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Industrial Arts in the Junior High School

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INDUSTRIAL ARTS IN THE JUNIOR HIGH SCHOOL

by

Grant Eugene Shelby

A paper submitted in partial fulfillment of the requirements for the degree of Master of Education, in the Graduate School of the Central Washington College of Education

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This project is a partial requirement of Education 222, which is a partial requirement for the Master of Education degree at the Central Washington College of Education.

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Chapter I
INTRODUCTION

This paper first deals with the history and the evolvement of the philosophy and the objectives of industrial arts\(^1\) as it relates to the education of youth. Secondly, a program of industrial arts for the junior high school is proposed that is in accordance with the philosophy and objectives of industrial arts as they have evolved to the present time.

THE PROBLEM

The need for this study was made evident to the writer upon observing the industrial arts program in a number of junior high schools. These junior high schools were located in towns of two to five thousand people and employed one and possibly two industrial arts teachers. In these schools the prevailing practice was to employ the unit shop. The unit shop has been defined as a highly specialized type of industrial arts education in one or two areas, such as woodworking and mechanical drawing.\(^2\) London and Wheeler state: "It is

\(^{1}\) Industrial arts is used as a collective noun.
impossible to offer a well balanced program in a single shop confined to woodworking or metal working or any other activity.\(^1\) Further, this is not in accordance with a trend toward a broadened program of activities for values inherent in self-expression and exploration.\(^2\)

In order to understand the philosophy and objectives of present day industrial arts an historical approach is necessary. One must understand the philosophies and purposes of education in antiquity and of Europe and America at the time of colonial settlements up to the Civil War, and of contemporary America.

The philosophy and purpose of education, and of any particular educational subject changes as a society's culture changes. Our early colonial schools were to function so that the causes of various religious beliefs might be furthered.\(^3\) Society was primitive as compared to present day. Wants were for the essentials and produced by artisans by hand.

However, the philosophy and purpose of education was not always based upon a religious need. Stone tablets at Ur in Chaldea revealed laws under which young people learned how to do things by hand for

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the practical as well as the education and enjoyment they received from such activity. The code of Hammurabi provides another example of such an early example.¹ Such laws were perfectly natural, because the idea of creative skilled work is as old as civilization itself. This philosophy and purpose is again accentuated many centuries later by such an educational writer as John Amos Comenius (1592-1670) when stating some of his educational philosophy, he wrote:

Let them be like ants, continually occupied in doing something, carrying, drawing, constructing and transporting, provided always that whatever they do, be done prudently... They are delighted to construct little houses, and erect walls of clay, chip or stone, thus displaying architectural genius.²

Sir William Petty, writing a century later advocated writing a book which would lay open the mysteries of the trades, so boys, when they were bound out as apprentices might select an occupation to which they were best suited.³ Such an educational idea has its counterpart in no small degree to our modern concept of vocational guidance.

Early American education, founded upon a religious philosophy and purpose, was not all in accord with such a practical or cultural view. However, America being dynamic outgrew this narrow view of

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life based upon religion. Social change brought on by democracy, Jackson's common man, industrialization and expansion of the west instituted educational change.1

With this change, education instituted courses in manual training solely for trade training. About 1870 educators began to recognize and add to manual training courses, the purpose being to better correlate the purposes of manual training with the purposes of general education. Values stressed by Comenius, Petty, Pestalozzi, Rousseau and others, which emphasized worthy use of leisure time, consumer appreciation and worthy home membership were put forth as values in general education, and particularly manual training.2

Some of the aims of manual training as adapted to use in American schools indicate the direction of educational philosophy at that time and may be summarized as follows: (1) to furnish an outlet for constructive impulses which had been lacking in general education, (2) make school training more purposeful by recognizing a definite relationship between school and society, (3) cultivation of habits of industry, and (4) manual training in the school which

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was expected to develop a respect for physical labor.¹

The period 1880-1900 brought about a more complete integration into the high school curriculum, and tended toward a richer curriculum in the metropolitan centers. A decade later the social philosophy of John Dewey was making itself felt, particularly in the elementary school. Dewey proposed industrial arts courses as the basis for teaching other subjects. This philosophy also required that real school life problems be selected as a basis for learning, rather than those of adult life. Meaningful activity, which is basic to the philosophy of industrial arts, had a staunch supporter in John Dewey. Manual training had now become "Manual Arts" because of its increased importance and educational value.²

Dr. William Benson, in 1913, further emphasized a new philosophy and purpose in industrial arts, not only as a means, but a means to an end, when he stated:

It will appear that primary emphasis will not be placed upon the production of industrial commodities, but rather upon their choice and use...The largest problems are those of developing an appreciative understanding of industry as it is at the present time...realizing its social problems.³

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Industrial arts had now, in addition to being an educative tool of the classroom in the eyes of some educators, encompassed consumer knowledge and an understanding of our industrial society and its social problems. To assume however, that education was developing with this advance would be only partly true. As pointed out by educational authorities, philosophies develop slowly and content and method occasionally lag far behind philosophy.¹

Leaders of education such as Nicholas M. Butler, wrote, "If shopwork is used as manual training, it is because of its disciplinary value, not because of its utility."² A. P. Marble, Superintendent of Schools in Worcester, Massachusetts wrote: "There is no information stored up in the plow, hoe handle, steam engine, but there is information stored up in books."³

Mental discipline has proven unscientific, and our industrial culture might well be more easily learned and better understood in the study of the hoe handle, with all its ramifications of design, type of wood, method of production and distribution. The hoe itself in antiquity, its history, and present day place in our modern mechanized agricultural programs is of equal value in grasping the problems of our present day culture.

3. Ibid., p. 370.
The views of Thomas Dewey and Nicholas M. Butler represent totally different values of industrial arts in education. Between these views, industrial arts in general education has advanced in varying degrees of measuring up to the objectives that would be of greatest benefit to the student and society.

BASIC POSTULATES OF PRESENT DAY INDUSTRIAL ARTS

In viewing present day philosophy and objectives of industrial arts, one might base them on four postulates.

1. Individual nature and needs
2. Understanding our material culture
3. Understanding our socio-economic forces
4. Modern educational thought

Individual nature and needs are concerned with the adolescent's tendency to manipulate, together with his curiosity concerning what things are. This provides a strong motive for learning as well as a means of self expression. Moore has stated:

True growth comes through actual participation. A boy must work with tools and materials if he is going to obtain information useful to himself. The manipulative experiences offered through industrial arts should be at least seventy-five percent of a pupil's industrial arts experience.

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Modern day youth, whether in a rural or urban environment, is frequently handicapped by inaccessability to the things he hears about and wants to experience. A group of boys building a boat or constructing short wave radios for conversing with each other is rarely possible except where tools, materials and guidance are available. Such activities point to the need for supplying such tools, materials and guidance for what youth needs and wants to do. Further, such exploratory and orientation courses for some youths are a vital need in determining what broad fields of human activity their interest is in. This is becoming increasingly important as society becomes more complex.

The second basic postulate, that of material cultures, is concerned with educational experiences which will help adolescents understand the technological advances in the past and present and thus more ably understand their present physical environment. The designs in building, pottery, furniture, and modern appliances have an historical background. The Greeks and Goths contributed to our architecture, the Chinese their glazes on pottery, and Egyptians the well-balanced lines we see in cars and appliances. Understanding and appreciation lead to consumer understanding. One of the basic objectives of an industrial arts course is to impart to students a knowledge of what constitutes good material, workmanship and design.

for a particular object.¹

The third postulate concerns socio-economic forces. In our country's beginning, the economic system was open to view and free from mystery. Trade was mainly local and in handmade articles. This situation is in contrast to the tremendous complexity of our modern economic and social system due to our advance in technology. Experience through the educational medium of industrial arts that will aid in an understanding of our modern society and that will help to lay the foundations for vocational interest is one of the teaching aims of an industrial arts program.²

In order to give pupils these experiences necessary to understanding and living successfully in our society, a new phase of industrial arts education must be inaugurated. Proffit concludes:

The school shop today can no longer justify its program if youngsters only make traditional objects out of wood and take them home as they did a generation ago. Functions of the modern program require a much more significant program. Such programs now provide for:

1. Activities in as many industries as school shops and laboratories will permit
2. Use of typical and important industrial tools
3. Experience in production methods
4. Experience in handicrafts

5. Acquaintance with the organization and operation of industrial and commercial industries

6. Study of safe and hygienic ways of doing all types of work

7. Selection and use of some of the products of industry

8. Practice in identifying the more important methods employed in industry

9. Utilization of salvaged materials for project work

10. Interpretation of the sources, principles and applications of power such as steam, water, internal combustion engines and electricity

11. Study of significant inventions

12. Study of materials from source to completed object

13. Study of vocational opportunities

From the above objectives of industrial arts in relation to our socio-economic system, one fact is evident. Industrial arts subjects must be representative of the trade and industry of the nation if they are to be of significance in guiding youth in an understanding of our social and economic forces, and helping him vocationally for

Matching men and jobs is one of the primary objectives of all schools, and industrial arts can further this objective greatly because it offers the materials, the experiences and the study of industrial technology of our society.

The fourth postulate concerns modern educational thought of learning through experience. Just what is the philosophy behind creating and learning by experiencing? Perhaps it is best expressed by John Dewey, when he stated, "We must conceive of work in wood, metal, of weaving, sewing and cooking as methods of life, not as distinct studies." Dewey further stated, "The aim is not the economic value of the products, but the development of social power and insight." Dewey thus saw the curriculum as basically embracing experiences that would give youth an insight and understanding of his total environment. In school, activities and experiences should parallel out of school experiences as much as possible so that the major goals of education may be achieved, namely, cultivation of wholesome living, development of social sensitivity and effective participation in group life and preparation for vocational

2. Ibid., p. 351.
4. Ibid., p. 16.
Further, any educational program must of necessity be broad enough to enable students to comprehend all areas of human experience. Active participation and experience must also further provide for creative living and thinking on the part of the student. Industrial arts through its experience method of pupil participation is ideally suited for the development of social power, human insight and an understanding by youth of his physical environment. Subject matter that gives experiences closely allied with real life situations and provides for creative thinking through its method of student planning and designing of projects is the unique contribution of industrial arts to educating for living through pupil participation and experiencing.

RELATIONSHIP BETWEEN INDUSTRIAL ARTS AND GENERAL EDUCATION

One may well ask whether these four postulates fit into the objectives of general education. The question can be best answered by inquiring into these objectives. Specialized training for specific

occupational activities is not a part of general education. Rather, it is concerned with the necessary skills, processes and attitudes required of an individual to become an integrated and effective member of a democratic society. It seeks to develop a wholesome personality capable of seeing the best in the thoughts and achievements of man and society. It further educates the individual for capacity to make adjustments and changes which are inherent in life and the progress of man. General education may be thus thought of as educating for wholesome personality development, capable understanding and appreciating our society with the ability to adjust, improve and become an integrated and effective member of a democratic society.

More specifically explaining this definition, general education may be considered to serve three purposes, namely:

1. Transmit a way of life, namely democracy

2. Improve that way of life, the most possible method being training for critical thinking

3. Meet the needs of the individual in the development of personality and basic living

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2. Ibid., p. 391.
We live in a democratic society and are therefore primarily concerned with democratic living as a way of life. A careful study of our democratic organization reveals itself as an industrial democracy.\(^1\) Industrialization has brought rapid and unprecedented changes in the nature of our society which has brought strains and lack of adjustment in American life.\(^2\) Youth, in order to transmit our industrial democracy must understand his environment. Thousands of new materials surround him, as social problems in labor and industry and a myriad of occupational choices. All of these point to the increasing importance to which industry should be emphasized in public schools as a teaching method in educating for industrial democracy. Democratic living can be furthered by democratic shop organization and student voice in planning projects. Industrial arts thus furthers democratic living by its content and classroom method.

The second purpose of general education, namely to improve our way of life, demands an aim and desire for better things materially, socially and culturally.\(^3\) This involves primarily critical thinking. One may safely say that the ability of a society to advance and make progress depends largely on the extent to which members are willing to do critical thinking.\(^4\) The first step in the process of critical thinking is recognition of a problem. General education

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1. Ibid., p. 17.
must present students with problems requiring a solution and encourage critical thinking. The implication of this fact for industrial arts is self-evident, because industrial arts involves the understanding of the materials, the planning and the making of a problem project. "It is probably more important from an educational viewpoint that a child be able to plan his project carefully than he be able to carry it out skillfully."¹

The third purpose of general education is meeting the individual needs of the student, both as to his personality development and basic living and facilitated by industrial arts.

An educational authority has listed two of several personality needs which are pertinent to an industrial arts curriculum: a sense of belonging and a feeling of success and accomplishment in worthwhile endeavors.² The informality of industrial arts classes and their organization of specified duties, as being shop foreman or in charge of the tool room for a week, all make the individual feel his rightful importance and worthy recognition. Thus the first need, a sense of belonging, is met by the industrial arts classes.

The second need, that of success, is ideally suited to industrial arts because this field of study allows for individual difference.

Ideally, each pupil will be working on different projects. The pupil's objective is not to keep up with the class in number of projects or do as good work as the next student, but rather, to accomplish successfully within his native ability. In a survey of seven hundred and twenty-one industrial arts teachers in Washington, pride and interest in accomplishment within the student's ability ranked first in fifteen industrial arts objectives.¹

The ten imperative needs of youth as suggested by the National Association of Secondary-School Principals are:

1. Development of saleable skills
2. Understanding of science
3. Good health
4. Appreciation of the arts
5. Rights and duties of citizenship
6. Wise use of leisure time
7. Appreciation of family life
8. Respect for others
9. Consumer knowledge
10. National thinking and understanding²

Industrial arts reaches all of these needs, but particularly the development of saleable skills, understanding of science, rights and duties of citizenship, wise use of leisure time and consumer knowledge.

Development of saleable skills is facilitated because of the exploratory nature of industrial arts. Youth comes in contact with many processes of industry and occupations. Because of these experiences, he is better able to choose a vocation wisely in later training or work. An understanding of science is aided by industrial arts because of the laboratory method of experiencing the products of science, as well as related studies regarding the products and materials with which students work. Training for effective citizenship is significantly aided since industrial arts deals directly with the basic element of our culture, namely technology, its products and processes. An understanding of our culture is basic to participation as a well-informed citizen. Use of leisure time is pertinent to industrial arts because of the hobbies and interests developed that may be made use of in later years. Woodworking, metal working, particularly art metal, may well serve a basic need in an age of increasing leisure time. Consumer knowledge is inherent in an industrial arts program. All projects and laboratory experiences deal with or study the kind and method of manufacturing of all materials used. An understanding of good construction and workmanship is greatly aided through actual shop work.
Thus industrial arts as a part of general education serves to give youth an understanding of our industrial democracy so he may further what is good and improve what is bad. The individual needs of belonging and success as well as the needs of basic living are fulfilled.

