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# Industrial Arts in the Junior High School

Grant Eugene Shelby
*Central Washington University*

# INDUSTRIAL ARTS IN THE JUNIOR HIGH SCHOOL

by

Grant Eugene Shelby

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**Approved:**

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**George Sogge, Committee Chairman**

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**Ralph Collins, Committee Member**

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**B. K. Bedford, Committee Member**

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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

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1. Industrial arts is used as a collective noun.
2. Newkirk, Louis V., and William J. Johnson, The Industrial Arts Program. New York: The Macmillan Co., 1948, p. 14.

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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1. London, H. H. and Merton C. Wheeler, "Composite General Shop Offers More Effective Industrial Arts Program," School Management. Vol. 18, Sept. 1948, New York: School Management Inc., p. 29.
2. Proffit, Morris M., Trends in Industrial Arts. United States Office of Education Pamphlet, No. 93, 1940, p. 3.
3. Edwards, Newton and Herman G. Richey, The School in the American Social Order. Boston: Houghton Mifflin Co., 1947, p. 19.

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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1. Proffit, Morris M., Industrial Arts, Its Interpretation in American Schools. United States Office of Education Bulletin No. 36, Washington: United States Office of Education 1937, p. 1.
2. Comenius, John Amos, School of Infancy. Edited by Will S. Monroe, Dallas, Texas: D. C. Heath and Co., 1901, pp. 44-45.
3. Keating, M. W., The Great Didactic of John Amos Comenius. London: Charles and Adam Block, 1896, p. 42.

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 leiusre 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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1. Edwards, Newton and Herman G. Richey, The School in the American Social Order. Boston: Houghton Mifflin Co., 1950, p. 356, et seq.
2. Hardin, Robert A., "Our Evolving Philosophy of Industrial Arts," Industrial Arts and Vocational Education. Vol. 39, May 1950, Milwaukee, Wisconsin: Bruce Publishing Co., p. 181.

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 beselected 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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1. Wendt, Erhard F., "A Brief History of Industrial Arts and Vocational Education," Industrial Arts and Vocational Education. Vol. 35, April 1946, Milwaukee, Wisconsin: Bruce Publishing Co., p. 153.
2. Hardin, Robert A., "Our Evolving Philosophy of Industrial Arts," Industrial Arts and Vocational Education. Vol. 39, May 1950, Milwaukee, Wisconsin: Bruce Publishing Company, p. 224.
3. Bennett, Charles A., A History of Manual and Industrial Education. 1870-1917, Peoria, Illinois: Charles A. Bennett Company, 1926, P. 454.

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.

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1. Hardin, Robert A., "Our Evolving Philosophy of Industrial Arts," Industrial Arts and Vocational Education. Vol. 39, June 1950, Milwaukee, Wisconsin: Bruce Publishing Co., p. 224.
2. Bennett, Charles A., A History of Manual and Industrial Education. 1870-1917, Peoria, Illinois: Charles A. Bennett Co., 1926, p. 369.
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[1]

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.[2]

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1. Proffit, Morris M., Industrial Arts, Its Interpretation in American Schools. Pamphlet No. 34, 1937, Washington: United States Office of Education, pp. 4, et seq.
2. Moore, Frank C., "Industrial Arts, A Complete Program," Education Vol. 70, September, 1949, Boston: Palmer Publishing Co., p. 29.

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.[1] One of the basic objectives of an industrial arts course is to impart to students a knowledge of what consitutes good material, workmanship and design

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1. Hippaka, Thomas A., "Industrial Arts Objectives," Industrial Arts and Vocational Education, Vol. 31, May 1942, Milwaukee, Wisconsin: Bruce Publishing Co., p. 200.

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:
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> 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

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1. Pancost, Maurice H., "General Education Needs Industrial Arts," Nations Schools. Vol. 41, June 1949, Chicago: The Nations Schools Publishing Co., Inc., p. 28.
2. Newkirk, Louis V. and William H. Johnson, The Industrial Arts Program. New York: The Macmillan Co., 1948, p. 7.

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

6. Study of safe and hygenic 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[1]

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

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1. Proffit, Morris M., Industrial Arts, Its Interpretation in American Schools. Bulletin No. 34, Washington: United States Office of Education 1937, pp. 9-10.

successful adult living.[1] 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.[2]

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."[3] Dewey further stated, "The aim is not the economic value of the products, but the development of social power and insight."[4] 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

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1. Johnston, Ralph O., "Matching Men and Jobs, Reorganizing the Industrial Arts Curriculum," Industrial Arts and Vocational Education. Vol. 37, November 1948, Milwaukee, Wisconsin: Bruce Publishing Co., p. 350.
2. Ibid., p. 351.
3. Dewey, John, The School and Society. Chicago: The University of Chicago Press 1900, second edition (1915) p. 11.
4. Ibid., p. 16.

competence.[1] Further, any educational program must of necessity be broad enough to enable students to comprehend all areas of human experience.[2] Active participation and experience must also further provide for creative living and thinking on the part of the student.[3] 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

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1. Bellafiore, Joseph, The Experience Idea in Education. High Points, Vol. 32, Oct. 1950, New York: Board of Education, p. 17.
2. Shannon, J. R., "Producing Pupil Participation," School Activities. Vol. 21, May 1950, Topeka: School Activities Publishing Co., p. 276.
3. Daurghty, James Henry and Frank Herman Gorman and Phillips Claude Anderson, Elementary School Organization and Management. New York: The Macmillan Co., 1950, p. 12.

occupational activities is not a part of general education.[1] 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.[2] It seeks to develop a wholesome personality capable of seeing the best in the thoughts and achievements of man and society.[3] It further educates the individual for capacity to make adjustments and changes which are inherent in life and the progress of man.[4] 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[5]

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1. Parker, Cecil J., "A Statement of the Meaning of General Education," California Journal of Secondary Education. Vol. 23, Nov. 1948, Berkeley, California: Journal of Secondary Education, p. 391.
2. Ibid., p. 391.
3. Briggs, Thomas H., "The Role of General Education," National Association of Secondary School Principals. Vol. 32, March, 1948, Washington D. C.: National Association of Secondary School Principals, p. 92.
4. Douglas, Harl R., The High School Curriculum. New York: Ronald Press Co., 1947, p. 95.
5. Wilbur, Gordon O., Industrial Arts in General Education. Scranton, Pennsylvania: International Book Co., 1948, p. 15.

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. 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. The first step in the process of critical thinking is recognition of a problem. General education

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1. Ibid., p. 17.
2. Landis, Paul H., Social Policies in the Making. Boston: D. C. Heath and Company, 1947, p. 102.

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.

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1. Wilbur, Gordon O., Industrial Arts in General Education. Scranton: International Textbook Co., 1948, p. 24.
2. Otto, Henry J., Principles of Elementary Education. New York: Rinehart and Co. Inc., 1949, pp. 285-286.

