to just what is to be expected of the student during the year.

Laboratory Maintenance

It is the responsibility of the industrial arts teacher to keep a check on his tools and equipment and to keep them in the proper working order at all times. The sharpening or repair of tools and equipment should be attended to as the need arises and not put off until it piles up. Tools and equipment that are not in good working order are potential sources of danger and contribute to inefficiency. Inoperative tools and equipment should be put into storage until they have been repaired.

CHAPTER V

TYPICAL COURSE OUTLINES

The following course outlines and lists of suggested projects are esigned to cover four areas of teaching. These areas are industrial crafts, nulti-field concept, major-field concept, and mechanical drawing. As dicated in Chapter II, the industrial crafts area is developed for use in the ower level of the junior high school or lower high school grades, and the najor-field area for the high school grades. Since the time alloted for each nit is flexible, particularly in the industrial crafts area and the multi-field aboratory, no attempt has been made to present a detailed outline of ontent or projects for the various units to be covered. The teacher is xpected to add to or delete from the content outline and list of projects ccording to the needs and interests of his pupils, his class organization, nd the available facilities. Complete lists of textbooks and reference books re available from the office of the State Supervisor.

Industrial Crafts

Although no effort has been made to outline the area of drawing and lanning in industrial crafts, it is to be expected that all students will be ntroduced to and receive basic information in this area.

. **Ceramics**

A. Course content

1. History, development, and uses of ceramics
2. Occupational opportunities and information
3. Sources of clay
4. Preparation of clay
5. Forming
6. Drying and firing
7. Glazing
8. Finishing

B. Typical activities

1. Jars
2. Ash trays
3. Figurines
4. Table lamps

II. Woodcrafts

A. Course content

1. History and development of woodcrafts
2. Areas of instruction in woodcrafts
3. Related areas of study
4. Materials for woodcrafts
5. Tools and supplies
6. Cutting and shaping operations
7. Staining, sealing, and finishing

B. Typical activities

1. Animal figures
2. Models

III. Art Metal

A. Course content

1. Historical background of the art metal craft
2. Occupational opportunities and information
3. Supplies and materials
4. Planning and layout
5. Cutting materials
6. Shaping and forming
7. Assembling and polishing

B. Typical activities

1. Free-form candy dish
2. Utility tray
3. Mint dish
4. Label pin

IV. Mosaics

A. Course content

1. History and development of mosaic arts
2. Occupational opportunities and information
3. Supplies and materials
4. Tools
5. Operations

B. Typical activities
   1. Wall plaques
   2. Figure coating
   3. Three-dimensional pictures
   4. Trays

V. Graphic Arts
   A. Course content
      1. History of the graphic arts industries
      2. Occupational opportunities and information
      3. Tools and supplies
      4. Blueprinting
      5. Designing with cutouts
      6. Making items with stencils
      7. Printing with a hectograph
      8. Printing with a mimeograph
      9. Linoleum — block carving and printing
      10. Silk screen printing
      11. Printing with stamps and types
   B. Typical activities
      1. Make a blueprint from tracing
      2. Cut a film for screen printing
      3. Picture prints
      4. Place cards

VI. Plastics

   A. Course content
      1. History and development of plastics
      2. Occupational opportunities and information
      3. Types and classification of plastics
      4. Layout and transferring designs
      5. Cutting and shaping
      6. Drilling, tapping, and threading holes
      7. Buffing and polishing
      8. Surface decorations

9. Methods of forming
10. Carving and engraving
11. Assembling
12. Coloring
13. Casting plastics
14. Fiber glass

B. Typical activities
1. Laminated box
2. Pin-up lamp
3. Serving tray
4. Clock

VII. Leather

A. Course content
1. History and manufacture of leather
2. Occupational opportunities and information
3. Tools and supplies
4. Craft leathers
5. Storing and caring for leathers
6. Designing and template making
7. Laying out and cutting leathers
8. Preparing leather for tooling and carving
9. Transferring designs to leather
10. Tooling and modeling designs on leather
11. Stamping and carving
12. Punching holes in leather
13. Assembling projects
14. Cleaning leathers
15. Finishing

B. Typical activities
1. Billfold
2. Coin purse
3. Belt
4. Arrow quiver

Multi-Field Laboratory

The multi-field laboratory provides pupil experiences in at least four different industrial activities carried on simultaneously in one room under the direction of one teacher. This type of laboratory is recommended as the soundest approach to the basic industrial arts courses at the junior high or middle school level.

A suggested plan for the rotation of the units of the multi-field laboratory, not necessarily the ones given in the example, is given in Appendix A. The selection of areas to be included in the multi-field laboratory should be considered carefully as an initial step in planning the program.

The orientation period should include some sketching, planning and drawing; safety practices; explanations of rotation charts, tool checking processes, and clean-up duties; and student evaluation and grade assignments, as well as an example to each student as to their purpose for taking industrial arts.

Sketches or drawings should be made of all projects to be worked on by the students, and these sketches should be checked and approved by the instructor before the student begins the actual work.

The following area outlines are typical of those found in many multi-field laboratories.

I. Basic Electricity-Electronics

A. Course content

1. History of electrical developments and occupational opportunities
2. Safety practices
3. The electron theory
4. Electricity and magnetism
5. History of magnetism
6. Kinds of magnets
7. Nature of magnetized materials
8. Inducing magnetism
9. Types of electricity
10. Sources of electricity
11. Electrical circuits
12. The flow of electricity and conducting materials
13. Introduction to electronics

14. Communications
15. Control devices
16. Measuring instruments
17. Safety devices

B. Typical activities

1. Electric motor
2. Transformer
3. Hot plate
4. Basic receiver
5. Continuity tester

II. Woods

A. Course content

1. Survey of the wood industry
2. Related information in the wood industry
3. Occupational opportunities and information
4. Safety instructions
5. Laying out
6. Cutting
7. Shaping
8. Joint construction
9. Smoothing
10. Assembling with bonding agents and fasteners
11. Staining, sealing, and finishing
12. Polishing wood surfaces
13. Introduction to power tools and machinery

B. Typical activities

1. Laminated tray
2. Gun rack
3. Boat paddle
4. Water skis

III. Mechanical Drawing and Planning

A. Course content

1. History and development of mechanical drawing
2. Occupational opportunities and information

3. Supplies and equipment
4. Manipulative skills
5. Lettering
6. Orthographical projection principle
7. Sketching
8. Reproduction of drawings

B. Typical activities
1. Lettering plates
2. Sketching plate
3. Projection practice

IV. Home Mechanics

A. Course content
1. Reading a working drawing
2. Care and use of common household tools
3. Application of paint and other finishes
4. Removing paint and other finishes
5. Preparing materials for refinishing
6. Repair of screen and windows
7. Door maintenance and repair
8. Simple electrical maintenance
9. Elementary appliance repair
10. Basic plumbing maintenance and repair
11. Care of yard and garden equipment
12. Bicycle maintenance
13. First aid
14. Fire prevention and control
15. Safety at home
16. Tools and equipment for the home

B. Typical activities
1. Faucet repairs
2. Replacement of plugs and cords on electrical gadgets
3. Replacement of windowpanes
4. Refinishing furniture

V. Metals

A. Course content

1. History and development of metals and the metals industry
2. Occupational opportunities and information
3. Selecting and planning metals activities
4. Selection and care of materials
5. Tools and equipment
6. Cutting and filing
7. Bending and forming
8. Taps and dies
9. Metal spinning
10. Making castings
11. Heat treating
12. Decorating, polishing, and finishing metal surfaces
13. Ornamental iron work
14. Sheet metal work
15. Introduction to machine tools
16. Introduction to welding
17. Safety

B. Typical activities

1. Wall lamp
2. Mailbox post and hanger
3. Cold chisel
4. Tackle box
5. Duct construction

VI. Power Technology

A. Course content

1. History and development of mechanical power
2. Occupational opportunities and information
3. Safety practices
4. Tools and equipment
5. Power measures
6. Power transmissions
7. Fuels and lubricants

8. Steam engines
9. Internal combustion engines
10. Atomic and solar energy
11. Hydraulics and pneumatics

B. Typical activities
1. Check and adjust small gas engines
2. Disassemble and reassemble small gas engines

Major-Field Concept

The major-field course content should be expanded so as to provide functional skills and information for a two-semester experience. The multi-field laboratory should be a prerequisite to study on the advanced level.