From these basic objectives, and the relation of these objectives to general education, industrial arts has been defined as "That part of general education concerned with satisfying man's intimate desire to construct with concrete materials, and development of an intelligent understanding of our modern industrial civilization, and the problems which have resulted from it through contact and experience with a wide variety of industrial products, processes, and tools of manufacture."\(^1\) Another definition states, "Industrial arts are those phases of general education which deal with industry, its organization, materials, occupations, processes and products, and with the problems resulting from the industrial and technological nature of society."\(^2\)

For the purposes of this paper industrial arts is defined as a phase of general education which provides for creative and constructive needs with concrete materials, provides for personal development by its democratic class procedure and develops citizenship and integration

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into society by a curriculum based upon the processes and products of technology and the problems of an industrial democracy.

TENTATIVE PROJECTION OF THE DESIRABLE PROGRAM

In accepting this definition of just what the program of industrial arts contributes in the plan of general education, the evolution of philosophy and objectives is tremendous. No longer is it trade training for a specific occupation. Nor is it manual arts for the sake of learning to work with one's hands. Industrial arts has a psychological basis of student needs and personality development. It has a sociological basis in an understanding of one's environment and culture for better citizenship. Industrial arts is further an educative tool in the philosophy of learning by experiencing.

Recent trends are worthy of note, since they should govern any proposed program for industrial arts in general education. Among those suggested by Proffit are:

1. A strong trend toward allignment with the objectives and principles obtained in general education

2. A trend toward a broadened program of activities concerning self-expression, exploration, industry and society and industrial products

3. A trend toward increasing enrollments

4. A trend toward increasing qualifications of teachers

5. A trend toward improved physical facilities
6. A trend toward extending pupil experience beyond the class period and four walls of the shop

7. A trend toward keener relization of the value of industrial arts for girls

8. A trend toward the general shop

If a single outstanding trend of the present were to be used to predict the future of industrial arts, it would most certainly be the trend toward the organization of pupil experience for instructional purpose around the central idea of the general shop. Nothing in industrial arts has shown such growth, especially for the junior high school. London and Wheeler state:

About the only way a small school can provide a well balanced general arts program is through the medium of the composite general shop. It is impossible to offer a well balanced program in a unit shop confined to woodwork, metal work or any other single activity. The composite general shop is not a mixture of three or four shops in one. It is a carefully planned organization in which activities are chosen for student interest, relative importance and suitability for school presentation and combined into a unified program.

On the junior high school level the activities chosen center around contacts with materials, processes, products and occupations for their exploratory value. Through these the student will develop

2. Ibid., p. 12.
degrees of skills and become more competent to choose a future vocation. The program should be built around individual ability of each student so that confidence and self esteem of a student is developed. Planning a project through its different steps and areas of the general shop also increases confidence as well as good craftsmanship.

Four basic activities should be included in the composite general shop, namely woodwork, metal work, drafting and electricity. To these may be added activities from other groups which include graphic arts, ceramics, textiles, plastics and crafts in art, metal work, leather and jewelry.¹

Although the general shop includes equipment and materials for several kinds of work, it is not expensive to set up in comparison to the unit shop. Richman says:

Student experiences are spread out horizontally over several areas, and thus can be confined to the more elementary phases, thus minimizing equipment and material costs as compared to the unit shop where student activities are highly specialized with the resultant need for more elaborate equipment. Cost of tools and equipment for twenty-five students should cost around eight thousand dollars.

Newkirk adds: "Floor space of seventy to one hundred square feet per pupil is best. Thirty feet by seventy feet makes a suitable sized

2. Ibid., p. 253.
Each separate type of work has a particular location in the shop for its equipment and work space. However, unit work areas are all integrated into the whole plan of instruction. Ideally, each student project cuts across each of these units. The making of a lamp, for instance, involves many operations, as designing, planning, woodworking, metal work, electricity and finishing.

Because of all these factors, the general shop has proved itself superior. These factors of superiority as summarized by Proffit are:

1. Provides a variety of media, and consequently, of activities for pupil experience in manipulative work
2. Provides an excellent opportunity for acquiring, in a realistic way, information about industry and our industry society
3. Offers a large variety of activities that make it more nearly possible to provide experience within interest and development of pupil
4. Accords well with educational objectives and underlying principles of the junior high school
5. Makes it administratively possible to offer industrial arts in a larger number of communities than is possible under the unit shop plan.

2. Ibid., p. 85.
4. Ibid., p. 29.
The use of the general shop plan of instruction is of basic consideration in the proposed course of study of this paper, as well as the objectives of industrial arts and of industrial arts in relation to general education as they have evolved to the present.
Chapter II

GENERAL SHOP IN THE JUNIOR HIGH SCHOOL

Industrial arts is of particular significance to the Junior High School. At this age students begin to think seriously of their life work. They therefore need experience in knowing, handling and manipulating products about them. Industrial arts should further provide occupational data for their guidance into life work. In addition it should provide for an immediate, as well as future need in leisure time and recreational activity. Thus, the objectives may be briefly summarized as follows:

1. Orientational. The gaining of an overview picture of human technological experience and achievement

2. Avocational. Seeking the leisure time and recreational aspects of technology

3. Pre-vocational. The implication of technology for life work. Eventual training in specific lines of endeavor.

In order to provide such a broad field of experience, a program must be representative of as many areas as possible. Shop work should

consist of emphasis upon knowledge, understanding and appreciation. Manipulative skill in and of itself is not the dominant objective.\textsuperscript{1}

The industrial arts program must then be general rather than specific in order to provide a broad field of learning.

Because student learnings should be broad, the general shop, as has been pointed out, best fulfills the needs of students in industrial arts. The general shop may be conducted a number of ways. Two broad categories are the rotation system and the multiple activity system. In the rotation system, students rotate as a group from one type of experience to another. The multiple activity system permits many student activities in several areas under the direction of one teacher.\textsuperscript{2}

The two categories are further divided and explained by another authority, Friese, as follows:

1. Composite general shop. A number of groups engaged in activities at the same time.

2. Unrelated unit rotation. The entire class is rotated as a unit through several unrelated industrial experiences, one activity at a time.

3. Individual choice. Students pursue activities based upon the character of their particular problem.

4. Related experiences. A number of groups train in

\textsuperscript{1} State of Utah, Industrial Arts in Utah, Part I. Salt Lake City: Department of Education, 1941, p. 20.

each of several related trades at the same time.

5. Related rotation. The entire class is rotated as a unit through each of several closely related trades.

6. Unrelated unit program. The entire class is rotated as a unit through each of several unit shop students' experiences and several activities at a time.¹

The composite general shop, the unrelated unit rotation system and the individual choice method are frequently the only types feasible for the small school.² The composite general shop was chosen as the method of instruction by the writer. In such a shop, work will be carried on in several fields, usually under the direction of a single teacher.³ Typical facilities will provide experience in wood, metal crafts, electricity and the graphic arts.⁴ The composite general shop has facilities that are representative of phases of industry. The equipment need not be as great in any one area, as would be necessary in a system of complete class rotation from one activity unit to another. Thus, the composite general shop is the most economical and feasible.⁵ The composite general shop is further educatively advantageous over the related industrial experience method, as defined in the preceding paragraph, since the composite

² Ibid., pp. 149-51.
⁵ Ibid., p. 152.
general shop obviously encompasses more areas of experience.

Starting a class in a general shop presents a problem of organization. In order that students may experience all areas within the shop, they must be divided into groups.¹ Logically a system of group rotation must then be used. Divided group activity upon a rotation system is also pointed out by Friese:

A plan of organization of group rotation of pupils in general industrial arts courses is necessary whether the pupils are rotated within a single shop, a couple of general shops or several unit shops.²

The composite general shop is based upon the number of groups of activities in which the student is engaged at one time. In this paper, the writer has scheduled rotated group activities of from five to six weeks. These activities are not necessarily related. Near the end of each semester a period of two to three weeks is scheduled for student experience in projects that involve student experiences of the semester, as well as experiences the students have had in previous semesters. Suggested projects are listed throughout each unit of work. Newkirk states: "Planning and building pupil interested projects is a basic type of learning."³

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Presentation of the use of tools and materials in the general shop revolves around the teacher demonstration. Groups of students will be working in several areas at the same time. The teacher will therefore be confronted with the multiple demonstration (a demonstration to the whole class), or the single demonstration (to a single group activity). Both types of demonstration have their advantages and disadvantages, and both may be used effectively.

Student learnings of technical information and discussion of occupational matters should not take more than one fifth of the pupil's time. Students may well gather this knowledge under competent supervision. Materials are given in each unit on technical and occupational information which students are to study. The teacher will lead a teacher-pupil discussion of the information pupils should have.

The teacher will find that the use of visual aids will improve and extend his teaching of skills, related information and exploration and orientation of industry. Visual aids to be used include films,

2. Ibid., p. 114.
4. Ibid., p. 118.
industrial trips, charts and graphs.\textsuperscript{1} Talks by professional and business men in addition are very valuable teaching aids.\textsuperscript{2}

\textsuperscript{1} Ibid., p. 143.
Chapter III

PROJECTED COURSES OF STUDY FOR THE JUNIOR HIGH SCHOOL

I. Industrial Arts for the Seventh Grade

The program for the year consists of elementary drawing, elementary woodworking and elementary art metal work.

The first semester students are divided into equal groupings and rotated equally in time for work in drawing and woodworking. The second semester students are again grouped equally. One group working in drawing and the other group working in woodworking and metal work. These groups are rotated at the end of first six weeks. The remaining four to six weeks are student initiated and planned products.

An effective program at any grade level must start with a consideration of the students concerned. The typical seventh grade student may be characterized as follows:

1. Being highly active
2. Lacking in fine coordination skills
3. Having a short interest span
4. Liking to work with others
5. Being easily motivated
6. Acting before he thinks
7. Being primarily interested in immediate and personal values
8. Having a wide range of aptitudes and unknown abilities
8. Having a wide range of aptitudes and unknown abilities
9. Being inquisitive

In view of these characteristics, the work should not be too technical or of a too difficult manipulative nature. Class projects of a similar nature will provide a feeling of socialness.

In the planning of the year's work, the writer has divided the students learning experiences into three related headings, namely:

1. What students should be able to do. Under this heading, students are to be able to do specified manipulative skills or explain specified related material.

2. What students should know. Under this heading, pupils know specified information in regards to tools, materials, or related information of an economic or cultural nature as are related to related specific skills or abilities in the "What Students Should Be Able To Do" column.

3. Objectives and outcome: Under this heading the objectives are briefly summarized, and are directly related to "What The Student Should Know" and "What The Student Should Be Able To Do."

SEVENTH GRADE SCHEDULE

First Semester—sixteen to eighteen weeks—twenty-four students

Group A
Twelve students

Group B
Twelve students

First Eight Weeks

Group A—Introduction to Drawing (eight weeks)

Group B—Introduction to Woodworking (eight weeks)

Second Eight Weeks

Group A—Introduction to Woodworking (eight weeks)
Group B—Introduction to Drawing (eight weeks)

Second Semester—sixteen to eighteen weeks—twenty-four students

First Six Weeks

Group A—Introduction to Orthographic Projection (six weeks)
Group B—Elementary Woodworking (three weeks)
Elementary Art Metal (three weeks)

Second Six Weeks

Group A—Elementary Woodworking (three weeks)
Elementary Art Metal (three weeks)
Group B—Introduction to Orthographic Projection (six weeks)

Remaining Four to Six Weeks

Groups A and B—Projects involving drawing, woodworking and elementary art metal. Project should cut across two areas and preferably three.

SEVENTH GRADE INTRODUCTORY DRAWING

Eight Weeks in Length

First Semester

Purpose

To orient students into the field of drawing and motivate them of the value of planning in their shop work. Also to show the value of drawing in industry. One of the materials of drawing, namely
paper, is also studied.

**Basic Text**


**Related Information Material**


**WHAT STUDENTS SHOULD BE ABLE TO DO**

**WHAT STUDENTS SHOULD KNOW**

Recognize a drawing The purpose and value An understanding and of drawing in relation value of drawing, to the students' work and our industrial society.

Teacher will give lecture to class stressing:

1. Value of planning any project.
2. Drawing is basic to planning.
3. Industry's dependence upon drawing.

**Fasten paper to drawing board.**

**Basic text, p. 33**

How to square paper with board and attach thumb tacks.

Knowledge of elementary materials and tools of drawing, and their use.

**Use a T square and 45° triangle. Basic text, p. 45.**

Purpose of T square and 45° triangle.
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read a rule to sixteenths of an inch.</td>
<td>How a certain length is measured by a standard unit of measurement.</td>
<td></td>
</tr>
<tr>
<td>Choose a drawing pencil correctly.</td>
<td>Two grades of hardness of drawing pencil.</td>
<td></td>
</tr>
<tr>
<td>Sharpen a drawing pencil.</td>
<td>Method of sharpening pencil for good line work.</td>
<td></td>
</tr>
<tr>
<td>Make a point and line. Basic text, p. 15.</td>
<td>Importance of good line work. Draw vertical and horizontal lines to a given dimension.</td>
<td></td>
</tr>
<tr>
<td>Draw lines to definite lengths horizontally and vertically. Basic text, p. 18.</td>
<td>Importance of accuracy in lines of a drawing.</td>
<td></td>
</tr>
</tbody>
</table>

Teacher will give a demonstration of all operations thus far.

1. How paper is manufactured
   a. Raw materials
   b. Manufacturing process.
2. Grades and uses of paper in:
   a. Business and Industry
   b. Students' daily living.

Study of paper is a class assignment. Use of the related material and other materials the class may procure will be studied.
Suggested showing projects:

1. Football field
2. Basketball court
3. Garden and lawn yard plan
4. Simple house floor plans.

SEVENTH GRADE INTRODUCTION TO WOODWORKING

Eight Weeks in Length
First Semester

Purpose:
To explain the importance of wood in industry and daily living.
The value of conservation. Recognition and uses of five kinds of wood. Elementary hand tools and fundamental operations are undertaken in making simple projects.

Basic Text:

Related Information:
1. Western Pine Association. Plan Book For the Boy Builder,
2. Western Pine Association, The Story of Western Pines,
Portland, Western Pine Association: 1949 (pamphlet).
3. Douglas Fir Plywood Association, The Modern Miracle In Wood,
## What Students Should Be Able To Do

List the importance of wood in industry.