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 understanding[2]

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1. Warrick, Glenn D., "Industrial Arts Objectives," Industrial Arts and Vocational Education. Vol. 36, Sept. 1947, Milwaukee, Wisconsin: Bruce Publishing Co., p. 288.
2. National Association of Secondary-School Principals, Planning for American Youth. Washington D. C.: National Association of Secondary-School Principals, 1944, p. 43.

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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1. Siefield, Kermit A., "My Philosophy of Industrial Arts," The Industrial Arts Teacher. Vol. 10, October 1950, Cincinnati: American Industrial Arts Assoc., p. 1.
2. Wilbur, Gordon O., Industrial Arts in General Education. Scranton, Pennsylvania: International Book Co., 1948, p. 2.

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 snd 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[1]

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.[2] 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.[3]

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

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1. Proffit, Morris M., Trends in Industrial Arts. Washington: United States Office of Education, Pamphlet No. 93, 1940, pp. 2 et seq.
2. Ibid., p. 12.
3. London, H. H. and Merton C. Wheeler, "Composite General Shop Offers More Effective Industrial Arts Program," School Management. Vol. 18, Sept. '48, New York: School Management Inc., p. 29.

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

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1. Richman, Clyde P., "Planning the General Shop Program for the Junior High School," The High School Journal. Vol. 32, Nov. - Dec. 1949, Chapel Hill N. C.: University of North Carolina p. 251, et seq.
2. Ibid., p. 253.

general shop to accommodate twenty to twenty-five students."[1] Each separate type of work has a particular location in the shop for its equipment and work space.[2] However, unit work areas are all integrated into the whole plan of instruction.[3] Ideally, each student project cuts across each of these units.[4] 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.[5]

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1. Newkirk, Louis V., Organizing and Teaching the General Shop. Peoria, Illinois: Manual Arts Press 1947, pp. 82-83.
2. Ibid., p. 85.
3. London, H. H. and Merton C. Wheeler, "Composite General Shop Offers More Effective Industrial Arts Program," School Management. Vol. 18, Sept. '48, New York: School Management Inc., p. 29.
4. Ibid., p. 29.
5. Proffit, Morris M., Trends in Industrial Arts. United States Office of Education Pamphlet No. 93, 1940, Washington: United States Office of Education, pp. 12-13.

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.[1] They therefore need experience in knowing, handling and manipulating products about them.[2] 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.[3]

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

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1. Newkirk, Louis V., Organizing and Teaching the General Shop. Peoria: The Manual Arts Press, 1947, p. 19.
2. Wilbur, Gordon O., Industrial Arts in General Education. Scranton: International Textbook Co., 1949, p. 41.
3. State of Florida, The New Technology in Industrial Arts. Tallahasse: Department of Education, 1948, p. 18.

consist of emphasis upon knowledge, understanding and appreciation. Manipulative skill in and of itself is not the dominant objective.[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.[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

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1. State of Utah, Industrial Arts in Utah, Part I. Salt Lake City: Department of Education, 1941, p. 20.
2. 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

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1. Friese, John F., Course Making in Industrial Arts. Peoria: The Manual Arts Press, 1946, pp. 149-51.
2. Ibid., pp. 149-51.
3. State of Utah, Industrial Arts in Utah, Part I. Salt Lake City: Department of Education, 1941, p. 26.
4. Ibid., p. 26.
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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1. Wilbur, Gordon O., Industrial Arts in General Education. Scranton: International Textbook Co., 1949, p. 114.
2. Friese, John F., Course Making in Industrial Arts. Peoria: The Manual Arts Press, 1946, p. 149.
3. Newkirk, Louis V., Organizing and Teaching the General Shop. Peoria: The Manual Arts Press, 1947, p. 118.

Presentation of the use of tools and materials in the general shop revolves around the teacher demonstration.[1] 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.[2]

Student learnings of technical information and discussion of occupational matters should not take more than one fifth of the pupil's time.[3] Students may well gather this knowledge under competent supervision.[4] 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.[5] Visual aids to be used include films,

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1. Wilbur, Gordon O., Industrial Arts in General Education. Scranton: International Textbook Company, 1949, p. 109.
2. Ibid., p. 114.
3. Newkirk, Louis V., Organizing and Teaching the General Shop. Peoria: The Manual Arts Press, 1947, p. 118.
4. Ibid., p. 118.
5. Wilbur, Gordon O., Industrial Arts in General Education. Scranton: International Textbook Co., 1949, p. 124.

industrial trips, charts and graphs.[1] Talks by professional and business men in addition are very valuable teaching aids.[2]

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1. Ibid., p. 143.
2. Newkirk, Louis V., Organizing and Teaching the General Shop. Peoria: The Manual Arts Press, 1947, p. 117.

# 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 wood working 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[1]

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 | Group B |
|---|---|
| Twelve students | Twelve students |

First Eight Weeks

Group A--Introduction to Drawing (eight weeks)

Group B--Introduction to Woodworking (eight weeks)

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1. State of Minnesota, A Guide for Instruction in Industrial Arts: St. Paul Department of Education. 1950, p. 30-31.

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

Fryklind, J. E., and Fupler, F. R., General Drafting, Bloomington, Illinois: McKnight and McKnight 1938.

Related Information Material

Perry, Josephine, The Paper Industry, New York: Longmans, Green and Company, Inc., 1946.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Recognize a drawing | The purpose and value of drawing in relation to the students' work and our industrial society. | An understanding and value of drawing. |

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. | |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Read a rule to sixteenths of an inch. | How a certain length is measured by a standard unit of measurement. | |
| Choose a drawing pencil correctly. Basic text, p. 13. | Two grades of hardness of drawing pencil. | |
| Sharpen a drawing pencil. | Method of sharpening pencil for good line work. | |
| Make a point and line. Basic text, p. 15. | Importance of good line work. | Draw vertical and Horizontal lines to a given dimension. |
| Draw lines to definite lengths horizontally and vertically. Basic text, p. 18. | Importance of accuracy in lines of a drawing. | |

Teacher will give a demonstration of all operations thus far.

| | | |
|---|---|---|
| Explain the making and use of paper. Related Information, p. 16-73. | 1. How paper is manufactured<br>a. Raw materials<br>b. Manufacturing process.<br>2. Grades and uses of paper in:<br>a. Business and Industry<br>b. Students' daily living. | General knowledge of paper |

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:

Douglas, J. H. and Roberts, M. A., Units in Hand Woodworking. Wichita: The McCormick-Malthers Publishing Company.

Related Information:

1. Western Pine Association. Plan Book For the Boy Builder, Portland: Western Pine Association: 1948 (booklet).
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, Tacoma: Douglas Fir Plywood Association: 1950 (pamphlet).