The sample course outline represents only one of the five major multi-field courses which are as follows: Applied Electricity-Electronics, Woods, Metals, Mechanical Drawing, and Power Technology. However, any phase of industrial arts may be developed and used on the advanced level to suit the industrial complexion of the particular community.

I. Applied Electricity-Electronics

A. Course content
1. Historical developments
2. Occupational information
3. Safety practices
4. Terminology
5. Tools and equipment
6. Electron theory
7. Insulator and conductors
8. Electrical circuits
9. Types of electricity
10. Magnetism
11. Sources of electromotive force
12. Measuring and computing electrical units
13. Uses of electromotive force

14. Practical applications of electricity-electronics
15. House wiring and appliance repair
16. Electron tube and applications
17. Semiconductors and applications
18. Transistors and applications
19. Communications

B. Typical activities

1. Loudspeaker
2. Hi-Fi amplifier
3. Loudspeaker radio
4. Power supply unit

II. Mechanical Drawing

A. Course Content

1. History and development of mechanical drawing
2. Occupational opportunities and information
3. Supplies and equipment
4. Geometrical construction
5. Theory of shape description
6. Multiview projection
7. Sectional views
8. Auxiliary views
9. Revolutions
10. Dimensioning
11. Threads and fasteners
12. Design and working drawings
13. Oblique projections
14. Perspectives
15. Intersections and developments

B. Typical activities

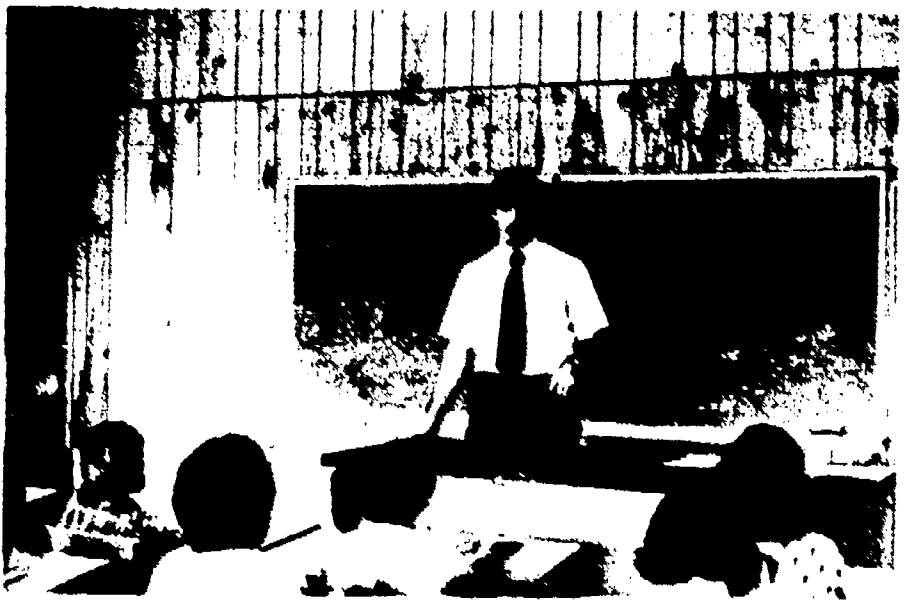
1. Problem solutions in various areas
2. Drawings of various types

CHAPTER VI

INTRODUCTION TO MODERN INDUSTRIAL PROCEDURES

Developing in each student an insight and understanding of modern industry and technology and its place in our culture is one of the primary goals of industrial arts. Some believe that this goal can best be met by giving students the opportunity to become involved in industry through the operation of their own industrial business endeavor.

In this endeavor the students form a corporate organization, raise necessary capital through the sale of stock, design and manufacture a product by means of mass production techniques, advertise and sell the product, declare a profit or loss to the stockholders, and finally terminate the corporation. Simultaneously while these activities are being carried on in the laboratory, the students are engaged in classroom studies about industry and the free enterprise system under which it operates.



An orientation to modern industrial procedures must be given to the class by the teacher advisor.

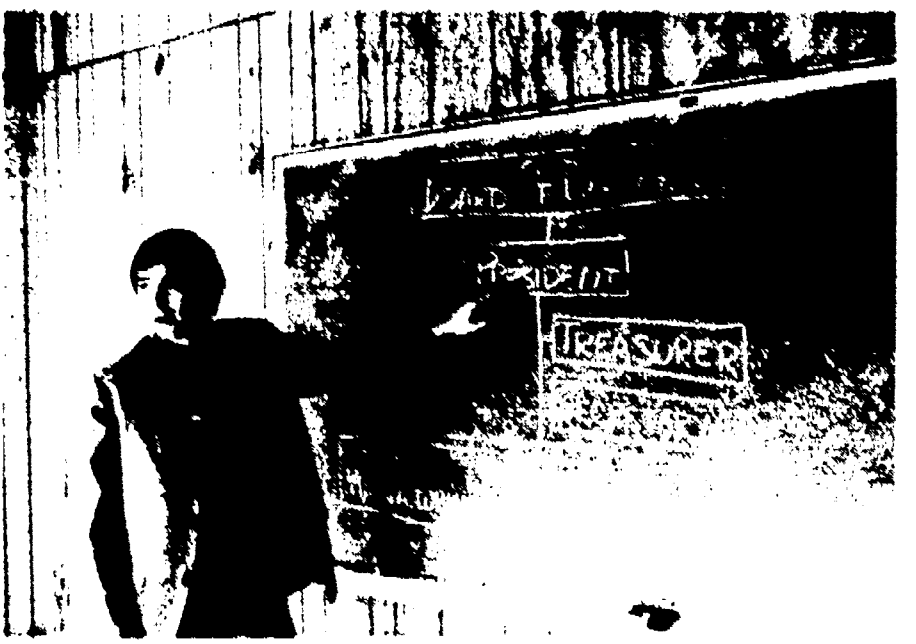
It is recommended that this approach to learning about industry be used in the latter part of a basic course in industrial arts, or it could encompass a full semester if the student has an opportunity to take two years of industrial arts. Any typical school industrial arts laboratory will serve for teaching a unit on modern industrial procedures.

This approach to teaching industrial arts will be discussed under the following seven headings: Organizing the Student Corporation, Researching and Designing the Product, Financing, Manufacturing the Product, Distributing the Product, Terminating the Corporation, and Evaluating the Learning Experience.

Organizing the Student Corporation

The students form a corporate type of business by each purchasing one share of stock in the corporation. (It is suggested that each share of stock be priced at $1.00. This figure can be adjusted, however, to meet local school conditions.) This investment makes the members of the class stockholders in the corporation and will allow the business to start with a small amount of capital in its treasury. A name for the corporation is selected by majority vote. Officers are elected to fill key positions in the corporation.

The president has the responsibility of coordinating the efforts of the three main departments of the corporation which are engineering, production, and sales. These departments are headed by vice presidents. Each class member is assigned to one of these departments.



Guest speakers may provide assistance in solving problems facing your student corporation.

The engineering department is responsible for constructing a prototype of the product to be manufactured, preparing required working drawings, and designing and building any jigs or fixtures needed by the production department.

As the name implies, the production department is responsible for all aspects of manufacturing the product.

The sales department is responsible for all aspects of advertisement and sale of the product manufactured by the corporation. If additional stock in the corporation is to be issued, the sales department will assume this responsibility.

Researching and Designing the Product

Many factors will determine the success or failure of the student corporation. The selection of the product to manufacture, however, is one of the most important because if the student business endeavor is to be profitable, the product selected must sell. The entire class should, therefore, be involved in its selection. In selecting, factors such as student ability, equipment available, space available, time required, availability of materials, and salability of the product must be carefully considered. Starting with as many ideas as possible, the selection is narrowed to two or three. A detailed study including market research should be made of these ideas. Market surveys can give information about selling price, color preferences, size, and design details. At this time students could become involved in taking a consumer survey, selecting a representative sample of the public, tabulating responses, and interpreting information received. After this has been accomplished, the product is selected based on a class vote.