### Knowledge

- Use of wood in industry.
- Our dependence upon wood.

## What Students Should Know

### List Location of Important Trees in the United States

<table>
<thead>
<tr>
<th>Location of:</th>
<th>Knowledge of Important Tree Areas in the United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spruce</td>
<td>1. Spruce</td>
</tr>
<tr>
<td>2. Douglas Fir</td>
<td>2. Douglas Fir</td>
</tr>
<tr>
<td>4. Redwood</td>
<td>4. Redwood</td>
</tr>
<tr>
<td>5. Oak</td>
<td>5. Oak</td>
</tr>
<tr>
<td>6. Walnut</td>
<td>6. Walnut</td>
</tr>
<tr>
<td>7. Maple</td>
<td>7. Maple</td>
</tr>
<tr>
<td>8. Hickory</td>
<td>8. Hickory</td>
</tr>
</tbody>
</table>

### List the Reasons for How Our Forests Are and How Conservation Is Practiced

<table>
<thead>
<tr>
<th>Knowledge of Importance and Methods of Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fires</td>
</tr>
<tr>
<td>2. Wasteful logging</td>
</tr>
</tbody>
</table>

### Measures Taken in Conservation:

<table>
<thead>
<tr>
<th>Measures Taken in Conservation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Selective logging</td>
</tr>
<tr>
<td>2. Planting</td>
</tr>
<tr>
<td>3. Use of waste mild products</td>
</tr>
<tr>
<td>4. Fire Prevention</td>
</tr>
<tr>
<td>5. State and government timber resources.</td>
</tr>
</tbody>
</table>

### List Basic Parts of a Tree

<table>
<thead>
<tr>
<th>Location and Purpose of: Knowledge of Parts of a Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bark</td>
</tr>
<tr>
<td>2. Cambiaim layer</td>
</tr>
<tr>
<td>3. Sapwood</td>
</tr>
<tr>
<td>4. Heartwood</td>
</tr>
<tr>
<td>5. Spring and summer growth rings.</td>
</tr>
</tbody>
</table>

### List General Classification of Trees

<table>
<thead>
<tr>
<th>General Classification Knowledge of Classification and Uses of Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bark</td>
</tr>
<tr>
<td>2. Cambiaim layer</td>
</tr>
<tr>
<td>3. Sapwood</td>
</tr>
<tr>
<td>4. Heartwood</td>
</tr>
<tr>
<td>5. Spring and summer growth rings.</td>
</tr>
</tbody>
</table>
WHAT STUDENTS SHOULD BE ABLE TO DO

WHAT STUDENTS SHOULD KNOW

OBJECTIVES AND OUTCOMES

1. Evergreens—soft
2. Deciduous—hard

How to recognize our important trees by color and grain.
Particular uses of our important trees.

Explain what plywood is. Related Information: Booklet 3.

How plywood is made
Advantages of plywood
Knowledge of importance
and advantages of plywood.

This far in the unit will not involve manipulated work. Class work will be built around a knowledge of trees, conservation, and lumber. Teacher will assign reading material and lead class discussion.

Use a rule to 1/16 of an inch. Basic Text, p. 26-27.

How to measure a specified length.

Read and use a rule

Square a board. Basic Text, p. 28.

How to use a framing and try square.
Procedure for squaring a board.

Select and use a saw correctly. Basic Text, p. 36

Types of saws according to:
1. Teeth
2. Use
   a. Cross cut
   b. Rip saw

Select and use two types of wood planes

Use and characteristics of:
Select and use a plane correctly.
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic text, p. 42</td>
<td>1. Jack plane</td>
<td>Select and use a carpenter's hammer.</td>
</tr>
<tr>
<td></td>
<td>2. Block plane</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technique of striking a nail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Withdrawing nails.</td>
<td></td>
</tr>
<tr>
<td>Secure wood together by:</td>
<td>Two types of metal wood fasteners:</td>
<td></td>
</tr>
<tr>
<td>1. Nails, brads.</td>
<td>1. Brads—size and use</td>
<td></td>
</tr>
<tr>
<td>2. Glue</td>
<td>2. Nails—size and use</td>
<td></td>
</tr>
<tr>
<td>Basic Text, p. 91-92.</td>
<td>Liquid fastener:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Procedure for a glue joint.</td>
<td></td>
</tr>
<tr>
<td>Finish wood with:</td>
<td>Purpose of Sandpaper</td>
<td>Ability to smooth and Two grades of sandpaper enamel wood.</td>
</tr>
<tr>
<td>1. Sandpaper</td>
<td>Ability to smooth and</td>
<td>and their use:</td>
</tr>
<tr>
<td>Basic text, p. 99</td>
<td>Two grades of sandpaper</td>
<td>1. Number 1</td>
</tr>
<tr>
<td>2. Enamel</td>
<td>enamel wood.</td>
<td>2. Number 0</td>
</tr>
<tr>
<td>Basic Text, p. 108</td>
<td>Procedure for using sandpaper.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How to apply enamel.</td>
<td></td>
</tr>
</tbody>
</table>

Suggested Projects:

1. Animal figures
2. Corner wall shelf of plywood.
SEVENTH GRADE INTRODUCTION TO ORTHOGRAPHIC PROJECTION

Six Weeks in Length

Second Semester

Purpose

To introduce simple orthographic drawing and develop an understanding of some of the uses of orthographic projection.

Basic Text


Related Information

Discussion by members of trade crafts, draftsmen, and the teacher regarding use of orthographic projection.

WHAT STUDENTS SHOULD WHAT STUDENTS SHOULD OBJECTIVES AND OUTCOMES BE ABLE TO DO KNOW


Teacher should conduct a fairly extensive series of lessons and exercises in lettering and numerical learning experiences.

Make an orthographic Meaning of three Meaning and location of projection from a views of an object: views or a drawing.
simple isometric 1. Plan view
WHAT STUDENTS SHOULD BE ABLE TO DO

drawing (no scaling involved) Basic Text, p. 7.
Dimension a drawing. Basic Text, p. 20-23.
Use triangles of 30°, 45°, and 60°. Basic Text, p. 39.
Use a:
  1. Architect's on full scale instruments in making definite lines.
     Basic Text, p. 31.
  2. Bow compass for circles of given diameters.
     Basic Text, p. 43.
Make a:
  1. Border line lines.
  2. Visible line When to use these lines in a drawing.
  3. Invisible line lines in a drawing.
     Basic Text, p. 46.
Erase a line How to erase a line neatly

WHAT STUDENTS SHOULD KNOW

2. Side view Location of views
3. End view Location of views

OBJECTIVES AND OUTCOMES

Dimension a drawing correctly.
Select and use triangles angles in a drawing correctly.
Purpose and method of using these straight and curved lines.
Skill in making specified

Teacher will give demonstrations on all foregoing material to import
basic comprehension and skills in elementary orthographic projection.

Suggested objects in isometric form from which orthographic
drawings can be made:

1. Small wood block
2. Large metal washer
3. Horseshoe magnet

SEVENTH GRADE ELEMENTARY WOODWORKING

Three Weeks in Length

Second Semester

Purpose

This unit involves the making of a bill of materials, an introduction to wood joints, and the introduction of a number of woodworking tools.

Basic Text


Related Material

None.

WHAT STUDENTS SHOULD BE ABLE TO DO

List the reasons for a bill of material.
Basic Text, p. 32.

WHAT STUDENTS SHOULD KNOW

Reason for making a bill of material
1. Save time
2. Save material.

OBJECTIVES AND OUTCOMES

Orderliness and accuracy in planning a project.
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure cost of project from bill of material. Basic Text, p. 32.</td>
<td>Figure board feet and other items of a project.</td>
<td>Ability to figure a bill of materials.</td>
</tr>
</tbody>
</table>

Teacher will have class figure cost of a small project. Students will compute the board feet and cost per board foot and make a bill of material. Teacher will give students small finished projects which can be measured in class. Students will measure these projects and make a bill of material and cost of the projects. Student learning will be measuring, making a bill of material, and computing board feet. Basic Text, pp. 32-33.

Use a brace and bit. What a wood bit is and Ability to select a bit and bore a hole to a Procedure for using a given diameter. brace and bit: 1. Procuring correct size a. How sizes are determined b. How to insert bit into a brace c. Use brace and bit correctly.

Use a wood chisel. Two types of chisels Select and use a wood and their uses: chisel correctly. 1. Tang-characteristics and uses. 2. Mortise-characteristic and uses.
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make a:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Butt</td>
<td>Purpose of wood joints.</td>
<td>Select and make a Butt</td>
</tr>
<tr>
<td>2. Rabbit joint</td>
<td>Purpose of Butt joint.</td>
<td>and Rabbit joint correct-</td>
</tr>
<tr>
<td>Basic Text, p. 77-78.</td>
<td></td>
<td>ly.</td>
</tr>
<tr>
<td></td>
<td>1. Method of making</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purpose of Rabbit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>joining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Method of making</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Use.</td>
<td></td>
</tr>
<tr>
<td>Select and use wood screws correctly.</td>
<td>Classification of screws</td>
<td>Select and use wood</td>
</tr>
<tr>
<td>Basic Text, p. 64-68.</td>
<td>according to:</td>
<td>screws correctly.</td>
</tr>
<tr>
<td></td>
<td>1. Head</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Diameter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Length</td>
<td></td>
</tr>
<tr>
<td>Procedure for using a screw:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bore pilot hole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Countersinking.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a marking guage. Basic Text, p. 27.</td>
<td>Procedure for adjusting</td>
<td>Skill in making lines</td>
</tr>
<tr>
<td></td>
<td>and making a marking guage.</td>
<td>on wood.</td>
</tr>
<tr>
<td>Use a bevel square. Basic Text, p. 27.</td>
<td>Set and use a bevel</td>
<td>Skill in marking given</td>
</tr>
<tr>
<td></td>
<td>square for a given angle.</td>
<td>angels.</td>
</tr>
<tr>
<td>Make a chamfer or beveled edge. Basic Text, p. 54-55.</td>
<td>Laying out chamfer or bevel edge.</td>
<td>Skill in edging a board</td>
</tr>
<tr>
<td></td>
<td>Planing for a chamfer of beveled edge.</td>
<td>at an angle.</td>
</tr>
<tr>
<td></td>
<td>Mix and apply shellac.</td>
<td></td>
</tr>
</tbody>
</table>
Teacher will give a demonstration on foregoing tools and materials. Remainder of unit will consist of projects which involve learnings of this unit. Suggested projects are:

1. Bread board
2. Small cedar chest
3. Wall shelf
4. Bird feeder

SEVENTH GRADE ELEMENTARY ART METAL WORK

Three Weeks in Length

Second Semester

Purpose

To provide manipulative experiences in simple art metal, and a general knowledge of copper and aluminum.

Basic Text

Smith, Robert E., Units in Etching, Spinning, Raising and Tooling of Metal.

Related Information

<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>List the important factors about aluminum.</td>
<td>Source of aluminum</td>
<td>General knowledge of aluminum.</td>
</tr>
<tr>
<td>Related Information No. 1 and 2.</td>
<td>Uses of aluminum</td>
<td>Economic importance of aluminum.</td>
</tr>
<tr>
<td>List the important factors about copper.</td>
<td>Source of copper</td>
<td>General knowledge of copper.</td>
</tr>
<tr>
<td>Related Information No. 1.</td>
<td>Use of copper</td>
<td>Manufacturing of copper.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic importance of copper.</td>
</tr>
</tbody>
</table>

Teacher will lead class in a discussion on aluminum and copper.

**Use a jeweler's saw to cut metal.** Basic Text, p. 3-4-5.
- Securing metal.
- Dulling hole for inside cutting.
- Selecting proper saw blade.
- Correct stroke pressure on saw blade.
- Skill in cutting metal with a jeweler's saw.

**Use a jeweler's file.** Basic Text, p. 5.
- Three types of jeweler's files according to shape and use.
  1. Equating
  2. Half round
  3. Flat taper
- Three types of jeweler's files and use according to number.
  1. 0 - course
  2. 3 - medium
  3. 6 - fine.
- Skill in filing metal.
WHAT STUDENTS SHOULD
BE ABLE TO DO

Make a pierced design. Basic Text, p. 8.

Procedure for making a design.
1. Paper layout
2. Transferring to metal
3. Use of jeweler's saw and file.

Finish aluminum or brass surface. Basic Text, p. 47-48.

Select and use correct abrasives.
1. Steel wool
2. Aluminum oxide cloth
   a. Grades of coarseness
   b. Correct use.

Apply protective coat. Reason for protective coating. Types of protective coating. Basic Text, p. 91.
1. Wax
2. Lacquer

Skill in making a pierced design on metal.
Skill in securing good finish on aluminum and copper.
Skill in waxing or lacquering aluminum and copper.

Teacher will give demonstrations of foregoing operations on aluminum and copper. Suggested projects for unit:

1. Watchfob
2. Miniature animal figures
3. Letter opener

The class will work as a group the remaining four to six weeks.

Suggested projects:

1. Book Ends (of wood with metal design on ends.) Student experiences are drawing, wood-metal.
2. Letter opener (of copper with student designed wood handle.)
   Student experiences are drawing, wood-metal.

3. Corner wall shelf (of wood with student designed edges.)
   Student experiences are wood, drawing, designing.

II. EIGHTH GRADE INDUSTRIAL ARTS

Students on this grade level will continue drawing and woodworking. Sheet metal, bench metal and electricity will be the new additional courses.

The year is divided into two semesters. The first semester consists of three groups working in drawing, sheet metal, and woodworking for periods of five weeks. These groups rotate. At the end of fifteen weeks, the class works as a group on projects involving the semester's learning experiences. The second semester consists of three groups working in bench metal, electricity, and drawing. These groups rotate for periods of five weeks work in each area. At the end of fifteen weeks, students work as a group. The remaining two or three weeks consist of projects involving the year's learning experiences.

The learning experiences on this grade level must take into consideration both the physical and mental maturation of the student. They have had a year's more experience than the seventh grade pupil. Eighth grade students may be characterized as follows:

1. Having more purposeful activities—being more aware of
his limitations.

2. Having better muscular co-ordination dealing with hand experiences.

3. Likes to do things by himself, and is more critical of himself.

4. Being harder to motivate, but possessing a high competitive spirit.

5. Thinks before he acts, and more conscious of shop safety.

6. Being interested in defined and projected values.

7. Being more able to evaluate his and his fellow students products.

8. Being more restrained.1

In view of these characteristics, the writer has planned the course of study to involve:

1. Projects of greater length to complete.

2. Manipulative work requiring greater number of hand tools.

3. Wider range of related studies.

The courses of study are outlined the same as in Chapter III, under the seventh grade division.