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the importance of wood in our society. | Use of wood in industry and home | Our dependence upon wood. |
| List location of important trees in the United States. Basic Text, p. 11-22. | Location of:<br>1. Spruce<br>2. Douglas Fir<br>3. Pine<br>4. Redwood<br>5. Oak<br>6. Walnut<br>7. Maple<br>8. Hickory | Knowledge of important tree areas in the United States. |
| List the reasons for, and how conservation is practiced. Basic Text, p. 7-8. | How our forests are depleted.<br>1. Fires<br>2. Wasteful logging<br>Measures taken in conservation:<br>1. Selective logging<br>2. Planting<br>3. Use of waste mild products<br>4. Fire Prevention<br>5. State and government timber resources. | Knowledge of importance and methods of conservation. |
| List basic parts of a tree. Basic Text, p. 10. | Location and purpose of:<br>1. Bark<br>2. Cambiaim layer<br>3. Sapwood<br>4. Heartwood<br>5. Spring and summer growth rings. | Knowledge of parts of a tree. |
| List general classification of trees. | General classification of trees. | Knowledge of classification and uses of trees. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. Evergreens--soft<br>2. Decidious--hard<br>How to recognize our important trees by color and grain.<br>Particular uses of our important trees. | |
| Explain what Plywood is. Related Information: Booklet 3. | How plywood is made<br>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.<br>Procedure for squaring a board. | Square a board accurately |
| Select and use a saw correctly. Basic Text, p. 36 | Types of saws according to:<br>1. Teeth<br>2. Use<br>a. Cross cut<br>b. Rip saw | Select and use a saw correctly for a particular cutting operation |
| Select and use two types of wood planes | Use and characteristics of: | Select and use a plane correctly. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Basic text, p. 42 | 1. Jack plane<br>2. Block plane | |
| Use a carpenter's hammer. Basic Text, p. 71. | Sizes of carpenter's hammers.<br>Technique of striking a nail<br>Withdrawing nails. | Select and use a carpenter's hammer. |
| Secure wood together by:<br>1. Nails, brads.<br>2. Glue<br>Basic Text, p. 91-92. | Two types of metal wood fasteners:<br>1. Brads--size and use<br>2. Nails--size and use<br>Liquid fastener:<br>1. Procedure for a glue joint. | Knowledge of wood fasteners and their correct use. |
| Finish wood with:<br>1. Sandpaper<br>Basic text, p. 99<br>2. Enamel<br>Basic Text, p. 108 | Purpose of Sandpaper<br>Two grades of sandpaper and their use:<br>1. Number 1<br>2. Number 0<br>Procedure for using sandpaper.<br>How to apply enamel. | Ability to smooth and enamel wood. |

Suggested Projects:

1. Animal figures
2. Corner wall shelf of plywood.
3. Book ends.

# 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

Fryklund, V. E. and Kipler, F. B., General Drafting, Bloomington, Illinois: McKnight and McKnight: 1938.

## Related Information

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

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make Gothic letters and numerals. Basic Text, p. 23-31. | Importance of good letters and numbers. | Skill in lettering and numbering on a drawing. |

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

| | | |
|---|---|---|
| Make an orthographic projection from a simple isometric | Meaning of three views of an object: 1. Plan view | Meaning and location of views or a drawing. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| drawing (no scaling involved) Basic Text, p. 7. | 2. Side view<br>3. End view<br>Location of views | |
| Dimension a drawing. Basic Text, p. 20-23. | What dimension lines are<br>Location<br>Method of Making. | Dimension a drawing correctly. |
| Use triangles of 30°, 45°, and 60°. Basic Text, p. 39. | Purpose of these angles in a drawing. | Select and use triangles correctly. |
| Use a:<br>1. Architect's on full scale face. Basic Text, p. 31.<br>2. Bow compass Basic text, p. 43. | Purpose and method of using these instruments in making definite length lines and circles of given diameters. | Skill in making specified straight and surved lines. |
| Make a:<br>1. Border line<br>2. Visible line<br>3. Invisible line<br>Basic Text, p. 46. | How to make these lines.<br>When to use these lines in a drawing. | Ability to make and use correct lines in simple drawings. |
| Erase a line | How to erase a line neatly | Skill in erasing |

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

Douglas, M. S. and Roberts, M. A., Units In Hand Woodworking, Wichita: McCormick-Mathers Publishing Co. 1946.

Related Material

None.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the reasons for a bill of material. Basic Text, p. 32. | Reason for making a bill of material<br>1. Save time<br>2. Save material. | Orderliness and accuracy in planning a project. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make a bill of material. Basic Text, p. 32. | Procedure in making a bill of material<br>1. Name<br>2. Size<br>3. Material. | Ability to make a bill of material. |
| Figure cost of project from bill of material. Basic Text, p. 32. | Figure board feet and other items of a project. | Ability to figure a bill of materials. |

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. Basic Text, pp. 63-64. | What a wood bit is and its purpose.<br>Procedure for using a brace and bit:<br>1. Procurring correct size<br>a. How sizes are determined<br>b. How to insert bit into a brace<br>c. Use brace and bit correctly. | Ability to select a bit and bore a hole to a given diameter. |
| Use a wood chisel. Basic Text, p. 74-75. | Two types of chisels and their uses:<br>1. Tang-characteristics and uses.<br>2. Mortise-characteristic and uses. | Select and use a wood chisel correctly. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make a:<br>1. Butt<br>2. Rabbit joint<br>Basic Text, p. 77-78. | Purpose of wood joints.<br>Purpose of Butt joint.<br>1. Method of making<br>2. Use<br>Purpose of Rabbit joining.<br>1. Method of making<br>2. Use. | Select and make a Butt and Rabbit joint correctly. |
| Select and use wood screws correctly. Basic Text, p. 64-68. | Classification of screws according to:<br>1. Head<br>2. Diameter<br>3. Length<br>Procedure for using a screw:<br>1. Bore pilot hole<br>2. Countersinking. | Select and use wood screws correctly. |
| Use a marking guage. Basic Text, p. 27. | Procedure for adjusting and making a marking guage. | Skill in making lines on wood. |
| Use a bevel square. Basic Text, p. 27. | Set and use a bevel square for a given angle. | Skill in marking given angels. |
| Make a chamfer or beveled edge. Basic Text, p. 54-55. | Laying out chamfer or bevel edge.<br>Planing for a chamfer of beveled edge. | Skill in edging a board at an angle. |
| Apply shellac. Basic Text, p. 116-117. | Ingredients of shellac.<br>Mix and apply shellac. | Apply a shellac finish. |