The entire class should be involved in the selection of the product to be manufactured.

Financing

Once the product that will be manufactured is known, a cost analysis is made to determine the expense in producing and distributing the product. This figure, multiplied by the number of units to be manufactured, determines the total manufacturing and distribution costs. If this cost exceeds the amount of money in the corporation treasury, additional capital must be raised. The board of directors may authorize the sale of preferred (non-voting) stock in the corporation. This stock can be sold to friends and parents at the same price per share as was the common stock. These stockholders will share equally in whatever profits are made by the corporation.

An alternate method of financing this student endeavor, which eliminates the sale of stock, is taking advanced orders for the product. This requires making several products to use as samples to show prospective customers. After orders are received, plans are made to produce the units needed to fill the orders.

Manufacturing the Product

Before manufacturing can begin, a prototype of the product must be built. This is done by the engineering department which will also make working drawings of all parts of the product.

Prototypes must be handmade because they cannot be mass produced.

In planning for production an analysis of operations is made, plans are made concerning how the work will be routed during the manufacturing process, inspection procedures are determined, and the work force is trained. The vice president of production may appoint individuals to serve as safety director, time and motion director, quality control director, training director, and in other positions to assure that the production process operates as efficiently as possible. The time actually devoted to manufacturing the product varies with the type and number of units produced. In junior high school, however, three to four weeks is the average time required.

During the actual process of production all class members have some job to perform on the production or assembly line. To add realism to the experience, class members may be paid a small wage for their production efforts. The board of directors must determine the amount of wages to be paid. Mass production techniques are employed in making the products.

A standard objective of industrial arts is to emphasize a systematic approach to an assigned task. The customized production of a single unit, as used in the industrial arts project method, only partially teaches this. When making a single unit an error in sequential planning may result in little more than minor frustration. However, in mass production an error in planning is multiplied many times and can be disastrous. Therefore, the production aspect of this experience provides a realistic opportunity to employ careful and detailed planning for the production cycle.

In a mass production operation a single unnecessary motion by a worker is multiplied by the number of production units he works on each day. Sometimes this one motion can make the difference between profit and loss. The production personnel in the corporation should be aware of this and plan in detail for maximum efficiency of each worker. This responsibility would include:

1. The most direct movement (shortest distance) from one work station to another of materials.

2. Avoiding unnecessary lifting and setting down. Throughout the production process materials should be kept at working level (usually bench height) whenever possible. Wheeled materials carts are desirable.

3. Making use of whatever special tools may be appropriate to facilitate production. This may require designing and constructing jigs or fixtures.

During the time that the class is engaged in the production process, visitation should be encouraged from other students, teachers, and parents. Invitations might even be sent to industrial and business-minded people of the community, for such an activity can create interest beyond the limits of the class or even the school itself. This outside interest gives additional encouragement to the students involved.

Distributing the Product

An advertisement campaign, designed to make the buying public aware of the product being manufactured by the student corporation, begins even before products are completed. This may include posters and displays in the school building and in stores in the community.

Posters are effective means of advertising the company product.

A sales campaign is not a haphazard activity. It requires detailed planning early in the corporation's life. A careful campaign may make the difference between financial success and failure of the corporation. The type of manufactured product will suggest the sales approach to be used. A low-cost item may sell best to other students within the school. A more expensive item may sell better to parents and other adults. Some items may be sold in business areas and by door-to-door salesmen (subject to school and municipal approval).

During the sales campaign all members of the class assume the role of sales personnel. The board of directors determines the amount of commission paid on product sales. As an incentive to boost sales efforts, a sales award trophy is often presented to the student making the most sales.

Terminating the Corporation

At the end of the project the student corporation is dissolved. This involves converting the corporation assets into cash (selling all incompleted products and materials) and determining what profits have been earned. The stock certificates are recalled and the dividends that have been made are divided equally among the stockholders. The student corporation no longer exists.

Dividend checks should be prepared prior to the meeting to dissolve the corporation.

Evaluating the Learning Experience

A follow-up discussion of the organization, planning, manufacturing, and selling of the corporation product is a very important phase of the study of modern industrial procedures. Each student should be given the opportunity to give an account of his experiences in his particular job. He should discuss his difficulties, his likes and dislikes, the relationship of his job to the total operation, and the education needed to assume such responsibilities in a real industry.

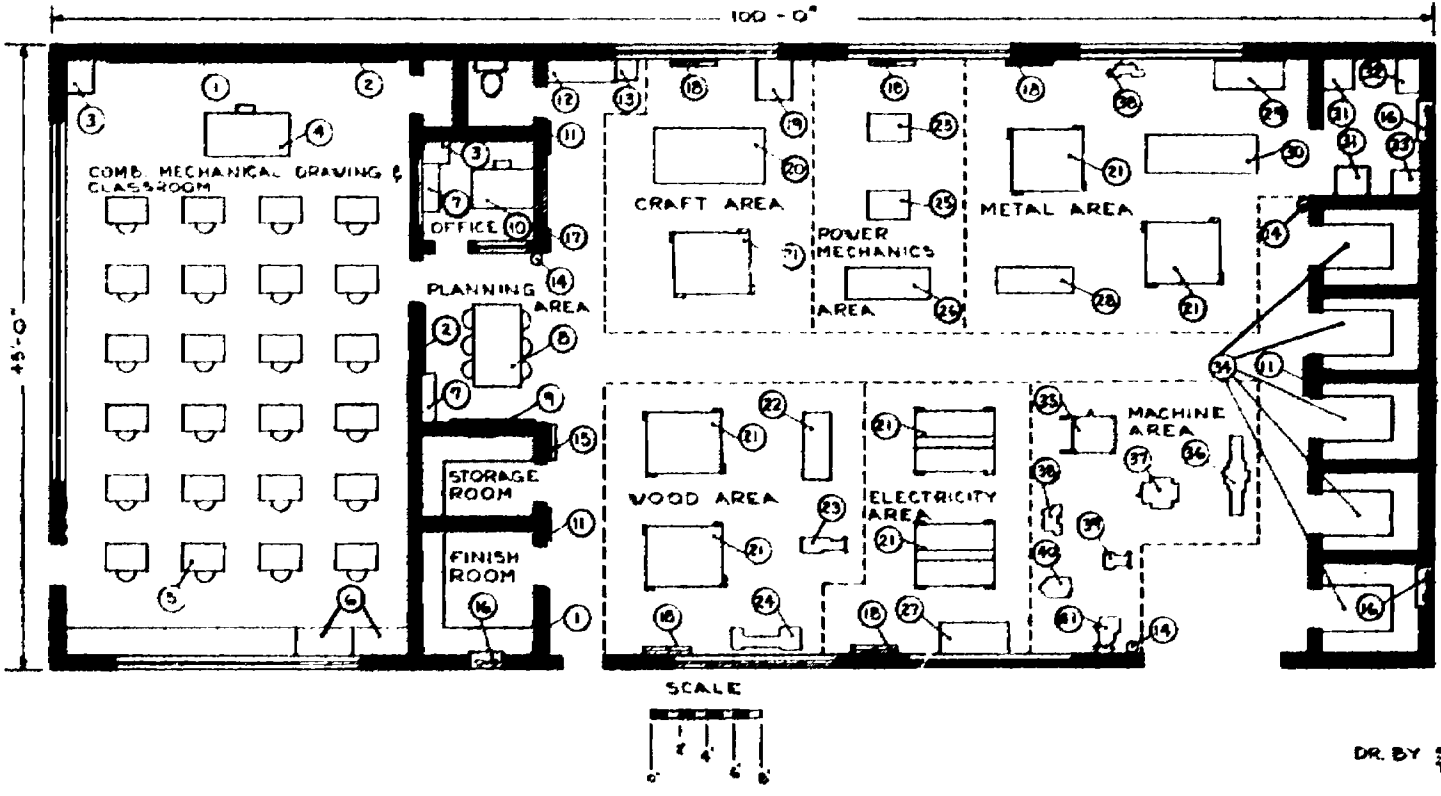
The discussion should identify problems that developed during the operation of the corporation. Possible solutions to these problems or suggestions for improving the operation should be emphasized.