EIGHTH GRADE SCHEDULE

Subject Schedule

First Semester - (of 16 weeks to 18 weeks) Drawing, sheet metal, and woodworking.

Second Semester - (of 16 weeks to 18 weeks) Bench metal, Electricity, and drawing.

Group A           Group B           Group C
Eight Students    Eight Students    Eight Students

Group A - 5 weeks in length
Group B - 5 weeks in length
Group C - 5 weeks in length

First Five Weeks
Group A - Drawing
Group B - Sheet Metal
Group C - Woodworking

Second Five Weeks
Group A - Sheet metal
Group B - Woodworking
Group C - Drawing

Third Five Weeks
Group A - Woodworking
Group B - Drawing
Group C - Sheet metal

Remaining Two to Three Weeks
All Groups - student planning, designing, and making of projects involving these areas.
First Five Weeks

Group A - Bench metal
Group B - Electricity
Group C - Drawing

Second Five Weeks

Group A - Electricity
Group B - Drawing
Group C - Bench metal

Third Five Weeks

Group A - Drawing
Group B - Bench metal
Group C - Electricity

Remaining Two to Three Weeks

All groups - Student planning, designing and making of projects involving areas that have been covered by the students.

EIGHTH GRADE DRAWING

Five Weeks in Length

First Semester

Purpose

Further study of orthographic projection involving the use of the architect's rule and drawing to scale. Use of hidden lines are introduced. Simple models or isometric drawing should be the basis of the exercises.


Basic Text


Related Information


WHAT STUDENTS SHOULD BE ABLE TO DO

List the reasons for a reduced scale drawing. Basic Text, p. 42.

Read an architect's rule. Basic Text, p. 36.

List the steps in developing a scaled drawing. Basic Text, p. 55-56.

List the reasons for drawing to scale. Basic Text, p. 59.

Use an architect's scale.

WHAT STUDENTS SHOULD KNOW

Purpose of a reduced scale drawing...Conserve space and material drawing.

Mathematical principle Understand the principle of reduced scaling.

Steps in developing a working drawing.

1. Design room
2. Consulting engineers
3. Drafting room.

Use of scaled drawing in industry.

1. Saves space
2. Saves time.

Understand scaling on blades of architect's scale.

OBJECTIVES AND OUTCOMES

Understand the uses and purposes of a scaled drawing.

Understand importance of scaled drawings.
WHAT STUDENTS SHOULD BE ABLE TO DO

Use an architect's scale to lay definite reduced lengths.

WHAT STUDENTS SHOULD KNOW

1. 1 inch and 1/2 inch blade
2. 3/4 inch and 3/8 inch blade
3. 1/4 inch and 1/8 inch blade.

Meaning of small graduations.

How lengths are reduced, Skill in using an architect's rule.

Explain meaning of and make a hidden line.

Purpose of a hidden line. When to use hidden lines.

Teacher will discuss and illustrate foregoing learning experiences.

Problems can be given using an architect's scale. Suggested isometric drawings or models (drawn to half a quarter scale).

1. U Block
2. Channeled block
3. Nail block
4. Mortised block

EIGHTH GRADE SHEET METAL

Five Weeks in Length

First Semester

Purpose

Metal is becoming increasingly important in our society. This
unit therefore stresses the materials, methods of manufacture and
opportunities in the sheet metal industry. Basic tools and skills
are learned through simple sheet metal projects.

Basic Text

McKnight and McKnight Company, 1939.

Related Information

1. American Iron and Steel Institute, The Picture Story of
Steel. New York, American Iron and Steel Institute
(pamphlet).
2. Bethlehem Steel Company, Steel in the Making, Bethlehem,
Bethlehem Steel Company (pamphlet).
3. Bethlehem Steel Company, The Production of Bethiolite,
Bethlehem, Bethlehem Steel Company, (pamphlet).
Bloomington, McKnight and McKnight, Publishers, 1938.

WHAT STUDENTS SHOULD BE ABLE TO DO

WHAT STUDENTS SHOULD KNOW

List the important types of sheet metal work. Related
Information Number 4, p. 98.

Types of sheet metal: An understanding of the sheet metal trade.

1. Heating and Ventilating
2. Industrial sheet metal
3. Factory sheet metal.
WHAT STUDENTS SHOULD BE ABLE TO DO

List the opportunities and training requirements in sheet metal career. Importance of sheet metal industry for a work. Related Information Educational requirements:

1. Apprenticeship requirements.

Teacher will lead class in discussion of foregoing materials. Resource people from the sheet metal industry should be used for talks.

Use the following measuring and marking tools:

1. Straight edge
2. Tinner's rule
3. Scriber
4. Triangle square

Basic Text, p. 10-11.

Procedure in using fundamental measuring and marking tools to:

1. Square metal
2. Measure a given distance
3. Scribe a given line.

Make simple straight line layouts on metal.

Cut Sheet Metal. Two types of tinner's snips and their particular use.

1. Straight
2. Combination

Procedure for cutting metal:

1. Hold and manipulate snips correctly.

Basic Text, p. 16-17.

Two types of tinner's snips and cut metal correctly.

Use a tinner's hammer. Purpose of tinner's hammer

1. Purpose of face and peen end of hammer.

Skill in using a tinner's hammer.

Basic Text, p. 25-30.
WHAT STUDENTS SHOULD
BE ABLE TO DO

Use a mallet. Basic Text, p. 25, 31, 33.


Use a bar folder. Basic Text, p. 23.

Make a folded seam. Basic Text, p. 31.

WHAT STUDENTS SHOULD
KNOW

Purpose of a mallet. 1. When to use.

Four types of stakes and their particular use.
1. Mandred
2. Beakhorn
3. Blawhorn
4. Hatchet

Procedure for bending metal.
1. Use of clamp and edge of bench.
2. Use of pan brake.
   a. Inserting metal
   b. Operating brake levers to secure correct angle in metal.

Procedure for using a bar folder
1. Adjust screw knobs for correct size bend.
2. Insert metal and operate handle to secure correct angle.

Procedure for making a folded seam.
1. Correct allowance for metal.

OBJECTIVES AND OUTCOMES

Skill in using a mallet.
Skill in selecting and using tinner's stakes for specified forming operations.
Skill in making specified bends in metal.
Skill in making bends in metal.
Ability to make a simple folded seam.
Teacher will demonstrate these tools and processes to students.

**Solder correctly**

Basic Text, pp. 33-34-35-36.

**Procedure for soldering**

**Ability to do simple soldering**

1. Lighting torch or furnace
2. Heat iron to correct temperature
3. Tinning iron
   a. filing clean
   b. use of sal ammoniac
4. Preparing surface to be soldered
   a. cleaning
   b. applying
   c. tinning
5. Putting pieces to be soldered together properly.
6. Applying soldering copper and solder.
7. Filing and smoothing a soldered joint.

Teacher will give class demonstration illustrating learning experiences in soldering.

**List the steps in production of iron.**

**Related Information**

**No. 1.**

<table>
<thead>
<tr>
<th>Where iron ore is mined</th>
<th>Knowledge of iron ore</th>
</tr>
</thead>
<tbody>
<tr>
<td>How iron ore is mined</td>
<td>1. How mined</td>
</tr>
<tr>
<td>How iron ore is smelted</td>
<td></td>
</tr>
<tr>
<td>1. How a blast furnace operates</td>
<td></td>
</tr>
</tbody>
</table>
WHAT STUDENTS SHOULD BE ABLE TO DO

List the sources and the uses of coal in steel production. Related Information No. 1.

List the steps in the production of steel. Related Information No. 2.

List the steps in production of sheet steel. Related Information, No. 3.

WHAT STUDENTS SHOULD KNOW

a. Use of coke
b. Use of limestone

What pig iron is.

Where coal is mined

Types of coal
1. Type used in smelting iron ore to pig iron

Coke
1. What it is
2. How used in smelting

Use of open hearth furnace
1. How it operates
2. Use of:
   a. Scrap iron
   b. Pig iron
   c. Limestone
3. Size of furnace
4. Temperature

Use of Bessemer Converter
1. How it operates.
2. Why used

Use of electric furnace
1. Making of alloy steels
2. What an alloy steel is

Ingots
1. What they are

Rolling ingots
1. Hot roll
2. Cold roll
   a. Zinc coating
   b. Terne coating
1. Lead
2. Zinc
3. Tin

Knowledge of the use of coal in making iron and steel.

A knowledge of method of manufacture and importance of sheet steel.

How sheet steel is made from ingots

A knowledge of how steel is protectively coated.
WHAT STUDENTS SHOULD BE ABLE TO DO

List the composition of tin plate and its use in our economy. Related information, No. 3.

- What tin plate is manufactured and used.
- How tin plate is coated.
- How tin plate is formed.
- Importance of tin plate.

List reasons for the importance of steel in our economy. Related Information, No. 1. and 2.

- Uses of steel.
- Value of product.

The Teacher will direct a class study of steel under the points enumerated. The use of all of the related material is excellent for this purpose. Suggested projects for learning experiences in sheet metal:

1. Broom holder
2. Card holder
3. Pad holder
EIGHTH GRADE WOODWORKING

Five Weeks in Length

First Semester

Purpose

Pupils will learn to use a wider variety of basic hand tools and materials already studied. The study of related information, wood fasteners and several wood finishes is undertaken. Projects should be increasingly difficult and student initiated.

Reference Material

Basic Text


Related Information

1. American Steel and Wire Company; Nails. Chicago, American Steel and Wire Company, 206 South La Salle Street. 1948 (pamphlet)


WHAT STUDENTS SHOULD BE ABLE TO DO

Recognize, use and adjust the following new tools:

1. Planes
   a. Smoothing plane
   b. Jointer plane
   Basic Text, p. 45.

2. Wood Files
   Select and use a file correctly.
   Basic Text, p. 59, 162.

3. Use a wood scraper. Basic Text, p. 102.

4. Saws
   a. Back saw
   b. Mitre saw
   c. Compass saw
   Basic Text, pp. 47-48.

5. Wood bits
   a. Auger bit
   b. Countersink bit
   c. Expansive bit
   d. Forstner bit
   Basic Text, pp. 60-63.

WHAT STUDENTS SHOULD KNOW

The particular use of each plane
How to disassemble, assemble and adjust
plane
iron by:
1. Grinding
2. Whetting.

The particular use of each plane
How to sharpen a plane
1. Grinding
2. Whetting.

Ability to select, adjust and use these wood planes correctly.

Ability to select and use a file correctly.

1. Shape
2. Degree of coarseness
3. Cut of Teeth

Use of each classification
1. Procedure for filing

When to use a scraper
Procedure for using Method of sharpening.

The particular use of Ability to select and use correctly these wood saws.

Select the right size bit and use

properly for:
1. Size
2. Particular operation

Basic Text, pp. 60-63.
WHAT STUDENTS SHOULD BE ABLE TO DO

6. Wood holding devices
   a. Cabinet clamp
   b. Cabinet screw

Teacher will give a demonstration on the selection, use, and care of each of these tools.

WHAT STUDENTS SHOULD KNOW

The particular use and proper method of using these wood holding devices.

Ability to use a cabinet clamp and wood screw correctly.

OBJECTIVES AND OUTCOMES

Select and use correctly the following wood fasteners:

1. Nails
   Method of manufacturing nails
   Importance of nails
   Characteristics and use of:
   1. Brads
   2. Finishing
   3. Casing
   4. Common
   5. Box

   Sizes of nails
   1. What penny means
   2. What the lengths are

Basic Text, p. 69-70. Related Material, No. 1.

2. Screws
   Method of manufacture
   Importance of screws
   Characteristics and uses of:
   1. Round head screws
   2. Oval head screws
   3. Flat Head screws
   4. Phillip's screws

Basic Text, p. 64-65.
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Brass screws</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Steel screws</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Meaning of numbers in regard to sizes
1. Number size
2. Length size

3. Glues

Types of glue and how Technical knowledge manufactured.

<table>
<thead>
<tr>
<th>Reference material, No.</th>
<th>Types of glue and how Technical knowledge manufactured.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic Text, p. 91-92</td>
<td>1. Animal</td>
</tr>
<tr>
<td></td>
<td>2. Liquid fish glue</td>
</tr>
<tr>
<td></td>
<td>3. Casein glue</td>
</tr>
<tr>
<td></td>
<td>4. Resin glue</td>
</tr>
</tbody>
</table>

Uses and advantages of the above types of glue a glued wood joint.

How to glue wood correctly
1. Proper fit of wood surface
2. Applying glue to wood
3. Clamping

Hinges (Teacher will have samples of these hinges).

Kinds of hinges and their particular use

<table>
<thead>
<tr>
<th>Procedure for installing each of these hinges.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Surface hinges</td>
</tr>
<tr>
<td>2. Butt hinges</td>
</tr>
<tr>
<td>3. Chest hinges</td>
</tr>
</tbody>
</table>

Ability to select and install correctly these three commonly used hinges.

The teacher will give a demonstration of the manipulative skill required in using these wood fasteners. Students, under the direction of the teacher will study the related materials as to methods of manufacture and classifications as to kind and size. This will be a class study project.
WHAT STUDENTS SHOULD BE ABLE TO DO

Select and use:
1. Varnish
2. Paints

Basic Text, p. 112 and p. 118. Reference material, Related Information, No. 3.

WHAT STUDENTS SHOULD KNOW

What a finishing material does for wood.

Varnish
1. Ingredients
2. Procedure for applying

Paints
1. Ingredients for the different pigments.
2. Procedure for applying.

Technical knowledge of varnish and paint. Skill in applying varnish and paint.

Teacher demonstration of manipulative skills and class study of technical materials of varnish and paint.

Suggested projects for remainder of unit:

1. Miniature cedar chest
2. Tie rack
3. Handkerchief box

EIGHTH GRADE BENCH METAL

Five Weeks in Length

Second Semester

Purpose

This unit explains the use of bench metal work in our industrial economy and introduces elementary basic tools and skills necessary
for simple bench metal projects.

Reference Materials

Basic Text


Related Information


WHAT STUDENTS SHOULD BE ABLE TO DO

List the differences Bench metal work involves: The meaning of between bench metal and sheet metal work. Basic Text, p. 4.

WHAT STUDENTS SHOULD KNOW

l. Sheet metal bench metal work. heavier than one eighth in thickness.
WHAT STUDENTS SHOULD BE ABLE TO DO

2. Bar, flat and round metals
3. Representative of more trades as tool makers, machinists, moulders, and so forth.
4. Use of a different type of tools.