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

1. Aluminum Company of America, An Outline of Aluminum. Pittsburg: Aluminum Company of America, 1948. (pamphlet)
2. Aluminum Company of America, The Working of Aluminum Alloys. Pittsburg: Aluminum Company of America, 1948. (pamphlet)
3. Compton's Pictured Encyclopedia, Copper, The Red Metal with Countless Uses. Chicago: E. F. Compton 1951, Vol. 3,

p. 473-475.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the important factors about aluminum. Related Information No. 1 and 2. | Source of aluminum<br>Uses of aluminum<br>Aluminum manufacturing<br>Economic importance of aluminum. | General knowledge of aluminum. |
| List the important factors about copper. Related Information No. 1. | Source of copper<br>Use of copper<br>Manufacturing of copper.<br>Economic importance of copper. | General knowledge of copper. |
| 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.<br>Dulling hole for inside cutting.<br>Selecting proper saw blade.<br>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.<br>1. Equating<br>2. Half round<br>3. Flat tapor<br>Three types of jeweler's files and use according to number.<br>1. 0 - course<br>2. 3 - medium<br>3. 6 - fine. | Skill in filing metal. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make a pierced design. Basic Text, p. 8. | Procedure for making a design.<br>1. Paper layout<br>2. Transferring to metal<br>3. Use of jeweler's saw and file. | Skill in making a pierced design on metal. |
| Finish aluminum or brass surface. Basic Text, p. 47-48. | Select and use correct abrasives.<br>1. Steel wool<br>2. Aluminum oxide cloth<br>a. Grades of coarseness<br>b. Correct use. | Skill in securing good finish on aluminum and copper. |
| Apply protective coat to aluminum and copper. Basic Text, p. 91. | Reason for protective coating<br>Types of protective coating.<br>1. Wax<br>2. Lacquer | 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

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1. State of Minnesota, A Guide for Instruction in Industrial Arts. St. Paul, Department of Education, 1950, p. 31.

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 Semester Schedule

First Five Weeks — Second Semester Schedule

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

Fryklund, V. E. and Kepler, F. R.; General Drafting. Bloomington, Illinois, McKnight and McKnight Co., 1938.

Related Information

1. Keuffel and Essar Company: Drafting Materials, Their Use and Care. San Francisco: Keuffel and Esser Company, 1948 (pamphlet)

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the reasons for a reduced scale drawing. Basic Text, p. 42. | Purpose of a reduced scale drawing...Conserve space and material | Understand the purpose of a reduced drawing. |
| Read an architect's rule. Basic Text, p. 36. | Mathematical principle of reduced scaling. | Understand the principle of scaling. |
| List the steps in developing a scaled drawing. Basic Text, p. 55-56. | Steps in developing a working drawing.<br>1. Design room<br>2. Consulting engineers<br>3. Drafting room. | Understand the uses and purposes of a scaled drawing. |
| List the reasons for drawing to scale. Basic Text, p. 59. | Use of scaled drawing in industry.<br>1. Saves space<br>2. Saves time. | Understand importance of scaled drawings. |
| Use an architect's scale. | Understand scaling on blades of architect's rule. | Understand an architect's scale. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. 1 inch and 1/2 inch blade<br>2. 3/4 inch and 3/8 inch blade<br>3. 1/4 inch and 1/8 inch blade.<br>Meaning of small graduations. | |
| Use an architect's scale to lay definite reduced lengths. | How lengths are reduced, on a drawing. | Skill in using an architect's rule. |
| Explain meaning of and make a hidden line. | Purpose of a hidden line.<br>When to use hidden lines. | Ability to represent hidden lines on a drawing. |

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. Channed 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

Smith, R. E., Units in Sheet Metal Work. Bloomington, Illinois. 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).
4. Fryklund, Vern C. and Kepler, Frank R., General Drafting. Bloomington, McKnight and McKnight, Publishers, 1938.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the important types of sheet metal work. Related Information Number 4, p. 98. | Types of sheet metal work:<br>1. Heating and Ventilating<br>2. Industrial sheet metal<br>3. Factory sheet metal. | An understanding of the sheet metal trade. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the opportunities and training requirements in sheet metal work. Related Information No. 4, p. 98-99. | Importance of sheet metal industry for a career.<br>Educational requirements:<br>1. Apprenticeship requirements. | An understanding of opportunities and educational 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:<br>1. Straight edge<br>2. Tinner's rule<br>3. Scriber<br>4. Triangle square<br>Basic Text, p. 10-11. | Procedure in using fundamental measuring and marking tools to:<br>1. Square metal<br>2. Measure a given distance<br>3. Scribe a given line. | Make simple straight line layouts on metal. |
| Cut Sheet Metal. Basic Text, p. 16-17. | Two types of tinner's snips and their particular use.<br>1. Straight<br>2. Combination<br>Procedure for cutting metal:<br>1. Hold and manipulate snips correctly. | Select tinner's snips and cut metal correctly. |
| Use a tinner's hammer. Basic Text, p. 25-30. | Purpose of tinner's hammer<br>1. Purpose of face and peen end of hammer. | Skill in using a tinner's hammer. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Use a mallet. Basic Text, p. 25, 31, 33. | Purpose of a mallet.<br>1. When to use. | Skill in using a mallet. |
| Use a tinner's stake. Basic Text, p. 19-20. | Four types of stakes and their particular use.<br>1. Mandred<br>2. Beakhorn<br>3. Blawhorn<br>4. Hatchet | Skill in selecting and using tinner's stakes for specified forming operations. |
| Bend Metal. Basic Text, p. 20-21, 23-24. | Procedure for bending metal.<br>1. Use of clamp and edge of bench.<br>2. Use of pan brake.<br>a. Inserting metal<br>b. Operating brake levers to secure correct angle in metal. | Skill in making specified bends in metal. |
| Use a bar folder. Basic Text, p. 23. | Procedure for using a bar folder<br>1. Adjust screw knobs for correct size band.<br>2. Insert metal and operate handle to secure correct angle. | Skill in making bends in metal. |
| Make a folded seam. Basic Text, p. 31. | Procedure for making a seam:<br>1. Correct allowance for metal. | Ability to make a simple folded seam. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. Engage the edges and secure with a groover and mallet. | |

Teacher will demonstrate these tools and processes to students.

| | | |
|---|---|---|
| Solder correctly<br>Basic Text, pp. 33-34-35-36. | Procedure for soldering<br>1. Lighting torch or furnace<br>2. Heat iron to correct temperature<br>3. Tinning iron<br>a. filing clean<br>b. use of sal ammoniac<br>4. Preparing surface to be soldered<br>a. cleaning<br>b. applying<br>c. tinning<br>5. Putting pieces to be soldered together properly.<br>6. Applying soldering copper and solder.<br>7. Filing and smoothing a soldered joint. | Ability to do simple soldering |

Teacher will give class demonstration illustrating learning experiences in soldering.