APPENDICES

Unit Rotation Chart

NAME	12 days	30 days	30 days	30 days	30 days	30 days	18 days
Area I	ORIENTATION AND DRAWING	Industrial Crafts	Electricity	Metal	Wood	Power Mechanics	INTRODUCTION TO INDUSTRIAL PROCEDURES
Area II		Electricity	Metal	Wood	Power Mechanics	Industrial Crafts	
Area III		Metal	Wood	Power Mechanics	Industrial Crafts	Electricity	
Area IV		Wood	Power Mechanics	Industrial Crafts	Electricity	Metal	
Area V		Power Mechanics	Industrial Crafts	Electricity	Metal	Wood	

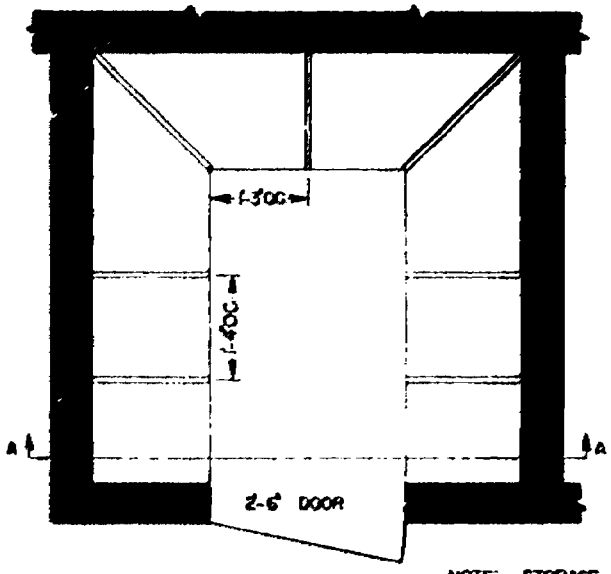
INDUSTRIAL ARTS MULTI-FIELD LABORATORY



DR. BY SHERRY THOMPSON

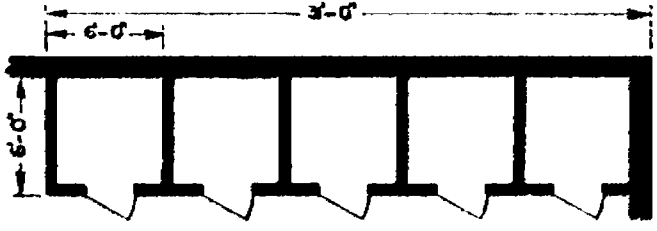
1 CHALKBOARD
2 BULLETIN BOARD
3 FILE CABINET
4 INSTRUCTOR'S DRAWING TABLE AND CHAIR
5 STUDENTS DRAWING TABLE AND STOOL
6 STORAGE CABINETS
7 BOOK CASE
8 PLANNING TABLE
9 MAGAZINE RACK
10 OFFICE DESK
11 LADDER
12 WASH SINK
13 DRINKING FOUNTAIN
14 FIRE EXTINGUISHER
15 FIRST AID
16 VENTILATION FAN
17 POWER CONTROL PANEL
18 TOOL PANEL
19 KILN
20 CRAFT BENCH
21 WORK BENCH
22 GLUE BENCH
23 SCROLL SAW 24"
24 WOOD LATHE 12"
25 WORK BENCH
26 POWER MECHANICS BENCH
27 ELECTRICAL TEST BENCH
28 METAL LATHE 10"
29 SOLDERING BENCH
30 STAKE BENCH
31 WELDING BENCH
32 WELDING MACHINE 225AMP
33 OXYGEN ACETYLENE WELDING OUTFIT
34 PROJECT STORAGE
35 TABLE SAW 10"
36 JOINTER 8"
37 PLANER 18"
38 GRINDER 7"
39 COMB. BELT AND DISC SANDER
40 DRILL PRESS 15"
41 BAND SAW 14"

CLASS PROJECT STORAGE ROOMS

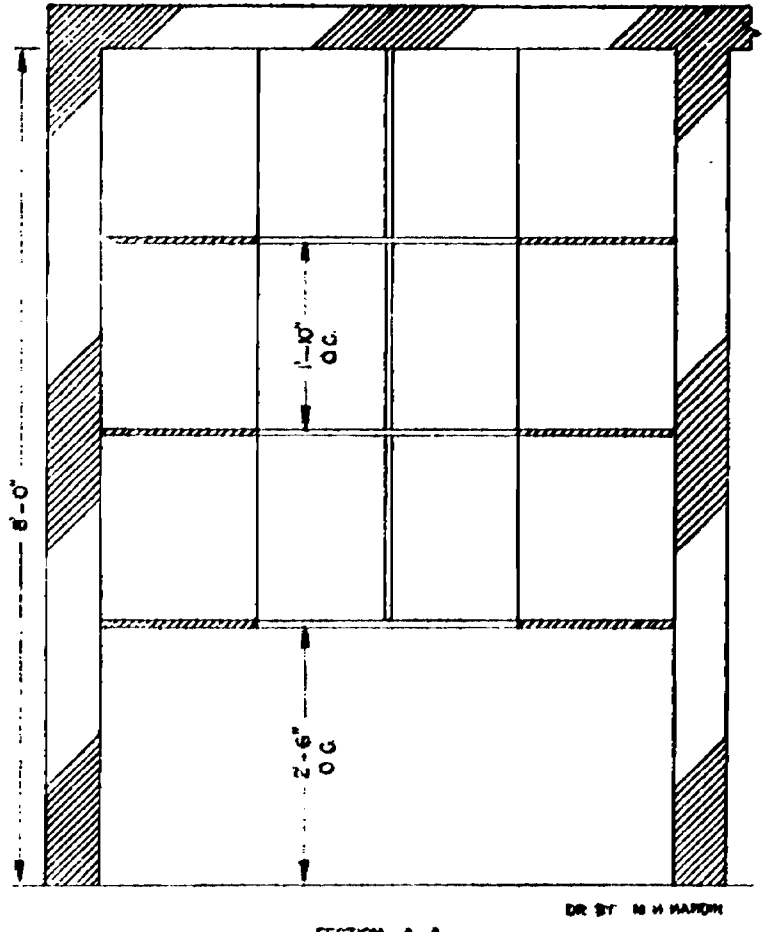


TOP VIEW DETAIL
SCALE $\frac{3}{4}$" = 1'-0"

NOTE: STORAGE BINS TO BE MADE OF $\frac{3}{4}$" PLYWOOD



FLOOR PLAN
SCALE $\frac{3}{8}$" = 1'-0"



DR BY M H HARDIN

SECTION A-A
SCALE $\frac{3}{4}$" = 1'-0"

APPENDIX C

Tools and Equipment

The following suggested lists of tools, machines, and other equipment are presented as a guide based on approximate needs for the development of units which may be included in the multi-field laboratory and those for the major-field laboratory.

It is suggested that school authorities preparing lists of tools and equipment be alert when specifying items for competitive bids. Carefully written specifications must be included to insure good quality tools and equipment. An equipment list with more detailed specifications may be obtained from the office of the State Supervisor of Industrial Arts.