WHAT STUDENTS SHOULD KNOW

List the important facts about bench metal in our economy.
Basic Text, p. 3.
Related Information, No. 4, 5.

Number of people employed The importance of Importance and value of - and opportunities our economy in the bench metal industry.
Opportunities metal work offers:
1. Types of work
2. Economic opportunities.

Since metal is becoming increasingly important to our economy, students should have a wide general knowledge of its processes and opportunities. A unit of study of several periods duration should be developed. Much helpful material may be obtained from manufacturing companies in the steel industry.

List the steps in production of bar, rod, wire, and pipe. Basic Text, pp. 4-5. Related Information, No. 4.

Process involved in the production of steel bars and plate. A general knowledge of production of metals heavier than number
1. Production of ten guage (1/8 inch hot steel slabs. thick)
2. Rolling of hot steel slabs.
1. Knowledge of production of steel plate.
WHAT STUDENTS SHOULD BE ABLE TO DO

3. Cold roll process for bars and plate of less than .05 inch thick
   Process involved in the production of red and wire.
   1. Reduction of rod and wire
      a. Cold drawing bar steel through dies.
   2. Process involved in the production of pipe
      a. Continuous weld pipe
      b. Lap weld pipe
      c. Seamless tubing.

Purpose and process of galvanizing:
   1. Use of zinc.

Measure the thickness of sheet steel and round steel correctly. Basic Text, pp. 4-5.

How to determine:

1. Wire thickness
   a. Guage sizes and equivalent in inches.

2. Steel plate
   a. Guage sizes and equivalent in inches.

3. Rod and bar sizes

4. Pipe sizes.

WHAT STUDENTS SHOULD KNOW

2. Knowledge of the manufacture of rods and wire.

3. Knowledge of the manufacture of pipe.

A knowledge of metal guage or thickness.

Teacher will lead the class in a study of the production of steel plate, wire, rod, bar and pipe. Also give a demonstration of the common sizes and guage of these materials.
WHAT STUDENTS SHOULD BE ABLE TO DO

Recognize and use correctly the following tools:
1. Files
2. Cold chisel and center punches.
   Basic Text, p. 21.
3. Hacksaw

WHAT STUDENTS SHOULD KNOW

Classification of files:
1. Cut
   a. Single  
   b. Double
2. Coarseness of cut.

Commonly used files and their purpose:
1. Mill file
2. Flat file
3. Hard file
4. Warding file
5. Half round

How to file:
1. Position of file
2. Pressure stroke
3. Draw filing
4. Clean a file

Procedure for cutting stock with a chisel:
1. Marking with light blow first
2. Cutting with hard blows.

Procedure for center punching metal.

OBJECTIVES AND OUTCOMES

Select and use a file correctly.

Select proper hacksaw blade and use a hacksaw correctly:
1. Types of sets correctly:
   a. Alternate  
   b. Raker  
   c. Undulated
2. Degree of coarseness of blade
WHAT STUDENTS SHOULD BE ABLE TO DO

WHAT STUDENTS SHOULD KNOW

OBJECTIVES AND OUTCOMES

a. Teeth per inch and type of metal to be cut.

3. Proper pressure on forward stroke.

4. Drills

Basic Text, p. 97.

How drill sizes are determined:

1. Sizes in fraction of an inch

2. Number sizes and fractional inch equivalent.

Use a drill correctly in:

1. Hand drill

2. Drill press.

List and use metal fasteners:

1. Rivets.

Basic Text, p. 25.

Rivets

Select the proper rivet for a specific purpose.

1. Classification according to shape:

   a. Oval head
   b. Flat head
   c. Cone head
   d. Countersunk head.

How size is determined by length:

Tinner's rivets

1. Size according to ounce.

2. Bolts.

Basic Text, p. 27.

Classification of bolts and their particular purpose:

1. Carriage bolts

2. Machine bolts

3. Stove bolts

Sizes of bolts:
WHAT STUDENTS SHOULD BE ABLE TO DO

Use pliers and wrenches correctly.
Basic Text, p. 20.

1. How size is determined by length and diameter.

Recognize the following wrenches:

1. Monkey
2. Crescent

Pliers:
1. Side cutting
2. Adjustable combination.

Select and use two types of vise.
Basic Text, p. 13.

Machinist vise
Select and use a vise correctly for a particular operation.

Utility bench vise
1. Characteristics and use of each type of vise.

Teacher will give a demonstration of the proper selection and use of the foregoing materials and operations.

Perform the following operations:

1. Simple bench layout involving measuring, scribing, and calculating bend allowances.
   1. Measure layout correctly.
   2. Determine center by intersecting line
   3. Use of dividers.

Basic Text, p. 10.

Calculate the length of flat bar required for angular bends:
1. Use of center line in layout
2. Adding or subtracting stock thickness for obtaining required net lengths.

Ability to do simple layout.
1. Measure layout correctly.
2. Layout in two directions.
3. Use of dividers.

Basic Text, p. 10.
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
<th>OBJECTIVES AND OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bend Metal. Basic Text, p. 22.</td>
<td>Procedure for bending flat bar in a vise. Skill in bending metal flat bar in a vise.</td>
<td></td>
</tr>
<tr>
<td>Twist metal Basic Text, p. 23.</td>
<td>Procedure for bending flat bar: Skill in twisting metal.</td>
<td></td>
</tr>
<tr>
<td>Drill metal. Basic Text, p. 29.</td>
<td>Procedure for drilling a hold: Ability to drill a given sized hole.</td>
<td></td>
</tr>
<tr>
<td>Rivet metal together. Basic Text, p. 30.</td>
<td>Procedure for riveting: Ability to fasten</td>
<td></td>
</tr>
</tbody>
</table>

- Correct use of hammer in bending metal.
- Use of a monkey wrench.
- Locating center of hold
- Marking with center punch
- Selecting right sized drill for hole diameter desired
- Secure stock and use a hand or breast drill correctly.

Calculate the length of flat bar required in making curved or irregular shapes.

1. Use of center line and wire.

Procedure for bending flat bar in a vise.

1. Position of metal in vise
2. Correct use of hammer in bending metal.

Procedure for drilling a hold:

1. Locating center of hold
2. Marking with center punch
3. Selecting right sized drill for hole diameter desired
4. Secure stock and use a hand or breast drill correctly.
WHAT STUDENTS SHOULD BE ABLE TO DO

1. Selecting two pieces of metal
   correct together securely by
   length of riveting.
   a. Formula for determining

2. Correct size hole to drill

3. Securing rivet
   a. Correct use of
      a ball pein hammer.

Teacher will give a demonstration on the foregoing operations.

Students will then have enough background to make simple bench metal projects.

Suggested projects:

1. Shoe rack
2. Pipe rack
3. Letter opener
4. Shoe scraper

EIGHTH GRADE ELECTRICITY

Five Weeks in Length

Second Semester

Purpose

Electricity has become basic to our manner of living. This unit brings out the importance of electricity and its vocational opportunities.
Also an understanding of how electricity is produced and how it operates is shown by student projects in magnetism, simple circuits, bell buzzer, and the repairing of small electrical appliances.

Reference Materials

Basic Text


Related Information


2. Films

General Electric Company, 710 Second Av., Seattle, Washington


c. Principles of Electricity. (No. S-2585. Twenty minutes, Color.)

d. Magnetism. (A slide film requiring a recoding machine) (Send request to Distribution Section Advertising and Sales Promotion Division, General Electric Company, Schenectady, 5, New York.)
**WHAT STUDENTS SHOULD BE ABLE TO DO**

- List important factors about electricity.

**WHAT STUDENTS SHOULD KNOW**

- Use of electricity in:
  1. Industry
  2. Home
  3. Defense
  4. Pleasures

**OBJECTIVES AND OUTCOMES**

Teacher will explain and illustrate how the student's everyday life is dependent upon electricity. Class discussion should bring out its importance in our industrial economy.

List the opportunities for Occupational opportunities in electrical vocations:

- Related Information, No. 1, pp. 11-18. Film No. 2.

- Various types of work
  1. Training required.

Vocational opportunities in the electrical industry:

- No. 2. Related Information, pp. 11-18. Film No. 2.

Occupational opportunities on the technical and professional level:

- Nature of work
- Training required.

Teacher should direct the students in the use of material listed.

Community resource—people as power officials, electrical engineers and electrical craftsmen should be used.

**Make an electromagnetic and show the lines of force by use of iron filings. Basic Text, pp. 1-3. Film No. 4.**

- Use of direct current in a coil around an iron core.

- Poles of a magnet
  1. North and south poles and how they repel or attract.

- An understanding of electricity as a force.
WHAT STUDENTS SHOULD BE ABLE TO DO

WHAT STUDENTS SHOULD KNOW

OBJECTIVES AND OUTCOMES

Line of force around a magnet.
Use of electro-magnets:
1. Generators
2. Motors
3. Radios
4. Buzzers

How the lines of force of electricity operate.
Uses of lines of force in electricity.

Measure rate of flow of an electric current. Basic Text, p. 9.

How rate of flow of an electro-current is measured.
1. Use of an ammeter
   a. How an ammeter works.

An understanding measuring rate of flow of an electric current.


How voltage (force) of electricity is measured.
1. Use of voltmeter
   a. How a voltmeter works.

An understanding of electricity as a force capable of being measured.

Illustrate resistance. Basic Text, p. 20-21.

What resistance is How resistance varies:
1. Length of wire
2. Size of wire
3. Temperature of wire

Measure resistance
1. Ohms Law

Uses made of resistance
1. Home
2. Industry.

An understanding of resistance to an electrical current by its conductor.
Teacher will lead class in a study of Ohm's law, and give problems in calculating the amperage, voltage, and ohm of an electrical current.

**WHAT STUDENTS SHOULD BE ABLE TO DO**

Illustrate how a battery produces electric current. Basic Text, p. 16-17. Film number 3.

**WHAT STUDENTS SHOULD KNOW**


How the ingredients react to produce an electrical current.

Teacher demonstrates by cutting an old dry cell battery in halves.

Illustrate how a storage battery works. Basic Text, p. 50-51.

Composition of a storage battery: 1. Lead plates 2. Sulphuric acid.


Students have now enough background to undertake a class project involving magnetism and the flow of an electrical current.

Convert electrical energy into mechanical energy by The two steps in converting electrical energy: Understand how electrical energy is converted into mechanical energy.
WHAT STUDENTS SHOULD BE ABLE TO DO

making a bell or buzzer operate with electrical current.
Basic Text, p. 5.

WHAT STUDENTS SHOULD KNOW

1. Changing electricity into magnetism by electromagnets.
2. Changing magnetism into motion by attraction and repulsion.

How a magnet converts this energy into motion:
1. The attraction and repulsion of the two poles of an electromagnet.

Students will construct a simple electromagnet and procure a gong bell with a clapper from the school or a supply house. A circuit should be made from electrical current supplied by dry cell batteries to the magnet. Students of more ability may construct a circuit employing a bell in one location and a buzzer in another location.

Produce electrical current by mechanical power. Basic Text, p. 54–55.

Purpose of a generator An understanding of
1. Produce how electrical energy is produced by voltage generators.
2. Furnish electrical current.

How generator produces voltage:
1. Rotation of coils between poles of magnets.

Type of current produced:
1. Alternating current
2. Action of the commutator to produce direct current.
Teacher should have a small generator and demonstrate by the use of a
galvanometer how current alternates. Also how the commutator changes
alternating current to direct current.

WHAT STUDENTS SHOULD BE ABLE TO DO

Make electrical wire joints. Related Information, No. 1, pp. 50-51.

WHAT STUDENTS SHOULD KNOW

How to make a Western Union splice.
How to make a top splice.
How to solder and insulate an electrical wire splice.

Read a simple electrical drawing. Related Information, No. 1, p. 52.

Know the symbols for:
1. Wire Connected electrical diagram.
2. Wires crossed but not connected.
3. Switch
4. Tap splice
5. Bell
6. Buzzer

Select the common sizes of electrical wire correctly. Basic Text, p. 25.

Recognize and know the knowledge of the use of:
1. Number 14 wire electrical wires.
2. Number 16 wire
3. Number 18 wire.

Teacher will demonstrate the foregoing materials and operations.

Suggested projects:

1. Make an appliance cord
2. Repair an appliance cord
3. Repair an electric iron or toaster
4. Connect a bell buzzer to dry cell.

EIGHTH GRADE DRAWING
Five Weeks in Length
Second Semester

Purpose

This unit introduces the principles of simple pictorial drawing.
Free hand pictorial sketching is followed by the making of definite
sized isometric and perspective and oblique drawings. The major
emphasis is on isometric drawings.

Reference Materials

Basic Text

Fryklund, Verne C., and Kepler, Frank R., General Drafting.
Bloomingon, McKnight and McKnight Publishers, 1938.

WHAT STUDENTS SHOULD  WHAT STUDENTS SHOULD  OBJECTIVES AND OUTCOMES
BE ABLE TO DO            KNOW

List important facts about a pictorial drawing.
Basic Text, p. 90.

Pictorial drawings show A general knowledge of objects somewhat as they what pictorial drawing appear in pictures. means.
The three types of pictorial drawings:
1. Oblique and cabinet drawing
2. Isometric drawing
3. Perspective drawing.
WHAT STUDENTS SHOULD KNOW

List the reasons for use of pictorial drawings. Basic Text, p. 90.

1. Gives an overall view of an object or building quickly.
2. Aids in designing.
3. Used extensively in daily living.
   a. Advertising
   b. Illustrations
4. Gives meaning to an orthographic drawing.

Teacher should lead the class in a discussion of what pictorial drawing is, and the importance of such drawing. Students should bring examples of pictorial drawing to class.

List the characteristics of oblique and cabinet drawings. Basic text, pp. 90-91.

1. Face of object in full form.
2. Receding lines are thirty, forty-five, or sixty degrees.
3. Oblique drawings receding lines are full length.
4. Cabinet drawings receding lines are half to three quarters true length.

Suggested oblique and cabinet drawing projects:

1. Square shape block
2. Irregular shape block

Basic Text, pp. 91-92.

WHAT STUDENTS SHOULD WANT TO KNOW

OBJECTIVES AND OUTCOMES

List the characteristics of an isometric drawing:

1. Three faces of an object shown
   a. Top
   b. Two sides

2. Three axes exist
   a. Vertical line axis
   b. Thirty degree line to right of axis
   c. Thirty degree line to left of axis

3. Vertical lines are drawn vertical

4. Horizontal lines forming right angles on the object are drawn thirty degrees

5. Means of overcoming apparent oversize by drawing thirty degree lines to isometric scale by projecting to forty-five degree line.