| | | |
|---|---|---|
| List the steps in production of iron.<br>Related Information No. 1. | Where iron ore is mined<br>How iron ore is mined<br>1. Types of mines<br>How iron ore is smelted<br>1. How a blast furnace operates | Knowledge of iron ore<br>1. How mined<br>2. How smelted. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | a. Use of coke<br>b. Use of limestone<br>What pig iron is. | |
| List the sources and the uses of coal in steel production. Related Information No. 1. | Where coal is mined<br>Types of coal<br>1. Type used in smelting iron ore to pig iron<br>Coke<br>1. What it is<br>2. How used in smelting | Knowledge of the use of coal in making iron and steel. |
| List the steps in the production of steel. Related Information No. 2. | Use of open hearth furnace<br>1. How it operates<br>2. Use of:<br>a. Scrap iron<br>b. Pig iron<br>c. Limestone<br>3. Size of furnace<br>4. Temperature<br>Use of Bessemer Converter<br>1. How it operates.<br>2. Why used<br>Use of electric furnace<br>1. Making of alloy steels<br>2. What an alloy steel is<br>Ingots<br>1. What they are | A knowledge of method of manufacture and importance of sheet steel. |
| List the steps in production of sheet steel. Related Information, No. 3. | Rolling ingots<br>1. Hot roll<br>2. Cold roll<br>a. Zinc coating<br>b. Terne coating<br>1. Lead<br>2. Zinc<br>3. Tin | How sheet steel is made from ingots<br>A knowledge of how steel is protectively coated. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the composition of tin plate and its use in our economy. Related information, No. 3. | Tin Plate<br>1. What tin plate is<br>2. How tin plate is coated<br>3. How tin plate is formed<br>4. Importance of tin plate. | A knowledge of tin plate as to its manufacture and use. |
| List reasons for importance of steel in our economy. Related Information, No. 1. and 2. | Importance of steel industry in our industrial economy.<br>1. Uses of steel<br>2. Value of product. | A knowledge of importance in our daily living and economy. |

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
4. Simple book ends.

# 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

Douglas, J. H. and Roberts, R. H., Units in Hand Woodworking. Wichita, The McCormick-Mather Co. 1946.

### Related Information

1. American Steel and Wire Company; Nails. Chicago, American Steel and Wire Company, 206 South La Salle Street. 1948 (pamphlet)
2. Casein Company of America; Casein Glueing Aids. New York, Casein Company of America, 350 Madison Ave., 1948, (pamphlet).
3. National Lead Company; Handbook on Painting. Los Angeles, National Lead Company, 932 Wilson St., Los Angeles, Calif., 1948, (pamphlet).

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Recognize, use and adjust the following new tools:<br>1. Planes<br>a. Smoothing plane<br>b. Jointer plane<br>Basic Text, p. 45. | The particular use of each plane<br>How to disassemble, assemble and adjust these planes<br>How to sharpen a plane iron by:<br>1. Grinding<br>2. Whetting. | Ability to select, adjust and use these wood planes correctly. |
| 2. Wood Files<br>Select and use a file correctly.<br>Basic Text, p. 59, 162. | Classification of files according to:<br>1. Shape<br>2. Degree of coarsness<br>3. Cut of Teeth<br>Use of each classification<br>1. Procedure for filing<br>2. Method of cleaning a file. | Ability to select and use a file correctly. |
| 3. Use a wood scraper. Basic Text, p. 102. | When to use a scraper<br>Procedure for using<br>Method of sharpening. | Ability to use and sharpen a wood scraper. |
| 4. Saws<br>a. Back saw<br>b. Mitre saw<br>c. Compass saw<br>Basic Text, pp. 47-48. | The particular use of each saw<br>How to use each of these saws. | Ability to select and use correctly these wood saws. |
| 5. Wood bits<br>a. Auger bit<br>b. Countersink bit<br>c. Expansive bit<br>d. Forstner bit<br>Basic Text, pp. 60-63. | The particular use of these wood bits.<br>Select the right size bit and use properly for:<br>1. Size<br>2. Particular operation | Ability to select and use correctly each of these wood bits. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| 6. Wood holding devices<br>a. Cabinet clamp<br>b. Cabinet screw<br>Basic Text, p. 89. | The particular use and proper method of using these wood holding devices. | Ability to use a cabinet clamp and wood screw correctly. |

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

| | | |
|---|---|---|
| Select and use correctly the following wood fasteners:<br>1. Nails<br>Basic Text, p. 69-70. Related Material, No. 1. | Method of manufacturing nails<br>Importance of nails<br>Characteristics and use of:<br>1. Brads<br>2. Finishing<br>3. Casing<br>4. Common<br>5. Box<br>Sizes of nails<br>1. What penny means<br>2. What the lengths are | Knowledge of nails as to method of manufacture. Select nails correctly for a particular operation. |
| 2. Screws<br>Basic Text, p. 64-65. | Method of manufacture<br>Importance of screws<br>Characteristics and uses of:<br>1. Round head screws<br>2. Oval head screws.<br>3. Flat Head screws<br>4. Phillip's screws | Knowledge of screws as to their method of manufacture. Select and use screws correctly for a particular operation. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 5. Brass screws<br>6. Steel screws<br>Meaning of numbers in regard to sizes<br>1. Number size<br>2. Length size | |
| 3. Glues<br>Basic Text, p. 91-92.<br>Reference material, No. 2. | Types of glue and how manufactured.<br>1. Animal<br>2. Liquid fish glue<br>3. Casein glue<br>4. Resin glue<br>Uses and advantages of the above types of glue<br>How to glue wood correctly<br>1. Proper fit of wood surface<br>2. Applying glue to wood<br>3. Clamping | Technical knowledge of glue.<br>Skill in making a glued wood joint. |
| Hinges (Teacher will have samples of these hinges). | Kinds of hinges and their particular use<br>1. Surface hinges<br>2. Butt hinges<br>3. Chest hinges<br>Procedure for installing each of these hinges. | 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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Select and use:<br>1. Varnish<br>2. Paints<br>Basic Text, p. 112 and p. 118. Reference material, Related information, No. 3. | What a finishing material does for wood.<br>Varnish<br>1. ingredients<br>2. procedure for applying<br>Paints<br>1. ingredients for the different pigments.<br>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
4. Bird houses.

## 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

Smith, R. E., Units in Bench Metal Work. Bloomington, Illinois. McKnight and McKnight Company, 1939.

Related Information

1. Simond's Saw and File Company, Hacksaw-ology. Fitchburg, Pennsylvania, Simond's Saw and File Company, (pamphlet).
2. Nicholson File Company, Short Cuts to Better Work for the Home Craftsman. Niagra Falls, N. Y., Carborundun Company, (pamphlet).
3. Carborundun Company, A File For Every Purpose. Providence, Rhode Island, Nicholson File Company, (pamphlet).
4. Bethlehem Steel Company, Steel in the Making. Bethlehem, Bethlehem Steel Co., 1950, (booklet).
5. American Iron and Steel Institute, Steel Sews the Farmer, New York, American Iron and Steel Institute, (pamphlet).