MECHANICAL DRAWING

Equipment for Combination and Unit Course

Description	Quantity
Chalkboard Set, complete with compass, T-square, straight edge, protractor and triangle	1 set
Drawing Board, 18" x 24"	24
Erasing Shield	24
Irregular Curve, 8½"	24
Paper Cutter, 24"	1
Pencil Sharpener, self feeder, draftsman	1
Protractor, 6", 5 degrees, semi-circular solid square edge	24
Scale, architect's 12", engine divided	24
Triangle, 30° x 60°, 10"	24
Triangle, 45° x 45°, 10"	24
T-Square, 24"	24
Drafting Storage Cabinet	1
Drawing Table, student's	24
Drawing and Demonstration Table, instructor's	1
Filing Cabinet, 4 drawer, legal size with lock	1
General Storage Cabinet	1
Stools for Drawing Tables, adjustable heights from 18" to 27"	24
Teacher's adjustable upholstered chair with ring footrest, adjustment from 20" to 28"	1
Draftsman Duster Brush	24
Paper Shears, 10"	1

Optional equipment for unit course:

Drawing Set	24
Lettering Set	4
Drafting Machine, board coverage 28" x 40"	24
Whiteprinter and Developer Combination, 42" capacity	1

ELECTRICITY-ELECTRONICS

Hand Tools and Testing Equipment

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Bit, auger, ¼"-1" x 16ths	0	1 set
Blades, hack saw, 12", HS: 18 T 24T	0	1 doz.
Brace, 10", open ratchet	0	2
Buzzers	6	18
Capacitance Tester, wired,	0	1
C-Clamp: 4", 6"	0	4 each
Chisel, wood: ¼", ½", ¾", 1"	0	1 each
Cold Chisels: ¼", ⅜", ½"	0	1 each
Combination Box and Open End Wrenches, set of 11, ⅜"-1"	0	1 set
Combination India Oil Stone, 6" x 2" x 1"	0	1
Compass, huntsman	1	4
Conduit Bender: ½", ¾"	1 each	1 each
Countersink, rose, ¼", brace	0	1
Crimper Cutter	2	4
Dividers, wing, 8"	0	2
Drill, S. S. Jobbers type, 1/16"-1.4" x 64ths	1 set	2 sets
End Nipper, 6"	0	1
Extension Cord, heavy, 25'	1	2
File, auger bit, 7"	0	2
File Card	0	4
File Handles, assorted sizes	0	1 doz.
File, mill, bastard cut, 10"	0	2
File, round, metal, 10"	0	2
File, round, wood, bastard cut, 10"	0	2
File, wood, cabinet, 10", half round	0	2
Galvanometer, 50-0-50 scale, 2½"	1	2
Hammer, ball pein, 8 oz., 12 oz.	0	1 each
Hammer, nail, 13 oz.	2	4
Hammer, soft face, 8 oz., resilient celluloid	0	1
Hand Drill, 3 18" cap.	1	2

Headphone, double	1	2
Hexnut Driver	1 set	2 sets
Knife, Sloyd	4	8
Magnets, bar, 2", permanent	1 set	2 sets
Magnets, lab set	1 set	2 sets
Mallet, rubber, 20 oz.	0	1
Mats, rubber, for test bench	1	2
Nail Set: 1/32", 3 32"	0	2
Needle Files, 12-6¼" long	1	1
20,000 Ohms Volt Multimeter, wired	0	2
Oscilloscope, 5", wired	0	1
Plane, block, 6"	0	2
Pliers, 6½", electrician's sidecutting	2	4
Pliers, 8½", lineman	2	4
Pliers, 6", needlenose with cutter	2	4
Pliers, 6", oblique	2	4
Punch, center, ⅛" x 4"	0	1
Punch, drive-pen, ⅛"	0	1
Rivet Set, 12 oz.	0	1
Rule, bench, 24"	2	4
Rule, 6', folding with brass slide	2	4
Saw, back, 14"	0	2
Saw, compass, 12"	0	1
Saw, coping, 6½"	0	1
Saw, crosscut, hand, 22", 10 pt.	0	1
Saw, hack, adjustable, 10", 12"	0	2
Saw, rip, hand, 26", 5½pt.	0	1
Screwdriver, electrician's, 8"	6	10
Screwdriver, offset, 4", 9/32" tip	1	1
Screwdriver, Phillips:		
No. 4, No. 5-9, No. 10-16	1 each	2 each
Signal Generator, wired	0	1
Signal Tracer, wired	0	1
Snips, aviation, left and right, 10"	0	2
Snips, tinner's 3" cut	0	2
Soldering, Copper, electric, 6½",		
3 16" tip, 25 watts	3	3
Soldering Gun	1	4
Square, aluminum, body 24" x 2",		
tongue 16" x 1½"	0	1
Square, combination try, 12"	0	3
Square, try, 10"	0	2
Tap and Die Set, includes NC and NF	0	1 set
Tester, electric circuit	2	6
Test Leads	1	4
Transformer, doorbell, 110 120 volt		
primary, 10V secondary	6	12
Tube Tester, wired	0	1
Vacuum Tube Voltmeter, wired	0	1

Voltmeter-Ammeter Combination		
0-25 amps AC 0-125/250 VAC		
0-50 amps AC 0-150/600 VAC	1 each	0
Wire Gauge	1	2
Wrench, adjustable: 4", 8"	1 each	2 each
Wrench, Allen type	1 set	2 sets

WOODS

Hand Tools

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Awl, scratch, 6"	3	3
Bench Stops, T-shape	4	8
Bit Auger, ¼"-1" x 16ths	1 set	2 sets
Brace, 10", open ratchet	2	4
Burnisher, 4½" blade	1	2
Caliper, 6", I.S. solid nut	1	3
Caliper, 6", O. S. solid nut	1	3
Chisel, pocket type:		
⅛"		
¼"		
½"		
¾"	2 each	4 each
1"		
1¼"		
1 ½"	1 each	2 each
Chisel, wood turning:		
1" skew		
½" skew		
⅛" gouge		
½" gouge		
½" rd. nose		
½ spear point		
½" parting	1 set	3 sets
C-Clamp:		
4"		
6"	4 each	8 each
Clamp, I-bar:		
30"		
36"		
48"	4 each	10 each
Clamp, hand: Length Jaw Opening		
12" 8½"		
14" 10"		
16" 12"	4 each	10 each
Clamp, miter frame, 24" capacity	1	3
Countersink, rose, ½", brace	1	2

Divider, wing:		
6"		
8"	1 each	2 each
Doweling Jig, 3/16"-1/2" guides	1	1
Drill, S. S. Jobber's type,		
1 16"-1 4" x 64ths	1 set	3 sets
Drill, fluted, 1 16"-11/16" (set of 8)	1 set	2 sets
Drill, hand, ¼" capacity	2	4
Expansion Bit, ⅜"-3"	1	2
File Card, steel back frame	3	6
File Auger Bit, 7"	1	3
File, cabinet, half round: 10", 12"	2 each	6 each
File, saw, slim taper, 7"	2	3
File, saw, extra slim taper, 7"	2	3
File, Mill, bastard cut, 10"	2	3
File, flat wood, 10"	2	4
File, round wood, bastard cut, 10"	2	4
File, half round wood, 10", bastard cut	2	4
Handles, file, assorted sizes	2 doz.	4 doz.
Gouge, auger bit	1	2
Gouge, marking	2	6
Bits, gimlet, assorted sizes	5	5
Glass Cutter	2	2
Gouge, outside ground with handle		
¼"	1	2
½"	1	2
¾"	0	2
1"	1	2
1½"	0	2
Gouge, inside ground, with handle:		
⅛"		
¼"		
⅜"		
½"		
¾"		
1½"	1 each	2 each
Hammer, nail: 13 oz., 16 oz.	2 each	4 each
Hammer, tack, 5 oz.	1	2
Hammer, upholsterer's, 7 oz.	1	2
Hatchet, half, 3½"	1	1
Knife, Sloyd, 3½" blade	3	6
Knife, putty, elastic blade, 3½"	2	3
Level, carpenter's, hardwood,		
1 level and 1 plumb, 24"	1	2
Mallet, carpenter's 2½" x 3" x 5"	4	8
Nail Set, sizes, 1 32", 3 32"	1 each	3 each
Oiler, 1 3 pt., straight spout	1	2
Plane, block, 6"	3	8
Plane, smooth, 8"	2	8
Plane, jack 14"	2	6
Pliers, combination, 8"	2	4