The students should spend considerable time on isometric drawings, since isometric drawings are used extensively in pictorial representation.

Suggested isometric drawings:

1. Blocks of regular and irregular shape

2. Wedge
3. V Blocks
4. Mortised piece.

WHAT STUDENTS SHOULD BE ABLE TO DO

List the characteristics of parallel perspective drawing.
Basic Text, pp. 93-94.

WHAT STUDENTS SHOULD KNOW

Characteristics of parallel perspective drawings: principles of perspective drawing.

1. Vertical lines in object appear vertical in the drawing.
2. Horizontal lines extending away from the eye appear to converge.
3. Horizontal lines perpendicular to horizon vanish in center of vision.
4. Horizontal lines parallel to horizon are sketched parallel to the horizon line.

List the characteristics of a parallel perspective.
Basic Text, p. 93.

Characteristics of parallel perspective.

1. Horizontal lines drawing extending away from the eye (neither parallel nor perpendicular) converge in vanishing points on either the left or right side of center of vision.

Suggested parallel perspective drawings for a project:

1. Square blocks
2. Irregular shaped blocks
3. Channel bar

Perspective drawings require considerable practice to do accurately. Further, for practical purposes oblique and isometric drawings are of greater value. Therefore, not too much time should be used on parallel perspective or other types of perspective drawings.

All students will work as a group for remaining two or three weeks. Suggested projects for remaining two to three weeks:
1. Small table lamp (of metal and wood). Student experiences are designing, drawing, bench metal, electricity, woodworking.
2. Gun rack (of metal and wood). Student experiences are drawing, woodworking, and bench metal.
3. Flower pot and holder (of sheet metal and flat bar) Student experiences are drawing, sheet metal, and bench metal.

III. NINTH GRADE INDUSTRIAL ARTS

Students on this grade level will continue work in woodworking and drawing. Additional work will consist of Pottery, Leatherwork, Foundry and Forging, and Home Mechanics.

The year is divided into two semesters. The first semester consists of three groups working in woodworking, machine drawing,
and pottery for periods of five weeks. These groups rotate. At the end of fifteen weeks the students work as a group on projects involving the semester’s work. The second semester consists of two groups working in leather craft and foundry and forging, for periods of six weeks. These groups rotate. The remaining four to six weeks the class works as a unit in home mechanics.

In planning the ninth grade learning experiences, one must consider the characteristics of students on this grade level. They may be characterized as:

1. Having advanced to a marked degree beyond the eighth grade in stature and muscular co-ordination.
2. Having made a noticeable improvement in acquiring skills and applying shop knowledge.
3. Being ready to assume a great deal more responsibility in working on projects.
4. Being ready to assimilate much more related information.
5. Being physically much larger and able to handle heavier objects and equipment.
6. Having enough co-ordination of hand and eye to be able to use power equipment.
7. Having become more safety conscious.¹

In view of these characteristics, the program given allows for

---

more individual planning and projects of greater length. Tools and learning experiences requiring safety consciousness are introduced. Learning experiences requiring more knowledge and skill are introduced.

The learning experiences are outlined as in the previous Seventh and Eighth grade levels.

NINTH GRADE INDUSTRIAL ARTS SCHEDULE

Subject Schedule

First Semester - (of sixteen to eighteen weeks, twenty-four students.)
Woodworking, pottery, and machine drawing.

Second Semester - (of sixteen to eighteen weeks, twenty-four students.)
Leather, foundry and forging, and home mechanics.

Group A  Group B  Group C
Eight Students  Eight Students  Eight Students

First Semester Schedule

First Five Weeks

Group A - woodworking
Group B - pottery
Group C - machine drawing
Second Five Weeks

Group A - pottery

Group B - Machine drawing

Group C - woodworking

Third Five Weeks

Group A - machine drawing

Group B - woodworking

Group C - pottery

Remaining Two to Three Weeks

All Groups - To be spent on projects involving all areas studied to date.

Second Semester Schedule

Group A          Group B
Twelve Students  Twelve Students

First Six Weeks

Group A - leathercraft

Group B - foundry and forging

Second Six Weeks

Group A - foundry and forging

Group B - leathercraft

Remaining Four to Six Weeks
Both Groups — work together in home mechanics class.

NINTH GRADE WOODWORKING

Five Weeks in Length

First Semester

Purpose

The purpose of the unit is to give student experience in wood finishing and wood turning. Several machine tools and wood joints of greater difficulty to make are introduced.

References

Basic Text


Related Information


2. Curtis Companies Service Bureau; *The Care of Woodwork*. Clinton, Iowa, Curtis Companies Service Bureau, 1947.
WHAT STUDENTS SHOULD BE ABLE TO DO

Select and apply wood stains properly. Basic Text, pp. 110-111.

WHAT STUDENTS SHOULD KNOW

Three kinds of stains and their characteristics:
1. Oil stain
   a. Easiest to apply wood or color.
   b. Tendency to fade
2. Water stains
   a. Raises grain of wood
   b. Gives a darker color
3. Spirit stains
   a. Expensive
   b. Fade easily
   c. Used for refinishing

Method of applying stains:
1. Oil stains with long, even strokes of brush
2. Water stains require several coats with a brush

Teacher will give a demonstration on the technique of applying the various stains to obtain the best results.

APPLY WOOD FILLERS TO OBTAIN DESIRED SURFACE FINISH.

Purpose of wood fillers Select and use wood and wood requiring fillers correctly.

1. Fills pores of wood
2. Wood requiring fillers
   a. Oak
   b. Walnut
   c. Mahagany
   d. Chestnut

Method of applying wood fillers:
1. Apply with cloth and rub in well
2. Cover with coat of shellac

APPLY CRACK FILLER

Types of crack fillers and their application

Apply a filler to remedy a defect
WHAT STUDENTS SHOULD BE ABLE TO DO

1. Stick or nail hole in wood.
2. Plastic wood
3. Method of application and finish.

Select and apply the following wood coatings:

1. Lacquer.
   Basic Text, pp. 120-121. Related Information, No. 2.

Advantages of lacquer:
1. Durable finish and apply
2. Water resistant properly:

Method of applying lacquer:
1. Always use an undercoat of shellac
2. Use of airbrush or hand brush

Thinning:
1. Use of lacquer thinner.

2. Varnish.
   Basic Text, pp. 118-119. Related Information, No. 2.

Types of varnish:
1. China wood oil
2. Synthetic resin
3. Alkyd
4. Spar

Advantages of Varnish:
1. Gives a clear durable finish.

Method of applying varnish:
1. Correct use of brush
2. Rubbing with pumice stone or commercial rubbing compound.

3. Enamel.
   Basic Text, p. 112. Related Information, No. 1.

Advantages of enamels:
1. Provides a hard gloss finish in a variety of colors.

Method of application:
1. Apply over smooth, clean surface.
WHAT STUDENTS SHOULD BE ABLE TO DO

1. Use brush correctly.
   Thinning:
   1. Use of turpentine.

Teacher will give a demonstration on the correct application of lacquer, varnish, and enamel.

Select and use the following power woodworking machines:
1. Bandsaw
   Basic Text, (2) pp. 109-110.

Purpose and use of the Ability to use a bandsaw safely and accurately:
1. Used to cut irregular or curved shapes quickly and accurately.
2. Safety precautions.

2. Planer.
   Basic Text, (2) pp. 112-114.

Purpose and use of the Ability to use a planer skillfully and safely:
1. Used to obtain a smooth accurate surface on the edge or face of a board
2. Used to obtain edges for gluing
3. Safety precautions.

3. Circular saw.
   Basic Text, (2) pp. 80-86.

Purpose and use of power saw:
1. Used to rip and cross cut lumber
2. Used to rout out for certain wood joints
   a. Routing attachments
3. Safety precautions.
Teacher will demonstrate the purpose, use, and safety precautions of these woodworking machines.

**WHAT STUDENTS SHOULD BE ABLE TO DO**

Make the following wood joints:

1. **Dowel joint.**
   - Purpose and advantages: Used for glued edges.
   - Procedure: 1. Plane edges smooth
   - Basic Text, p. 78-80.

2. **Edge joint.**
   - Purpose and advantages: Used for glued edges of wood.
   - Procedure: 1. Planing to obtain accurate square edges.
   - Basic Text, p. 80.

3. **Blind Mortise and tenon.**
   - Purpose and advantages: Used in furniture and how to make a construction blind mortise and joint not easily discernible.
   - Procedure in making: 1. Lay out mortise
   - Basic Text, p. 78-85.

4. **Combination dado, tongue**
   - Purpose and advantages: Used in drawer how to make a
WHAT STUDENTS SHOULD BE ABLE TO DO

and rabbet joint.
Basic Text 2, pp. 89-90.

WHAT STUDENTS SHOULD KNOW

construction combination Dado, Tongue, and Rabbet joint.

1. Provides a strong joint

2. Procedure in making:
   1. Layout
   2. Set guide on power saw
   3. Cut out material with dado blades.

Teacher will have samples of these wood joints and demonstrate the layout and tool and machine operations involved in making these wood joints.

Turn wood to desired round shape using:
   1. Wood lathe.
Basic Text, 2, p. 12.

How wood is turned to desired circular shape:
Recognize and use the following elementary wood turning tools:
   1. Guages
      a. Shape and use
   2. Skew chisels
      a. Shape and use
   3. Parting tool
      a. Shape and use
   4. Calipers

Know what a wood lathe is and how it operates.
Select and use properly elementary wood turning cutting tools.

Perform the following Method of centering wood turning operations: stock for turning in wood lathe:
   1. Center stock on the wood lathe: Ability to turn wood to
   2. Gouge stock Method of using a gouge desired shape.
Basic Text, 2, p. 19-41. to make:
WHAT STUDENTS SHOULD BE ABLE TO DO            WHAT STUDENTS SHOULD KNOW

1. Convex surface
2. Concave surface

3. Cutting to length            Method of using a parting tool to cut to length.            Ability to perform simple cutting operations on the lathe.

4. Cutting tapered surfaces and square shoulder.    Method of using skew chisel to make tapered surfaces and square shoulders.    Ability to make tapered round shapes and cut square shoulders.

5. Fasten stock to face plate.    Procedure for fastening stock to face plate:
   1. Centering face plate on stock
   2. Securing face plate on stock with screws.

Teacher will give a demonstration of these basic operations.

Suggested projects:

1. Table lamp
2. Small chest
3. Sewing cabinet.
NINTH GRADE ELEMENTARY POTTERY

Five Weeks in Length

First Semester

Purpose

To acquaint students with the field of pottery of the past and present. Also to develop an appreciation of artistic form and line through simple operations in projects of clay.

Reference Materials

Basic Text


Related Information

1. University of Wisconsin; From Mountain to Cement Sack. Madison, University Extension Division, University of Wisconsin, (a film).

2. University of Wisconsin; Clay Modeling. Madison, University Extension Division, University of Wisconsin, (a film).
WHAT STUDENTS SHOULD BE ABLE TO DO

Explore the historical background of pottery. Basic Text, pp. 1-7.

WHAT STUDENTS SHOULD KNOW

Contributions of early civilizations to the art of pottery: peoples and times to

1. Egypt (300 BC) the art of pottery.
   a. Developed brilliant glazes
2. Greeks (500 BC)
   a. Form and figure painting
3. Persia (500 BC)
   a. Simple colors
4. Rome (600 BC)
   a. Red glazes
   b. Introduced potter's wheel
5. Chinese (3000 BC)
   a. Artistic design

List the basic factors of good pottery design.

Good pottery has:

1. Smooth lines good pottery design.
2. Graceful form
3. Appropriate color.

Teacher will lead a discussion of early history of pottery. Duplicates of the early forms of pottery as well as modern pieces will illustrate to the students the meaning of good pottery.

List the basic material of pottery. Related Information, No. 1.

What clay is:

A general knowledge of clay.

1. Silica of alumina

Where found:

1. River beds and open pits

Classification of clay:

1. Residual
2. Sedimentary.
WHAT STUDENTS SHOULD BE ABLE TO DO

Prepare clay.
Basic Text, p. 18.

Correct amount of water for a given amount of clay.
Kneading the clay.
Wedges the clay.

WHAT STUDENTS SHOULD KNOW

Ability to mix clay correctly.

OBJECTIVES AND OUTCOMES

Roll clay flat.
Basic Text, p. 25.

Method of making clay flat:
1. Use of a rolling pin.

Cut clay.

Method of cutting:
1. Use of a knife
2. Use of a straight edge
3. Use of an irregular shaped template.

Form clay into predetermined shapes and forms by:
1. Template method.
Basic Text, p. 19.

How to form by objects out of clay in the flat form:
1. Making a paper template of a planned project
2. Cutting clay to size of template.

2. Coil method.
Basic Text, pp. 20-21.

How to form by using clay coils:
1. Rolling a clay rope
2. Method of forming object by coil method.

3. Pinch method.
Basic Text, p. 19.

How to form objects by hand:
1. Use of the fingers to form from ball of clay.

Related Information, No. 2.
Teacher will give a demonstration on the preparing and methods of forming clay.

WHAT STUDENTS SHOULD BE ABLE TO DO

Smooth a dried piece of pottery. Basic Text, p. 24-25.

WHAT STUDENTS SHOULD KNOW

1. Use of a sponge preparation for glazing.
2. Use of a scraper or knife.

Objectives and Outcomes

List the basic composition of glazes. Basic Text, pp. 112-114.

Classification of glazes and their main ingredients:

1. Raw glazes
   a. Lead, zinc, flint, clay and other minerals in natural form
2. Fritted glazes
   a. Lead, zinc, flint, clay and other minerals that have to be fritted.

How colors are obtained in a glaze:

1. Addition of certain minerals:
   a. Copper gives green
   b. Cobalt gives blue
   c. Iron gives yellow and brown.

Apply a glaze. Basic Text, pp. 116-118.

Methods of applying a glaze:

1. Dipping object in a glaze properly.
2. Pouring on a glaze
3. Brushing on a glaze
4. Spraying on a glaze.

Teacher will give a demonstration on smoothing the surface and applying glaze correctly after biscuit firing. Students should also
be told the kind and composition of the glazes they are applying.

WHAT STUDENTS SHOULD BE ABLE TO DO

Fire a kiln.

Basic Text, pp. 105-9.

WHAT STUDENTS SHOULD KNOW

Pack a kiln correctly

Skill in packing and Purpose of biscuit fire

Firing a kiln.