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the differences between bench metal and sheet metal work. Basic Text, p. 4. | Bench metal work involves: 1. Sheet metal heavierthan one eighth in thickness. | The meaning of bench metal work. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Bar, flat and round metals<br>3. Representative of more trades as tool makers, machinists, moulders, and so forth.<br>4. Use of a different type of tools. | |
| List the important facts about bench metal in our economy. Basic Text, p. 3. Related Information, No. 4,5. | Number of people employed<br>Importance and value of our economy<br>Opportunities metal work offers:<br>1. Types of work<br>2. Economic opportunities. | The importance of and opportunities in the bench metal industry. |

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.

| | | |
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| 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.<br>1. Production of hot steel slabs.<br>2. Rolling of hot steel slabs. | A general knowledge of production of metals heavier than number ten guage (1/8 inch thick)<br>1. Knowledge of production of steel plate. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 3. Cold roll process for bars and plate of less than .05 inch thick | |
| | Process involved in the production of rod and wire.<br>1. Reduction of rod and wire<br>a. Cold drawing bar steel through dies. | 2. Knowledge of the manufacture of rods and wire. |
| | 2. Process involved in the production of pipe<br>a. Continuous weld pipe<br>b. Lap weld pipe<br>c. Seamless tubing. | 3. Knowledge of the manufacture of pipe. |
| | Purpose and process of galvenizing:<br>1. Use of zinc. | |
| Measure the thickness of sheet steel and round steel correctly. Basic Text, pp. 4-5. | How to determine:<br>1. Wire thickness<br>a. Guage sizes and equivalent in inches.<br>2. Steel plate<br>a. Guage sizes and equivalent in inches.<br>3. Rod and bar sizes<br>4. Pipe sizes. | 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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Recognize and use correctly the following tools:<br>1. Files<br>Basic Text, pp. 17-18. Related Information, No. 2. | Classification of files:<br>1. Cut<br>a. Single<br>b. Double<br>2. Coarseness of cut.<br>Commonly used files and their purpose:<br>1. Mill file<br>2. Flat file<br>3. Hard file<br>4. Warding file<br>5. Half round<br>How to file:<br>1. Position of file<br>2. Pressure stroke<br>3. Draw filing<br>4. Clean a file | Select and use a file correctly. |
| 2. Cold chisel and center punches.<br>Basic Text, p. 21. | Procedure for cutting stock with a chisel.<br>1. Marking with light blow first<br>2. Cutting with hard blows.<br>Procedure for center punching metal. | Use a chisel and center punch correctly. |
| 3. Hacksaw<br>Basic Text, pp. 14-15. Related Information, No. 1. | Select and use a hacksaw correctly:<br>1. Types of sets of teeth and their uses.<br>a. Alternate<br>b. Raker<br>c. Undulated<br>2. Degree of coarseness of blade | Select proper hacksaw blade and use a hacksaw correctly. |

| 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.<br>3. Proper pressure on forward stroke. | |
| 4. Drills<br>Basic Text, p. 97. | How drill sizes are determined:<br>1. Sizes in fraction of an inch<br>2. Number sizes and fractional inch equivalent.<br>Use a drill correctly in:<br>1. Hand drill<br>2. Drill press. | Select proper size drill and use correctly. |
| List and use metal fasteners:<br>1. Rivets.<br>Basic Text, p. 25. | Rivets<br>1. Classification according to shape:<br>a. Oval head<br>b. Flat head<br>c. Cone head<br>d. Countersunk head.<br>How size is determined by length<br>Tinner's rivets<br>1. Size according to ounce. | Select the proper rivet for a specific purpose. |
| 2. Bolts.<br>Basic Text, p. 27. | Classification of bolts and their particular purpose:<br>1. Carriage bolts<br>2. Machine bolts<br>3. Stove bolts<br>Sizes of bolts: | Select and use proper bolt for a specific purpose. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. How size is determined by length and diameter. | |
| Use pliers and wrenches correctly. Basic Text, p. 20. | Recognize the following wrenches:<br>1. Monkey<br>2. Crescent<br>Pliers:<br>1. Side curring<br>2. Adjustable combination. | Select and use correctly common wrenches and pliers. |
| Select and use two types of vise. Basic Text, p. 13. | Machinist vise<br>Utility bench vise<br>1. Characteristics and use of each type of vise. | Select and use a vise correctly for a particular operation. |
| Teacher will give a demonstration of the proper selection and use of the foregoing materials and operations. | | |
| Perform the following operations:<br>1. Simple bench layout involving measuring, scribing, and calculating bend allowances.<br>Basic Text, p. 10. | Lay out length<br>1. Measure correctly.<br>Layout in two directions.<br>1. Determine center by intersecting line<br>2. Use of dividers.<br>Calculate the length of flat bar required for angular bends:<br>1. Use of center line in layout<br>2. Adding or subtracting stock thickness for obtaining required net lengths. | Ability to do simple layout. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | Calculate the length of flat bar required in making curved or irregular shapes.<br>1. Use of center line and wire. | |
| Bend Metal.<br>Basic Text, p. 22. | Procedure for bending flat bar in a vise.<br>1. Position of metal in vise<br>2. Correct use of hammer in bending metal. | Skill in bending metal in a vise. |
| Twist metal<br>Basic Text, p. 23. | Procedure for bending flat bar:<br>1. Position of metal in vise<br>2. Use of a monkey wrench. | Skill in twisting metal. |
| Drill metal.<br>Basic Text, p. 29. | Procedure for drilling a hold:<br>1. Locating center of hold<br>2. Marking with center punch<br>3. Selecting right sized drill for hole diameter desired<br>4. Secure stock and use a hand or breast drill correctly. | Ability to drill a given sized hole. |
| Rivet metal together.<br>Basic Text, p. 30. | Procedure for riveting: | Ability to fasten |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. Selecting correct length of rivet<br>a. Formula for determining<br>2. Correct size hole to drill<br>3. Securing rivet<br>a. Correct use of a ball pein hammer. | two pieces of metal together securely by riveting. |

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

Jones, E. W., General Electricity. Wichita, The McCormick-Mathers Publishing Co., 1937.

### Related Information

1. Lush, C. K., and Engle, G. E., Industrial Arts Electricity. Peoria, The Manual Arts Press, 1946.
2. Films

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

   a. The Light of Your Life. (No. AS-2666. Twenty Minutes. Color.)
   b. The World's Largest Workshop. (No. S-2428. Thirty minutes. Black & White).
   c. Principles of Electricity. (No. S-2585. Twenty minutes, Color.)
   d. Magnetism. (A slide film requiring a recoding maching) (Send request to Distribution Section Advertising and Sales Promotion Division, General Electric Company, Schnectady, 5, New York.)

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List important factors about electricity. | Use of electricity in:<br>1. Industry<br>2. Home<br>3. Defense<br>4. Pleasures | The importance of electricity in our economy and life. |

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.

| | | |
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| List the opportunities in electrical vocations. Related Information, No. 1, pp. 11-18. Film No. 2. | Occupational opportunities in the electrical trades:<br>1. Various types of work<br>2. Training required.<br>Occupational opportunities on the technical and professional level<br>1. Nature of work<br>2. Training required. | Vocational opportunities in the electrical industry. |

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.