Rasps, half round, 10", bastard	2	4
Rule, bench, 24" x 1¼" maple	6	12
Rule, folding, 6', brass slide	2	6
Saw Clamp, 9½"	1	1
Saw, coping, 6½"	4	4
Saw, compass, 12"	1	2
Saw, back, 14"	4	8
Saw, crosscut, hand, 22", 10 pt.	2	4
Saw, rip, hand, 26", 5 pt.	2	4
Saw, set (for hand saws)	1	1
Saw, miter box, 28" x 5"	1	1
Scraper, cabinet, 2¾" x 11½"	1	4
Scraper, hand, 3" x 5"	4	8
Screwdriver, standard:		
3"	1	2
4"	1	2
6"	2	4
12"	1	3
Screwdriver, Phillips:		
No. 4		
No. 5-9		
No. 10-16	1 each	2 each
Screwdriver Bits, ¼"	1	2
Spoke Shave, 10" x 2¼"	1	4
Square, carpenter's, aluminum, body 24" x 2", tongue 16" x 1½"	2	4
Square, combination try, 12"	3	6
Square, try:		
10"	4	10
8"	0	2
6"	0	2
Stone, India Combination Oil, 6" x 2" x 1"	1	4
Stone, slip, medium, 4½" x 1¾" x ¼" x 1/16"	1	2
Surfome, plane type	0	4
Surform, file type	0	4
T-Bevel, sliding, 10"	1	4
Wrecking Bar	1	2
Wrench, adjustable: 6", 10"	1 each	2 each
Wrench, Allen type	1 set	2 sets
Woodcarving Set	2 sets	1 set

WOODS

Power Tools

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Drill Press, 15" floor model	1	1
Grinder, 7", complete with pedestal	0	1

Jointer, 8"	1	1
Lathe, wood, 12" swing, complete with accessories	1	3
Planer, 18"	1	1
Sander, Belt, 4" x 24"	0	1
Sander, belt and disc combination	1	1
Sander, finishing, ⅛" orbital action	0	2
Saw, Band, 14"	1	1
Saw, blades and dado heads for 10"	1 set	1 set
Saw, scroll, 24"	1	2
Saw, table, 10"	1	1
Shaper, wood, complete with accessories	0	1
Shield, safety eye, 6" visor type	1	3

WOODS

Benches

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Glue and Stain Bench	1	1
Workbench, 64" x 54" x 2¼", 32" high, each complete with 4 woodworking vises	2	9

METALS

Hand Tools

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Bending Jig, metal, capacity ½" x 1"	1	2
Blades, jeweler's saw, 5"	2 doz.	4 doz.
Chisel, cape, ¼"	1	2
Chisel, cold:		
⅛"		
⅛"		
⅛"		
¼"		
1"	1 each	2 each
Chisel, diamond point, ¼"	1	2
Chisel, round nose, ¼"	1	2
Countersink, ½", HS steel	2	4
Dividers, wing type, 8"	2	6
End Nipper, 6"	1	3

File Cards	6	12
File, half round, bastard, 10"	2	6
File, handles, assorted sizes	1 doz.	3 doz.
File, round bastard:		
8"	2	4
10"	1	4
File, mill bastard:		
8"	2	4
10"	3	6
12"	1	4
Gage, center	0	1
Gage, sheet metal	1	2
Goggles, clear	4	6
Grinding Wheel Dresser	1	2
Groover, hand:		
3/8"		
5/16"		
7/32"	1 each	4 each
Hack Saw, adjustable	3	6
Hack Saw Blades, 12" HS:		
18-T		
24-T	3 doz. each	6 doz. each
Handy Seamer:		
⅛" x 3½"		
6⅞" x 10¼"	1 each	2 each
Hammer, ball pein:		
4 oz.	1	3
8 oz.	4	6
16 oz.	2	8
32 oz.	0	2
Hammer, blacksmith's, 40 oz.	0	1
Hammer, metalcraft forming with handle	4	4
Hammer, rawhide, 7½ oz.	1	3
Hammer, riveting, 12 oz.	1	3
Hammer, setting, 12 oz.	2	3
Mallet, rubber, 20 oz.	1	3
Mallet, tinner's, 2½" x 6"	3	6
Melting Ladle, 6"	1	1
Metal Punch Kit	1	3
Micrometer, 0-1"	1	3
Oiler, bench, 5" spout	1	2
Pliers, combination, 8"	2	4
Pliers, needle nose, 6", no cutter	1	3
Pliers, side cutting, 6"	1	3
Punch, center, 1½" x 5"	1	4
Punch, hollow, 1", 1¼", 1½"	1 set	2 sets
Punch, pin, ⅛" x ⅜"	1 set	2 sets
Punch, prick, ¼" x 5"	1	3
Punch, taper, 1/8", 3/16", 1/4"	1 set	2 sets

Rivet Set, sizes 8, 6, 4, 2	1 set	2 sets
Saw Frame, jeweler's 5" deep, 5" saw	2	2
Scratch Awl, 6"	6	10
Screwdriver, Phillips:		
No. 4		
No. 5-9		
No. 10-16		
No. 18-up	0	1 each
Screwdriver: 4", 6", 8", 12"	0	1 each
Shield, visor type, 6"	3	6
Snips, aviation, left and right, 10"	3 each	6 each
Snips, tinner's, 3" cut	3	6
Soldering Copper, 1 lb. with handle	2	4
Square, aluminum, body 24" x 2", tongue 16" x 1½"	2	4
Square, aluminum, body 12" x 1½", tongue 8" x 1"	2	6
Square, combination, 12", with square and center head	2	4
Tap and Die, NC and NF	1 set each	1 set each
Tongs, curved lip, 20", ½" lip	0	1
Tongs, gad, 24"	0	1
Tongs, straight lip, 20", ½" lip	0	1
Vise, drill press	1	1
Wrench, adjustable: 4", 8"	1 each	1 each
Wrench, combination box and open end, ⅜"-1", set of 11	1 set	1 set

METALS

Machines and Equipment

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Adjustable Bar Folder, 20"	1	1
Anvil	0	1
Bender, 12" cap., complete with accessories	0	1
Box and Pan Brake, 24"	1	1
Combination Rotary Machine, complete with accessories	0	1
Drill, electric hand, ⅜" capacity	0	1
Drill Press, 15"	0	1
Electric Arc Welder	1	2
Furnace, heat treating	0	1
Furnace, soldering	1	1
Grinder-Buffer Combination	1	0
Grinder, electric 7", pedestal type	1	1
Hack Saw, metal cutting	1	1

Helmets, welding	2	4
Metal Lathe, 10" complete with accessories	1	2
Milling Machine, horizontal, complete with accessories	0	1
Shears, cut-off, 16 ga. cap.	0	1
Slip Roll, 24"	1	1
Spot Welder	0	1
Squaring Shears, foot type	0	1
Stake, beakhorn, 38"	1	2
Stake, bevel edge square, 2½" x 4½"	1	1
Stake, blowhorn, 27"	1	1
Stake, conductor, 28"	1	1
Stake, hollow mandrel, 40"	1	1
Stake, needle case, 18½"	1	1
Welding and Cutting Outfit	1	1

METALS

Benches

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Machine Bench, 60" x 40" x 2¼", 32" high	0	2
Soldering Bench, 60" x 24" x ¼", 32" high	1	1
Stake Bench, 96" x 40" x 2¼", 32" high	1	1
Workbench, 64" x 54" x 2¼", 32" high complete with 4 woodworking vises each	1	4
Workbench, 64" x 54" x 2¼", 32" high, complete with 4 machinist's vises each	1	4

POWER MECHANICS

Hand Tools

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Bar, pry	1	1
Bits, twist drill, H.S., 1 16"-1 2" x 32nds	0	1 set
C-Clamps: 6", 8"	0	4 each
Chisel, cold: ¼", ½", ¾"	1 each	2 each
Drill, electric hand, ⅜" capacity	0	1
Extractors, screw, set of 5	1 set	1 set