Purpose of glaze fire

Use of Pyrometric cones.

Teacher will give a demonstration on packing a kiln and raising the pyrometric cone to obtain correct temperature.

Suggested Projects:

1. Leaf design
2. Small box
3. Ash tray
4. Animal figures

NINTH GRADE MACHINE DRAWING

Five Weeks in Length

First Semester

Purpose

The purpose of this unit is to acquaint the student of the opportunities and importance of machine drawing in our society. Also to provide simple experience wherein the student will learn the principles of machine drawing as used in industry.
Basic Text

Fryklund, Vernce C. and Kepler, Frank R., General Drafting.

Bloomington, McKnight and McKnight Publishers, 1938.

WHAT STUDENTS SHOULD BE ABLE TO DO

List the purposes and uses of machine drawings. Basic Text, pp. 54-55.

Machine drawing deals with:

1. Producing machines
2. Assembling machines
3. Installing machines

Steps in developing a machine drawing: used in making a product

1. Sketch or design of industry.
   a. Experimental assembly layout design
   b. Final assembly design

Purpose of machine drawing:

1. Detailed drawings of parts of a machine
2. Shows relationship of part of a machine.

WHAT STUDENTS SHOULD KNOW

List the opportunities in the broad field of mechanical drawing. Basic Text, pp. 55-56.

Importance of machines in our society.
The necessity of drawing to machine production and operation.
Various branches of mechanical drawing:

1. Designers
   a. College training
2. Draftsmen
   a. Apprentice training.

Teacher will lead the students in a study of the meaning and

Knowledge of opportunities in the field of mechanical drawing and the educational requirements.
importance of machine drawing. The opportunities offered in the broad field of mechanical drawing is also of equal importance.

**WHAT STUDENTS SHOULD BE ABLE TO DO**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Method/Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw arcs and circles with a compass or bow.</td>
<td>Method of adjusting compass</td>
</tr>
<tr>
<td>Basic Text, pp. 68-69.</td>
<td>How to hold compass in making an arc or circle</td>
</tr>
<tr>
<td>Bisect an angle.</td>
<td>How to draw a straight line tangent with the arc of a circle.</td>
</tr>
<tr>
<td>Basic Text, p. 76.</td>
<td>How to draw straight lines tangent with two arcs.</td>
</tr>
<tr>
<td>Dimension correctly and accurately.</td>
<td>Procedure in bisecting an angle.</td>
</tr>
<tr>
<td>Basic Text, pp. 70-72.</td>
<td>Skill in drawing arcs and circles.</td>
</tr>
<tr>
<td>Indicate correctly machine operations</td>
<td>Dimension correctly the following:</td>
</tr>
<tr>
<td>to be performed on a drawing. Basic Text, p. 73-74.</td>
<td>1. Overall and inside lines of various views.</td>
</tr>
<tr>
<td></td>
<td>2. Drilled hole</td>
</tr>
<tr>
<td></td>
<td>3. Radius of a circle or arc</td>
</tr>
<tr>
<td></td>
<td>4. Pitch of a thread.</td>
</tr>
<tr>
<td>Indicate correctly by words:</td>
<td>Skill in dimensioning a machine drawing correctly.</td>
</tr>
<tr>
<td>1. Drill</td>
<td>1. Overall and inside lines of various views.</td>
</tr>
<tr>
<td>2. Ream</td>
<td>2. Drilled hole</td>
</tr>
<tr>
<td>3. Type of finish</td>
<td>3. Radius of a circle or arc</td>
</tr>
</tbody>
</table>

**WHAT STUDENTS SHOULD KNOW**

- Skill in drawing arcs and circles.
- Skill in drawing lines tangent to an arc.
- Skill in bisecting an angle accurately.
- Skill in dimensioning a machine drawing correctly.
- Ability to indicate the operational procedure in making a machine part.
WHAT STUDENTS SHOULD BE ABLE TO DO

Draw a center line of a view. Basic Text, p. 77.

Draw the symbols for various metals. Basic Text, p. 78.

Draw the conventional representation of a thread. Basic Text, p. 74.

Make a working drawing that involves a sectional view. Basic Text, pp. 78-79.

WHAT STUDENTS SHOULD KNOW

Correct position of a center line
Value of a center line.

Draw the symbols for:
1. Cast iron composition of a machine part in a sectional view by
2. Steel
3. Lead
4. Bronze, brass symbols, copper composition.

External method of representing a thread.
Internal method of representing a thread.

Meaning of a sectional view:
1. Shows the ability to draw the interior of an object.

Types of sectional views:
1. Full section
2. Half section
3. Revolved section

Types of lines used in sectional views and their uses:
1. Detail line
2. Section line
3. Construction line
4. Cutting plane line
5. View line.

OBJECTIVES AND OUTCOMES

Ability to use a center line correctly in a view.

Ability to indicate the composition of a machine part in a sectional view by bronze, brass, and copper compositions.

Ability to represent a thread.

Teacher will demonstrate the foregoing basic skills and operations to the students.
Teacher will illustrate by models and drawings the meaning of sectional view drawings. The exercises in the basic text, page 79, are suggested as a means for students to understand the meaning of sectional views. Engineers rule should be used if scaled drawings are undertaken.

Suggested full section or half section drawings problems:

1. Collar
2. Arbor washer
3. Compression coupling.

**WHAT STUDENTS SHOULD BE ABLE TO DO**

Make a simple assembly drawing. Basic Text, pp. 87-88.

**WHAT STUDENTS SHOULD KNOW**

Purpose of an assembly drawing:

1. Planning general structure
2. Assembling parts.

Steps in making an assembly:

1. Determine main parts to be drawn
2. Sketch main parts, using a center line
3. Sketch in detail drawing
4. Draw the assembly, drawing from the sketch, place in all dimension lines.

**OBJECTIVES AND OUTCOMES**

Understand what an assembly drawing is.

Ability to make a simple assembly drawing.
Suggested assembly drawing projects:

1. Pulley (simple in design)
2. Drawer pulls (free swinging knobs)
3. Hinges.

**NINTH GRADE ELEMENTARY LEATHERWORK**

Six Weeks in Length

Second Semester

**Purpose**

To develop a student knowledge of kinds and methods of manufacture of leather. Also to develop student ability to use leather craft tools, make designs, and perform operations necessary for elementary leathercraft projects.

**Reference Materials**

**Basic Text**

Cheny, Raymond; General Leathercraft. Bloomington, McKnight and McKnight Publishing Company, 1919.

**Related Materials**

1. Burges Handicraft and Hobby Service; Comparing Samples of Leather. Chicago, 117 Wabash Ave., Burges Handicraft and Hobby Service, (a chart).
2. Hoefer, Louise C.; Design. Glendale, California, Louise
C. Hoefer (publisher), 1949.

WHAT STUDENTS SHOULD BE ABLE TO DO

Explore history and manufacture of leather. Basic Text, pp. 11-15.

WHAT STUDENTS SHOULD KNOW

History of leather: A knowledge of history and manufacturing methods.
1. Used by:
   b. Romans
   c. Greeks
   d. American Indians

Method of manufacture of leather:
1. Soaking pelts in lime water and removing hair
2. Soaking in bark of tree solution or chromium salts
3. Pressing and splitting leather
4. Polishing and dyeing of leather.

Select four kinds of leather. Basic Text, pp. 13-14.

Four types of leather by texture and their characteristics:
1. Suede
2. Calfskin
3. Steerhide
4. Goat

Identify and use the following leather working tools:

1. Steel square.
   Basic Text, p. 23.

Use of steel square:
1. Used for layout and cutting leather.

Knowledge of four common types of leather and their main use.

Ability to use correctly the fundamental tools of leather craft.
WHAT STUDENTS SHOULD BE ABLE TO DO

2. Swivel knife. Use of swivel knife:
   Basic Text, p. 33.
   1. Used to cut out a design.

3. Skinning knife. Use of skinning knife:
   Basic Text, p. 40.
   1. Used to thin leather at edges or folds.

4. Square knife. Use of square knife:
   Basic Text, p. 23.
   1. Used to cut leather.

5. Edge creaser. Use of edge creaser:
   Basic Text, p. 39.
   1. Used to make a decorative depressed line along edge.

6. Modeler. Use of modeler:
   Basic Text, p. 17.
   1. Used to trace design and emboss background.

7. Ball point. Use of ball point:
   Basic Text, p. 28.
   1. Used to stipple or enrich background of a design.

8. Revolving punch. Use of a revolving punch:
   Basic Text, p. 42.
   1. Used to punch holes for lacings.

Perform the following operations:
1. Make a template pattern in making a project. Ability to make pattern template.

Basic Text, pp. 22-23.
Related Information, No. 2.
Basic Text, p. 23.
1. Place template on leather
2. Use steel square on edges
3. Hold knife at angle and cut through first stroke.

Basic Text, p. 24.
1. Sponge leather with water on unfinished side
2. Place leather on a flat surface.

4. Transfer a design. Procedure in transferring a design: Ability to transfer a design onto leather.
Basic Text, p. 25.
1. Secure design on finish side of leather with paper clips.
2. Place leather on hard surface
3. Use modeler to trace design. Use edge of square for straight lines.

5. Stipple a background. Procedure for stippling: Ability to stipple a background on a design.
Basic Text, p. 28.
1. Moisten flesh side of leather
2. Place on hard surface
3. Use ball point modeler in vertical position. Apply pressure and turn at same time.
   Basic Text, p. 40.
   1. Place leather on flat surface
   2. Draw line width of skive
   3. Shave leather from this line to edge.

7. Carve leather. Procedure in carving leather: Ability to carve a design on leather.
   Basic Text, p. 33.
   1. Hold and pull swivel knife
   2. Cut one half thickness of leather

   Basic Text, p. 42.
   1. Lay out holes on leather with awl.
   2. Select size punch desired
   3. Center tube of punch over hole.

9. Make an edge lacing. Procedure in making an edge lacing: Ability to finish a leather project with a suitable lacing.
   Basic Text, pp. 44-45.
   1. Shine edge suitable lacing.
   2. Mark and punch holes
   3. Make a single button hole.
Teacher will give a demonstration of these operations to the students.

Suggested leather projects:

1. Book marker
2. Knife sheath
3. Comb case
4. Coin purse.

NINTH GRADE ELEMENTARY FOUNDRY AND FORGE PRACTICE.

Six Weeks in Length

Second Semester

Purpose

To give the student a knowledge of the importance and characteristics of foundry work and forging in our industrial economy. Also to introduce fundamental tools and operations necessary in elementary foundry and forge work.

Reference Materials

Basic Texts

Related Information

1. Brigham Young University; The Story of Steel, Manufacture of Rails, Plates and Other Hot Rolled Products. Provo, Bureau of Visual Instruction, Brigham Young University, (a film).


3. United States Steel; Suiting the Heat Treatment to the Job. Pittsburg, United States Steel, 1946, (booklet).


WHAT STUDENTS SHOULD BE ABLE TO DO

Explore the importance and opportunities of foundry work.

Basic Text 1, p. 2. Related Information, No. 5, p. 1 B.

What foundry work is: A general understanding of foundry work as to moulten metal type of work and vocational opportunities.

Importance in our society:

1. Persons employed
2. Place in our industry
   a. Production of many objects of iron and alloy steel for industry and home.

Type of work and training required:

1. Patternmaker
WHAT STUDENTS SHOULD BE ABLE TO DO

2. Molder
   a. Makes and pours molds

3. Apprenticeship training

Requirements for these occupations.

Teacher will lead a class discussion on foundry work. The characteristics and vocational opportunities of foundry work should be stressed.

Use the following patternmaking terms correctly:

1. Draft
   - Basic Text 1, pp. 4-5.

Meaning and use of the following terms:

1. Draft
   a. Taper of a pattern to facilitate removal of pattern from sand.

2. Drag
   a. An impression of lower or drag half of mold.

3. Cope
   a. The impression of the top half of mold.

Explain the use of the following molding equipment. Basic Text 1, pp. 31-33.

Meaning and use of the following:
<table>
<thead>
<tr>
<th>What Students Should Be Able to Do</th>
<th>What Students Should Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flask.</td>
<td>Flask is a frame to hold molding sand.</td>
</tr>
<tr>
<td>2. Molding sand.</td>
<td>Molding sand is a special type of sand used in molding.</td>
</tr>
<tr>
<td>3. Sprue pin.</td>
<td>Sprue pin is a tapered pin to form a pouring hole in sand.</td>
</tr>
<tr>
<td>4. Parting dust.</td>
<td>Parting dust is a powder used to smooth the surface of a sand mold.</td>
</tr>
<tr>
<td>5. Crucible.</td>
<td>Crucible is used to melt and pour molten metal.</td>
</tr>
<tr>
<td>6. Crucible tongs.</td>
<td>Crucible tongs are used to hold and carry a crucible.</td>
</tr>
</tbody>
</table>

Teacher will demonstrate the meaning and use of the above terms and equipment.

Make a simple pattern (No shrinkage allowance). Basic Text, p. 8-9. (A paper weight block rectangular in shape is suggested).

Steps in making a pattern:
1. Make wood pattern
   a. Make surfaces smooth and true
   b. Allow for drag on edges.
2. Attach tapered knot to center of cope side

Ability to make a simple pattern.
WHAT STUDENTS SHOULD BE ABLE TO DO

Make a mold from a pattern. Basic Text, 1, pp. 34-36.

Pour a mold. Basic Text, p. 58.

Steps in making a mold: Ability to make a
1. Prepare sand to simple mold.
2. Place drag side on molding board
3. Center pattern with drag side down
4. Pack in well riddled sand
5. Turn over and attach cope to drag
6. Pack in well riddled sand
7. Make several air holes with wire over pattern
8. Remove cope and remove pattern
9. Apply parting dust and replace cope.

Steps in pouring a mold: Ability to pour a
1. Heat metal to simple mold.
2. Use crucible and tongs to carry and pour metal
3. Pour metal in hole (left by knob on pattern) until hole is full.

Teacher will give a demonstration on procedure of making and pouring a mold. Safety should be stressed in the pouring of a mold.

WHAT STUDENTS SHOULD KNOW

Steps in making a mold: Ability to make a
1. Prepare sand to simple mold.
   right dampness
2. Place drag side on molding board
3. Center pattern with drag side down
4. Pack in well riddled sand
5. Turn over and attach cope to drag
6. Pack in well riddled sand
7. Make several air holes with wire over pattern
8. Remove cope and remove pattern
9. Apply parting dust and replace cope.