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| 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.<br>Poles of a magnet<br>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.<br>Use of electro-magnets:<br>1. Generators<br>2. Motors<br>3. Radios<br>4. Buzzers | How the lines of force of electricity operate.<br>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.<br>1. Use of an ammeter<br>a. How an ammeter works. | An understanding measuring rate of flow of an electric current. |
| Measure force of an electric current. Basic Text, p. 12-13. | How voltage (force) of electricity is measured.<br>1. Use of voltmeter<br>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<br>How resistance varies:<br>1. Length of wire<br>2. Size of wire<br>3. Temperature of wire<br>4. Material of wire.<br>Measure resistance<br>1. Ohms Law<br>Uses made of resistance<br>1. Home<br>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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Illustrate how a battery produces electric current. Basic Text, p. 16-17. Film number 3. | Composition of a dry cell:<br>1. Zinc<br>2. Copper<br>3. Acid.<br>How the ingredients react to produce an electrical current. | An understanding of how a dry cell produces electricity. |

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

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| Illustrate how a storage battery works. Basic Text, p. 50-51. | Composition of a storage battery:<br>1. Lead plates<br>2. Sulphuric acid.<br>How ingredients produce electricity:<br>1. Action of gray lead<br>2. Action of lead peroxide<br>3. Action of the electrolyte (sulphuric acid). | An understanding of how a storage battery produces electricity. |

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

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|---|---|---|
| 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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| making a bell or buzzer operate with electrical current. Basic Text, p. 5. | 1. Changing electricity into magnetism by electromagnets.<br>2. Changing magnetism into motion by attraction and repulsion.<br>How a magnet converts this energy into motion:<br>1. The attraction and repulsion of the two poles of an electro-magnet. | |

Students will construct a simple electro-magnet 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<br>1. Produce voltage<br>2. Furnish electrical current.<br>How generator produces voltage:<br>1. Rotation of coils between poles of magnets.<br>Type of current produced:<br>1. Alternating current<br>2. Action of the commutator to produce direct current. | An understanding of how electrical energy is produced by generators. |

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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make electrical wire joints. Related Information, No. 1, pp. 50-51. | How to make a Western Union splice.<br>How to make a top splice<br>How to solder and insulate an electrical wire splice. | How to splice electrical wire. |
| Read a simple electrical drawing. Related Information, No. 1, p. 52. | Know the symbols for:<br>1. Wire Connected<br>2. Wires crossed but not connected<br>3. Switch<br>4. Tap splice<br>5. Bell<br>6. Buzzer<br>7. Ground. | How to read a simple electrical diagram. |
| Select the common sizes of electrical ware correctly. Basic Text, p. 25. Related Information, No. 1, p. 92. | Recognize and know the use of:<br>1. Number 14 wire<br>2. Number 16 wire<br>3. Number 18 wire. | A knowledge of the most common sizes of electrical wires. |

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. Bloomington, McKnight and McKnight Publishers, 1938.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List important facts about a pictorial drawing. Basic Text, p. 90. | Pictorial drawings show objects somewhat as they appear in pictures. The three types of pictorial drawings:<br>1. Oblique and cabinet drawing<br>2. Isometric drawing<br>3. Perspective drawing. | A general knowledge of what pictorial drawing means. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the reasons for use of pictorial drawings. Basic Text, p. 90. | Pictorial drawings used extensively in industry and construction because:<br>1. Gives an overall view of an object or building quickly.<br>2. Aids in designing<br>3. Used extensively in daily living.<br>a. Advertising<br>b. Illustrations<br>4. Gives meaning to an orthographic drawing. | Why pictorial drawings are important. |

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 an oblique and cabinet drawings. Basic text, pp. 90-91. | Oblique and cabinet drawings:<br>1. Face of object in full form<br>2. Receding lines are thirty, forty-five, or sixty degrees.<br>3. Oblique drawings receding lines are full length<br>4. Cabinet drawings receding lines are half to three quarters true length. | An understanding of oblique and cabinet drawings. |

Suggested oblique and cabinet drawing projects:

1. Square shape block

2. Irregular shape block

Basic Text, pp. 91-92.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the characteristics of an isometric drawing. Basic Text, pp. 91-92. | Characteristic of isometric drawing:<br>1. Three faces of an object shown<br>a. Top<br>b. Two sides<br>2. Three axes exist<br>a. Vertical line axis<br>b. Thirty degree line to right of axis<br>c. Thirty degree line to left of axis<br>3. Vertical lines are drawn vertical<br>4. Horizontal lines forming right angles on the object are drawn thirty degrees<br>5. Means of overcoming apparent oversize by drawing thirty degree lines to isometric scale by projecting to forty-five degree line. | An understanding of principles of isometric drawing. |

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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the characteristics of parallel perspective drawing. Basic Text, pp. 93-94. | Characteristics of perspective drawings:<br>1. Vertical lines in object appear vertical in the drawing.<br>2. Horizontal lines extending away from the eye appear to converge<br>3. Horizontal lines perpendicular to horizon vanish in center of vision<br>4. Horizontal lines parallel to horizon are sketched parallel to the horizon line. | An understanding of principles of perspective drawing. |
| List the characteristics of a parallel perspective. Basic Text, p. 93. | Characteristics of parallel perspective.<br>1. Horizontal lines extending away from the eye (neither parallel nor perpendicular) converge in vanishing points on either the left or right side of center of vision. | An understanding of parallel perspective drawing. |

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

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1. State of Minnesota; A Guide for Instruction in Industrial Arts. St. Paul, Department of Education, 1950, p. 34.

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 Eight 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 | Twleve 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 truning. Several machine tools and wood joints of greater difficulty to make are introduced.

### References

#### Basic Text

1. Douglas, J. H. and Roberts, R. H.; Units in Hand Woodworking. Portland, McKormick-Mathers Publishing Company, 1946.
2. Smith, Robert H.; Machine Woodworking. Bloomington, Illinois, McKnight and McKnight Publishers, 1948.