Feeler Gauges	1 set	2 sets
File, flat, double cut, 6", 10"	1 each	2 each
File, mill, bastard cut, 6", 10"	1 each	2 each
File, round, metal, bastard cut, 10"	1	2
File, saw: 5", 6"	1 each	2 each
Flywheel Holder	1	2
Flywheel Puller	1	2
Hack Saw, adjustable	0	2
Hammer, ball pein, 12 oz., 16 oz.	1 each	2 each
Hammer, brass, 8"	1	2
Impact Nuts	2	4
Mallet, rawhide, 6 oz.	1	2
Mallet, rubber, 20 oz.	1	2
Piston Ring Compressor	2	4
Pliers, combination, 8"	2	4
Pliers, diagonal, 6"	1	2
Pliers, needle nose, without cutter, 6"	2	4
Pliers, snap ring	1 set	2 sets
Pliers, Tru Arc	1	2
Pliers, vise grip, 7", 1¼" opening	1	2
Pliers, waterpump	1	2
Punch, center, 4", 3/32" point	1	2
Punch, pin, 8", sizes: ⅛", ¼"	1 each	2 each
Screwdriver, offset: 3", 4", 5", 6"	1 each	2 each
Screwdriver, Phillips:		
No. 4		
No. 5-9		
No. 10-16		
No. 18-larger	1 each	2 each
Screwdriver, standard:		
4", 6", 8", 12"	1 each	2 each
Tin Snips, aviation, left and right	0	1 each
Valve Guide Reamers	1	2
Valve Seat Cutter	1	2
Valve Spring Compressor	1	2
Wrench, adjustable: 4", 8"	1 each	2 each
Wrench, Allen	1 set	2 sets
Wrench, combination, ⅜"-1", set of 11	1 set	3 sets
Wrench, pipe, 12"	1	2
Wrench, socket set, ¼" square drive	1 set	2 sets
Wrench, socket set, ½" drive	1 set	2 sets
Wrench, spark plug, socket	1 set	2 sets
Wrench, Torque, 0-100 ft. lb. capacity	1	2

POWER MECHANICS

Equipment

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Coil Condensor Magnets	1	1
Compression Tester	1	1
Small Engine Tachometer	1	1
Swivel Base Vise	2	6
Test Stand	1	3

POWER MECHANICS

Benches

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Power Mechanics Bench, 1½" x 24" x 36"	2	8
Power Mechanics Test Bench, 6" x 28" x 1¼", 32" high, with storage	1	2

INDUSTRIAL CRAFTS

Leatherworking Equipment

Description	Quantity for Multi-Field Laboratory
Awl, automatic	1
Awl, scratch, 2"	2
Bone Folder, 6"	2
Carving Tools, 100 stamps, assorted	1 set
Compass, leather	1
Creaser, edge: No. 1, 3, 5	1 each
Drive Punch, round: 13/32", 9/16"	1 each
Edger: 1/8", 5/32", 7/32"	1 each
Edger, quick cut: 1/32", 1/16"	1 each
Embossing Wheel Carriage, complete with 8 wheels	1
Eyelet setter	1
Fid, 2¼" blade	1
Head Knife, 4½" x 2⅛"	1
Knife, skiving	3

Lacing Pliers, 5¼"	2
Leather Shears: 8", 10"	1 each
Modeler, assortment of 4	4
Mallets, rawhide	6
Punch, revolving, 8"	3
Riveter: 5/16", 3/8", 7/16"	3 each
Skife	2
Snap Fastener Set	1
Space Marker, 7"	1
Square, 12" x 1" x 7" x 1"	2
Stippler	1
Swivel Cutter: ¼", ½" blades	3 each
Thonging Chisel:	
3 32" single prong	
3 32" double prong	
3 32" three prong	
3 32" four prong	
1 8" single prong	
1 8" double prong	
1 8" three prong	
1 8" four prong	1 each

INDUSTRIAL CRAFTS

Plastic Equipment

Description	Quantity for Major-Field Laboratory
Asbestos Gloves	1 pair
Coping Saws	3
File Cards	2
Files, flat mail, 6"	3
Files, rat tail, 6"	2
Files, rat tail, 10"	2
Files, triangle, 6"	3
Flexible Shaft Carving Tool, electric, complete with accessories	1
Heating Oven, portable	1
Rule, bench, 1"	2

INDUSTRIAL CRAFTS

Ceramics Equipment

Description	Quantity for Multi-Field Laboratory
Kiln, electric, complete with steel base	1
Modeling Tool, 8", assorted set of 12	1 set
Molds	10
Spray Outfit	1
Wedging Board	2

INDUSTRIAL CRAFTS

Benches

Description	Quantity for Multi-Field Laboratory
Angle Steel Stool, 14" top, 24" high	6
Craft Unit, 96" x 48" x 2¼", with 12" x 12" center riser, 32" high	1
Workbench, 64" x 54" x 2¼", 32" high, complete with 2 utility type vises	1

PLANNING AREA

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Planning Table, 72" x 42" x 1¼", 32" high	1	1
Chairs for Planning Table	6	6

ADDITIONAL EQUIPMENT

Description	Quantity	
	Multi-Field Laboratory	Major-Field Laboratory
Aprons, students'	24	24
Bench Duster, 8"	8	8
Blackboard, portable	1	1
Book Case	1	1
Brooms	6	6

Dust Collector Vacuum Combination	1	1
Filing Cabinet	1	1
First Aid Kit	1	1
Office Desk	1	1
Trash Can	2	2

APPENDIX D

Assistance available from the State Department of Education:

1. Consultive services to school administrators who are establishing new programs or upgrading existing programs
2. Individual teacher conferences to help improve instruction
3. Industrial arts equipment and supply lists
4. Listing of State adopted text and reference books for industrial arts
5. Mississippi Industrial Arts Teacher Directory
6. Addresses for industrial arts equipment supply houses
7. Addresses for teaching aids and materials
8. Addresses for free 16MM films for industrial arts
9. Addresses for professional journals
10. Addresses for publishing companies
11. Addresses for curriculum guides from other states
12. Addresses for safety aids and teaching materials
13. Listing of free loan materials for industrial arts and vocational education available in the State Department of Education
14. Lists of additional related information

APPENDIX E

Material Requisitions

Date	Projects	Materials	Size	Unit Cost	Total Cost
			Total Cost of Materials		

Approved ______________________

____

____

Name ______________________

APPENDIX F

STUDENT JOB PLAN

Student's Name: _____

Course _____ Period _____

Date Started _____ Date Completed _____

INSTRUCTIONS: Before starting any project a Student Job Plan must be completed and checked by your instructor.

---

1. Name of Project: _____
2. Make sketch of project below. NOTE - If detailed drawing is required, it should be made on separate sheet and stapled to the Student Job Plan.