Steps in pouring a mold: Ability to pour a
1. Heat metal to simple mold.
   right temperature
   in forge or furnace.
2. Use crucible and tongs to carry and pour metal
3. Pour metal in hole (left by knob on pattern) until hole is full.

Teacher will give a demonstration on procedure of making and pouring a mold. Safety should be stressed in the pouring of a mold.

WHAT STUDENTS SHOULD OBJECTIVES AND OUTCOMES

Explore the meaning and importance of forging. Related Information Units 1 and 2.

What forging is: A general knowledge of forging as it relates to our society.
1. Forming heated metal by hammering or exerting pressure
WHAT STUDENTS SHOULD BE ABLE TO DO

Importance in our society:
1. Used more and more in industry.
   a. Automobile engines
   b. Tools
   c. Machinery of all kinds

List the types of work in forging.

Type of work and training required:
1. Drop hammer operators
2. Heat treatment technicians
3. Tool makers
4. Blacksmiths
5. Apprentice training for craftsmen, college for technicians.

Teacher will lead a class discussion on forging. The importance of forging and its characteristics and opportunities should be stressed.

Use the following forge tools:
1. Forge.
   Basic Text 2, p. 16.

How to operate a forge:
1. Start a fire
2. Use air controls
3. Supply fire with coke.

2. Anvil.
Basic text 2, p. 19.

Purpose of an anvil
Use of square and horn end.

Basic Text 2, pp. 21-23.
1. Ball pein

Know and use the elementary tools of forging.
WHAT STUDENTS SHOULD BE ABLE TO DO

WHAT STUDENTS SHOULD KNOW

2. Cross Pein
3. Straight Pein
4. Sledges

4. Tongs. Recognize and know purpose of the following tongs:
Basic Text 2, pp. 22-23.
1. Flat jawed
2. Curved lip
3. Pick up.

Basic Text 2, p. 25.

Teacher will demonstrate the proper use of these tools.

Perform following operations:
1. Cut stock.
Basic Text 2, pp. 33-34.

Procedure for cutting stock:
1. Using a hardie on cold stock.
2. Using a hardie on hot stock.

2. Upset method.
Basic Text 2, pp. 46-47.

Purpose and method of upsetting:
1. Purpose is to decrease length, increase width of stock.
2. Method:
a. Heat properly
b. Hammer on face of anvil.

3. Draw stock.
Basic Text 2, p. 31.

Purpose and method of drawing stock:
1. Purpose is increased length
WHAT STUDENTS SHOULD
BE ABLE TO DO

WHAT STUDENTS SHOULD
KNOW

OBJECTIVES AND OUTCOMES

1. Use of hammer and anvil.

2. Method:
   a. Hammer square
   b. Drawn by hammering on horn of anvil.

4. Square or true stock.
   Method of squaring and truing stock:
   Basic Text 2, p. 33.
   1. Use of hammer and anvil.

5. Swage stock.
   Purpose and method of swaging:
   Basic Text 2, p. 27.
   1. Purpose is to round stock
   2. Method:
      a. Proper heating
      b. Proper use of a swage.

   Procedure for heating stock:
   Basic Text 2, p. 106.
   1. Position of stock in forge
   2. Color of stock.

Teacher will give a demonstration of these operations to students.

List three types of iron, their characteristics and uses.
Basic Text 2, pp. 13-14.

Properties and use
Know the properties of three common forms of:

1. Wrought iron iron.
   a. Carbon content .04 percent
   b. Used in forging
   c. Breaks easily when formed cold

2. Mild steel
   a. Carbon content .05 to 25 percent
   b. Excellent forge material

3. Tool steel
   a. Carbon content .6 to 1.5 percent
   b. Used for tools.
**Performs following heat treating operations:**

1. **Anneal stock.**
   
   **Basic Text 2, p. 101.**

2. **Harden tool steel.**
   
   **Basic Text 2, p. 101.**

3. **Temper steel.**
   
   **Basic Text 2, p. 101.**
   **Related Information, No. 3 and 4.**

**Purpose and method:**

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1. **Purpose of annealing:**
   - To soften steel.

2. **Method:**
   - Heat cherry red and cool off in lime.

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1. **Purpose of hardening:**
   - To make steel very hard before tempering.

2. **Method:**
   - Heat to cherry red.
   - Immerse in cold water.

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1. **Purpose of tempering:**
   - To soften and toughen a hardened steel object.

2. **Method:**
   - Heat to a determined temperature.
   - Cool in oil quickly to desired color.

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**Teacher will give a demonstration on annealing, hardening, and tempering of tool steels.** The class should be divided into foundry and forging experience the first half of this unit. The second half of the unit the groups should be reversed.
Suggested projects:

1. Paper weight
2. Knife handle
3. Forged hook
4. Roasting fork
5. Punch (small)
6. Hunting knife

NINTH GRADE HOME MECHANICS
Four to Six Weeks in Length

Second Semester

Purpose

Home mechanics is a direct means of relating the work of industrial arts to the home. The present day home because of its mechanization, abounds in jobs of adjusting and repairing equipment. Students have learned the fundamental processes and manipulative skills that will apply in doing home mechanic projects.

A number of the common home mechanic projects are given, which the teacher will present to the class. Students may also initiate their own projects.

Reference Materials
Basic Texts


WHAT STUDENTS SHOULD BE ABLE TO DO

Upholster a chair. Basic Text 1, pp. 128-129.

WHAT STUDENTS SHOULD KNOW

Procedure in upholstering a chair:

1. Weave and tack webbing across open frame
2. Cover webbing with muslin
3. Spread and sew padding to webbing
4. Cover with muslin (tightly stretched and tacked down)
5. Cover muslin with thin layer of cotton.
6. Place on covering of tapestry or leather and tack securely down.

OBJECTIVES AND OUTCOMES

Ability to do a simple upholstering project.
WHAT STUDENTS SHOULD BE ABLE TO DO

Refinish marred furniture. Basic Text 1, pp. 123-125.

WHAT STUDENTS SHOULD KNOW

Procedure in refinishing furniture: Ability to refinish marred wood finishes.

1. Removing
   varnish or lacquer
   a. Brush on varnish or lacquer remover
   b. Remove varnish or lacquer with putty knife or steel wool
   c. Sand surface (No. 00 sandpaper)

2. Applying finish
   a. Apply spirit stain to wood
   b. Apply wood filler (let dry twelve hours)
   c. Apply coat of shellac (let dry six hours)
   d. Apply lacquer or varnish.


Procedure in setting and filing a saw: Ability to sharpen a cross cut saw and rip saw.

1. Setting a saw

2. Clamp saw in bench vise, teeth up
   a. Even all teeth with flat mill file
   b. Bend pints of alternate teeth as formerly were

3. Filing teeth of crosscut
   a. Clamp saw in a saw clamp
   b. Grasp three cornered file in both hands.
   c. File should be:
      1. Pointed toward the heel of saw (sixty-five degrees with band)
WHAT STUDENTS SHOULD BE ABLE TO DO

KNOW

2. Handle about fifteen degrees below teeth
3. File every other tooth
4. Reverse saw and file remaining teeth

4. Filing teeth of ripsaw
   a. Same as crosscut saw except file is held in horizontal position and right angle to saw blade.

Cut and thread a water pipe. Basic Text 2, pp. 39-40.

Procedure in cutting and threading a pipe. Ability to cut and thread a water pipe.

1. Cutting a pipe:
   a. Measure length desired
   b. Place pipe in vise and cut with hacksaw or pipe cutter
   c. Ream out

2. Threading pipe:
   a. Select collar and die of size desired and put together.
   b. Slip collar over pipe
   c. Press die against pipe and turn until die begins cutting
   d. Apply oil liberally while cutting desired length of thread.


Procedure in soldering Ability to solder metal seams and holes in utensils (aluminum excepted).

1. Seams
   a. Scrape surface until bright.
WHAT STUDENTS SHOULD BE ABLE TO DO

KNOW

2. Apply flux
   (zinc chloride)
3. Sweat solder into
   seam with well tinned
   hot copper

Restr:
1. Clean surface around
   hole
2. Apply enough solder
   to cover hole with
   well tinned hot copper.

Repair a toaster. Procedure in repairing Ability to repair an
Basic text 5, electric toaster.
pp. 140-141.

1. Test electric cord
   with test lamp
2. Repair cord if necessary
3. Dismantle frame from
   heating unit
4. Rewrap wires at terminal
   posts if broken
5. Replace any broken wires
   in heating element.

Read an electric Procedure in determining Ability to deter-
house meter and mine the cost of
figure cost of electricity used for
a month.

Procedure in determining
kilowatt hours used in a
month:

1. Record reading
   on watt meter
   as follows (from
   left to right)
   a. Units
   b. Tens
   c. Hundreds
   d. Thousands
2. Subtract these figures
   from previous month's
   reading

Procedure in determining cost
Procedure in determining cost
for the month:
for the month:
WHAT STUDENTS SHOULD KNOW

BE ABLE TO DO

1. Determine the cost per kilowatt hour on a rate basis
2. Multiply rate basis cost by kilowatt hours used.

Students should bring in electric meter readings from their homes and figure the cost of electricity for a given month.

Repairs a faucet. Procedure in repairing Ability to repair a water faucet.
Basic Text 3, pp. 464-5.

1. Replacing washer
   a. Unscrew packing nut
   b. Turn handle until it comes out
   c. Unscrew set screw at bottom of stem
   d. Replace old washer
   e. Reassemble parts of faucet

2. Replace packing
   a. Unscrew packing nut
   b. Turn handle until it comes out
   c. Take out old packing
   d. Place in new packing (candlewicking), wind same way as handle screws into faucet
   e. Reassemble faucet.

Sharpen a kitchen knife. Procedure in sharpening Ability to sharpen a kitchen knife.
Basic Text 3, p. 224.

1. Put a drop of oil on a natural oil stone
2. Place knife edge against stone (back raised about twenty degrees)
<table>
<thead>
<tr>
<th>WHAT STUDENTS SHOULD BE ABLE TO DO</th>
<th>WHAT STUDENTS SHOULD KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace a window screen. Basic Text 3, p. 552.</td>
<td>3. Draw blade from heel to point across stone</td>
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<tr>
<td></td>
<td>4. Repeat on one edge and then the other till knife cuts as desired.</td>
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<tr>
<td>Repair a broken leg of a chair. Basic Text No. 3, p. 544.</td>
<td>A Procedure in replacing a window screen:</td>
</tr>
<tr>
<td></td>
<td>1. Remove moulding</td>
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<tr>
<td></td>
<td>2. Remove all tacks</td>
</tr>
<tr>
<td></td>
<td>3. Cut new screen slightly longer than old screen</td>
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<td>4. Place new screen in location old screen occupied</td>
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<td></td>
<td>5. Start center of one side and tack secure using No. 4 carpet tack</td>
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<td></td>
<td>6. Stretch and tack other side and the ends</td>
</tr>
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<td></td>
<td>7. Replace moulding.</td>
</tr>
<tr>
<td></td>
<td>Ability to repair broken chair leg:</td>
</tr>
<tr>
<td></td>
<td>1. Make desired size dowel holes in broken ends of leg</td>
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<tr>
<td></td>
<td>a. Hole should be about one-third diameter of one leg and one-half inch deep</td>
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<td></td>
<td>b. Glue leg ends, holes, and dowels</td>
</tr>
<tr>
<td></td>
<td>Ability to replace wornout window screens.</td>
</tr>
</tbody>
</table>
WHAT STUDENTS SHOULD BE ABLE TO DO

WHAT STUDENTS SHOULD KNOW

c. Assemble parts and clamp straight.

Suggested projects in addition to those previously suggested are:

1. Cut glass
2. Repair a tire tube
3. Straighten bent kitchen utensils (of metal)
4. Mix cement
5. Repair a door lock.
SUMMARY AND CONCLUSIONS

The purpose of this paper has been two-fold. First, to trace the history and philosophy of industrial arts from antiquity to the present, with emphasis upon the present. Second, a program for the small Junior High School has been proposed that is in accordance with the modern day purpose and objectives of industrial arts.

History from antiquity to now shows the need and desire of youth for self-expression in hand work. About the time our country began as a nation, European countries were developing schools of trade skills and crafts for their youth. Two countries were notable in this movement. Russia developed vocational training in its educational system. Sweden integrated both vocational and avocational studies in its educational program.

Our country, however, thought of the education of youth in hand work only in a vocational aspect. This was perhaps justifiable in view of having to make the necessities of life by hand. Later, the philosophy of mental discipline as a prime objective was thought important.

Our present society, however, has become more complex, with its industrial development and occupational problems. Therefore, manual training has come to have a broader purpose in our present general educational program. Significantly, manual training is now called industrial arts in keeping with our industrial society.
Industrial Arts as a part of general education's purpose of preparing youth for life now encompasses three main objectives, namely:

1. Orientation into the industrial and economic aspects of our society.

2. Pre-vocational studies and experiences of skilled industrial work opportunities.

3. Avocational development of leisure time activities.

Obviously such objectives could not be learned in shop experiences encompassing one or two areas of study. Therefore, a shop program of many areas was developed, significantly called the General Shop. In a shop of this nature, students study and work in a great many areas that are representative of our industrial life as well as developing avocational skills in leisure time crafts.

In order to present such a program, a system of student rotation into areas of study is a fundamental requirement. The writer has chosen the group method system of rotation. This method is most widely used, because it has certain distinct advantages over the alternate system, namely single rotation.

A system of single rotation would not lend itself well to student psychology at the Junior High School level. Students of this age like working together as a group. Again, single rotation from the teacher's viewpoint would make time a precarious element. The teacher must teach and supervise two or three areas of study during a single
period. Teaching time should not be lost supervising students who are in different stages of completing projects or studies of related materials. Conversely, completion of student learnings by group aids the teacher's supervisory problem, thus making for more effective teaching.

Reference materials used in developing the courses of study are likewise not conclusive. Materials used by the writer were obtained from the college library, several Junior High Schools, various state departments of education and a number of industrial manufacturing companies. Such sources offer a constant supply of new teaching aids.

As pointed out, the method and materials used are not conclusive. Likewise, the areas of study used are not all that are available. Other areas as machine shop, jewelry making, and graphic arts, to mention a few, exist. However, student experiences in such areas are expensive in materials and equipment. Further, such areas of study offer no greater learning experiences than the areas proposed in this paper.

This proposed course of study may serve as a guide to the inexperienced teacher and contain many helpful suggestions for the experienced teacher. The areas of study and the method of presentation offer a well-rounded program for the small junior high school. Costs are at a minimum, and study areas are varied and broad enough to meet present day industrial art objectives.
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CHARTS