3. List machines and tools required in the construction of the project.

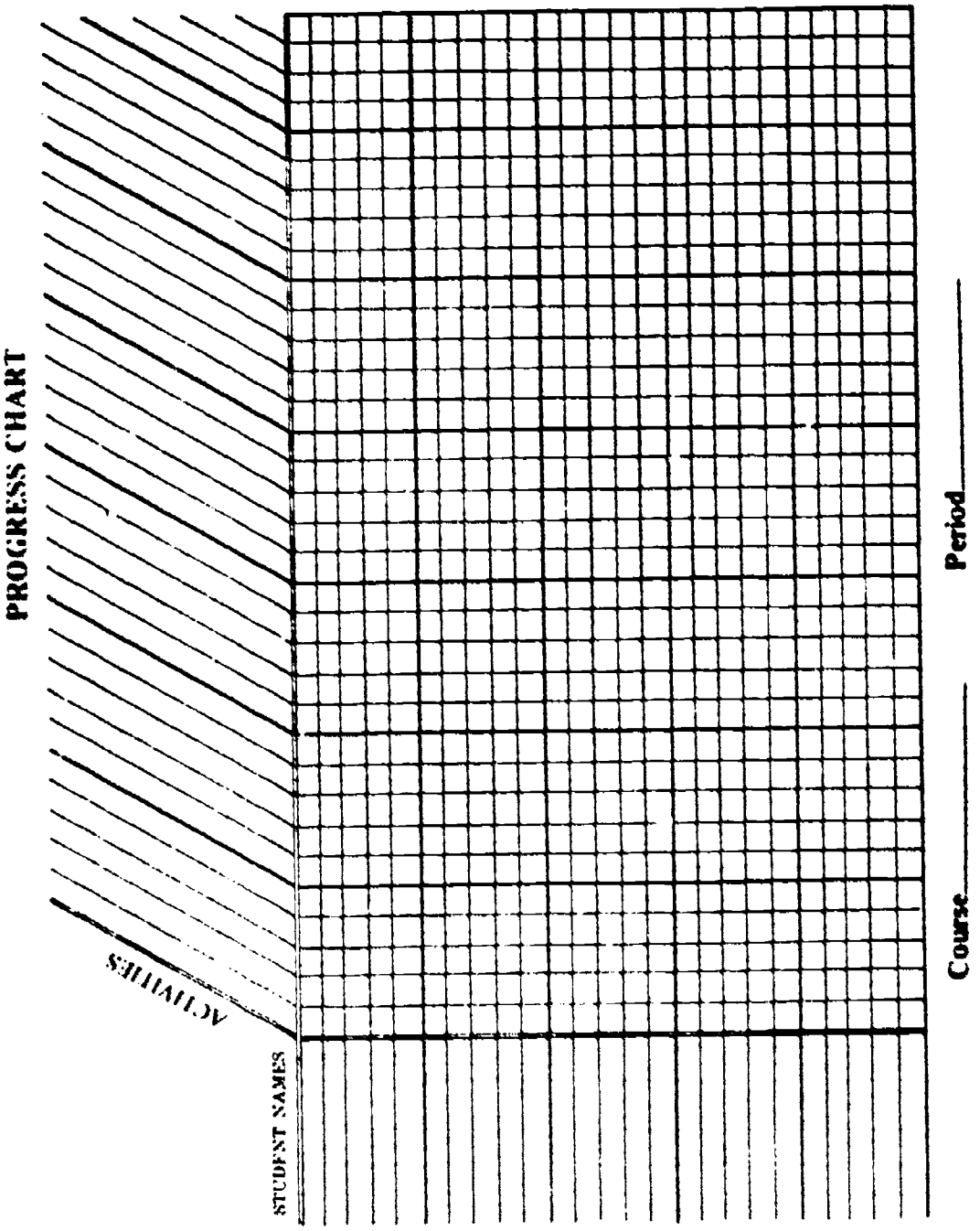
_____	_____
_____	_____
_____	_____
_____	_____

4. Fill in the following Bill of Materials

No. Pcs.	Kind of Mat.	Size	Description	Approx. Cost

5. List the Steps of Procedure to follow in construction of the project.

1.
2.
3.
4.
5.
6.
7.
8.



SUPPLIES INVENTORY

Sheet No._____ of _____ sheets

School_____ Course or Unit_____ Date_____ Instructor_____

Item	Description	Purchased from: (Name and Address)	Date Purchased	Quantity or Amt.	Cost		On Hand June 19____	Needed for Next Year
					Unit	Total		

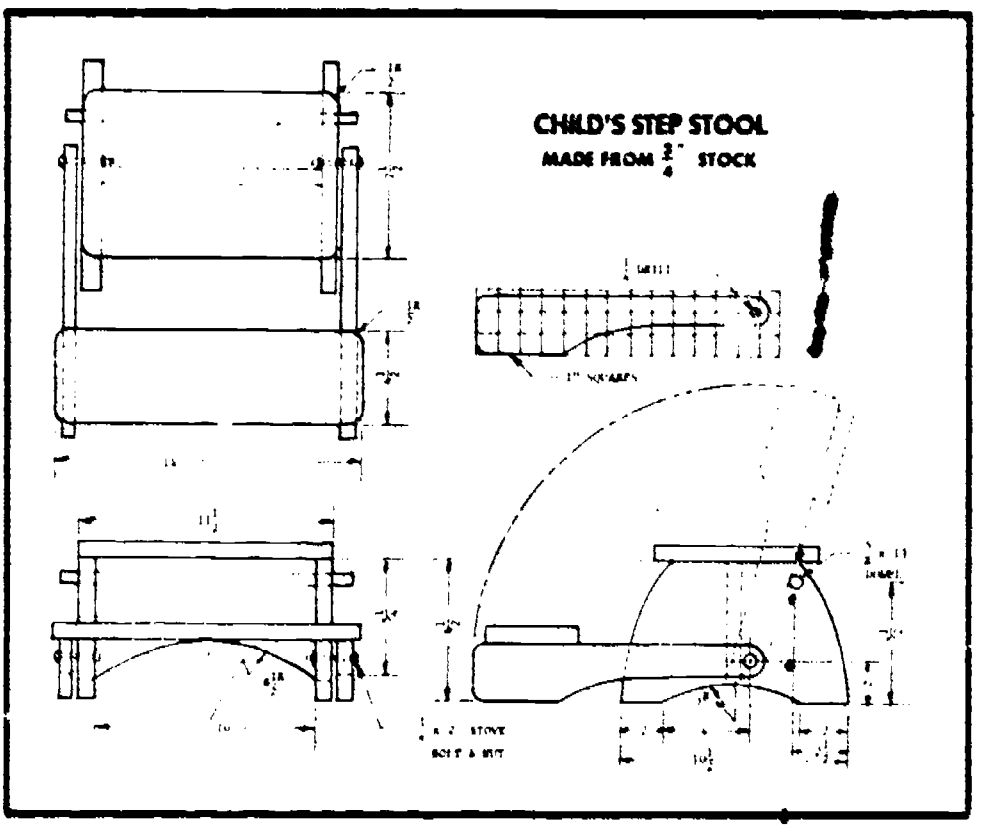
APPENDIX I

Project Sheet No. _____ Course: _____

Student's Name: _____ Period: _____

You will find many uses for this project — either as a child's stool with back rest or as a step stool. The completed project can be painted or shellacked; and, if you wish, decals may be added.

Directions: Read the entire project sheet and study the drawings so that you will be familiar with all details of construction before starting to work. Follow the steps of procedure carefully and refer to the references noted with each step if you are not familiar with the operation. This will save you time and will result in a project for which you can be proud.



Specifications: Project to be constructed of ¾" white pine or fir, fastened with #8 - 1¼" F.H.B. wood screws except where noted on drawings. Dowel to be ¾" x 14" birch rod. Finish as desired. Decal optional.

Learning Units Involved in this Project: In making this project you will have an opportunity to learn the new skills listed below and to increase your skills and knowledges concerning those with which you are already familiar.

1. Read a working drawing
2. Make a bill of material
3. Compute cost of a project
4. Select stock
5. Square stock to dimensions
6. Enlarge pattern by grid method
7. Lay out and cut irregular shapes
8. Lay out and drill holes and countersink
9. Smooth surfaces with sandpaper
10. Fasten wood using wood screws
11. Apply a finish
12. Apply a decal (optional)

Steps of Procedure: Check off each step as completed.

___ 1. Complete a Student Job Plan and have approved by instructor
___ 2. Secure materials, check and record on Student Shop Card
___ 3. Lay out and cut all parts to length and width (p. 79)
___ 4. Square sides where needed (p. 92)
___ 5. Enlarge pattern for back rest arms and trace on wood (p. 99)
___ 6. Locate and bore holes in sides and arms (p. 105)
___ 7. Lay out and cut all irregular shapes (p. 97)
___ 8. Cut dowel rod to length (p. 83)
___ 9. Sand all parts of project until smooth (p. 145)
___10. Assemble stool and back rest separately using wood screws (p. 110)
___11. Apply finish as desired (decal optional) (p. 146)
___12. Assemble back rest to stool with stove bolts
___13. Apply test of workmanship
___14. Turn in completed project with Student Job Plan for grading by instructor
___15. Take completed project, Student Job Plan, and Project Sheet home and show your parents

Test of Workmanship: When you have completed this project, test your workmanship on the following points before submitting it for a grade.

1. Does the step stool sit squarely on a flat surface?
2. Does the back rest turn easily?
3. Are all parts of the project the same size as the dimensions given on the drawing?
4. Is the finish smooth and free of runs?
5. What improvements would you make in your workmanship if you should make this same project again?

Reference:

Groneman, Chris H. and Feirer, John H. **General Shop** New York. McGraw-Hill Book Company, 1963