#### Related Information

1. National Lead Company; Handbook on Painting. Los Angeles, 932 Wilson St., National Lead Company, (pamphlet), 1948.
2. Curtis Companies Service Bureau; The Care of Woodwork. Clinton, Iowa, Curtis Companies Service Bureau, 1947.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Select and apply wood stains properly. Basic Text, pp. 110-111. | Three kinds of stains and their characteristics:<br>1. Oil stain<br>a. Easiest to apply<br>b. Tendency to fade<br>2. Water stains<br>a. Raises grain of wood<br>b. Gives a darker color<br>3. Spirit stains<br>a. Expensive<br>b. Fade easily<br>c. Used for refinishing<br>Method of applying stains:<br>1. Oil stains with long, even strokes of brush<br>2. Water stains require several coats with a brush<br>3. Spirit stains with a brush. | Ability to select and use the proper stain for a particular wood or color. |
| 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. Basic Text, pp. 114-115. | Purpose of wood fillers and wood requiring fillers:<br>1. Fills pores of wood<br>2. Wood requiring fillers<br>a. Oak<br>b. Walnut<br>c. Mahoganey<br>d. Chestnut<br>Method of applying wood fillers:<br>1. Apply with cloth and rub in well<br>2. Cover with coat of shellac | Select and use wood fillers correctly. |
| Apply crack filler | Types of crack fillers and their application | Apply a filler to remedy a defect |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. Stick shellac<br>2. Plastic wood<br>3. Method of application and finish. | or nail hole in wood. |
| Select and apply the following wood coatings:<br>1. Lacquer.<br>Basic Text, pp. 120-121. Related Information, No. 2. | Advantages of lacquer:<br>1. Durable<br>2. Water resistant<br>Method of applying lacquer:<br>1. Always use an undercoat of shellac<br>2. Use of airbrush or hand brush<br>Thinning:<br>1. Use of lacquer thinner. | Select for desired finish and apply properly:<br>1. Lacquer<br>2. varnish<br>3. enamel |
| 2. Varnish.<br>Basic Text, pp. 118-119. Related Information, No. 2. | Types of varnish:<br>1. China wood oil<br>2. Synthetic resin<br>3. Alkyd<br>4. Spar<br>Advantages of Varnish:<br>1. Gives a clear durable finish.<br>Method of applying varnish:<br>1. Correct use of brush<br>2. Rubbing with pumice stone or commercial rubbing compound. | |
| 3. Enamel.<br>Basic Text, p. 112. Related Information, No. 1. | Advantages of enamels:<br>1. Provides a hard gloss finish in a variety of colors.<br>Method of application:<br>1. Apply over smooth, clean surface. | |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Use brush correctly.<br>Thinning:<br>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:<br>1. Bandsaw<br>Basic Text, (2) pp. 109-110. | Purpose and use of the bandsaw:<br>1. Used to cut irregular or curved shapes quickly and accurately.<br>2. Safety precautions. | Ability to use a band-saw safely and accurately. |
| 2. Planer.<br>Basic Text, (2) pp. 112-114. | Purpose and use of the planer:<br>1. Used to obtain a smooth accurate surface on the edge or face of a board<br>2. Used to obtain edges for glueing<br>3. Safety precautions. | Ability to use a planer skillfully and safely. |
| 3. Circular saw.<br>Basic Text, (2) pp. 80-86. | Purpose and use of power saw:<br>1. Used to rip and cross cut lumber<br>2. Used to rout out for certain wood joints<br>a. Routing attachments<br>3. Safety precautions. | |

Teacher will demonstrate the purpose, use, and safety precautions of these woodworking machines.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make the following wood joints:<br>1. Dowel joint.<br>Basic Text, p. 78,80. | Purpose and advantages:<br>1. Used for glued edges<br>2. Provides extra strength<br>Procedure:<br>1. Plane edges smooth<br>2. Drill dowel holes and countersink. | Know when to use and how to use and make a dowel joint. |
| 2. Edge joint.<br>Basic Text, p. 80. | Purpose and advantages:<br>1. Used for glued edges of wood<br>2. Provides good strength without use of dowels.<br>Procedure:<br>1. Planing to obtain accurate square edges. | Know when to rise and how to make a dowel joint. |
| 3. Blind Mortise and tenon.<br>Basic Text, p. 78-85. | Purpose and advantages:<br>1. Used in furniture construction<br>2. Provides a strong joint not easily discernible<br>Procedure in making:<br>1. Lay out mortise<br>2. Drill series of holes and<br>3. Lay out tenon<br>4. Saw around tenon<br>5. Pare tenon down with chisel. | Know when to rise and how to make a blind mortise and tenon joint. |
| 4. Combination dado, tongue | Purpose and advantages:<br>1. Used in drawer | Know when to use and how to make a |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| and rabbet joint.<br>Basic Text 2, pp. 89-90. | construction<br>2. Provides a strong joint<br>Procedure in making:<br>1. Layout<br>2. Set guide on power saw<br>3. Cut out material with dado blades. | combination Dado, Tongue, and Rabbet joint. |

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:<br>1. Wood lathe.<br>Basic Text, 2, p. 12. | How wood is turned to desired circular shape:<br>Recognize and use the following elementary wood turning tools:<br>1. Guages<br>a. Shape and use<br>2. Skew chisels<br>a. Shape and use<br>3. Parting tool<br>a. Shape and use<br>4. Calipers<br>a. Method of measuring stock. | Know what a wood lathe is and how it operates.<br>Select and use properly elementary wood turning cutting tools. |
| Perform the following wood turning operations:<br>1. Center stock<br>2. Gouge stock<br>Basic Text, 2, p. 19-41. | Method of centering stock for turning on the wood lathe:<br>Method of using a gouge to make: | Ability to center stock in wood lathe.<br>Ability to turn wood to desired shape. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. Convex surface<br>2. Concave surface<br>3. Straight round. | |
| 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:<br>1. Centering face plate on stock<br>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

Jenkins, Horace, R.; Practical Pottery. Milwaukee, The Bruce Publishing Co., 1941. (Fourth edition, 1950).

### 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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Explore the historical background of pottery. Basic Text, pp. 1-7. | Contributions of early civilizations to the art of pottery:<br>1. Egypt (300 BC)<br>a. Developed brilliant glazes<br>2. Greeks (500 BC)<br>a. Form and figure painting<br>3. Persia (500 BC)<br>a. Simple colors<br>4. Rome (600 BC)<br>a. Red glazes<br>b. Introduced potter's wheel<br>5. Chinese (3000 BC)<br>a. Artistic design | A knowledge of the contributions of other peoples and times to the art of pottery. |
| List the basic factors of good pottery design. | Good pottery has:<br>1. Smooth lines<br>2. Graceful form<br>3. Appropriate color. | Knowledge of what is good pottery design. |

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:<br>1. Silica of alumina<br>Where found:<br>1. River beds and open pits<br>Classification of clay:<br>1. Residual<br>2. Sedimentary. | A general knowledge of clay. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Prepare clay.<br>Basic Text, p. 18. | Correct amount of water for a given amount of clay<br>Kneeding the clay<br>Wedging the clay. | Ability to mix clay correctly. |
| Roll clay flat.<br>Basic Text, p. 25. | Method of making clay flat:<br>1. Use of a rolling pin. | Ability to roll clay flat. |
| Cut clay.<br>Basic Text, p. 26. | Method of cutting:<br>1. Use of a knife<br>2. Use of a straight edge<br>3. Use of an irregular shaped template. | Ability to cut clay in straight or irregular shapes. |
| Form clay into predetermined shapes and forms by:<br>1. Template method.<br>Basic Text, p. 19. | How to form by objects out of clay in the flat form:<br>1. Making a paper template of a planned project<br>2. Cutting clay to size of template. | Ability to form clay into desired shapes. |
| 2. Coil method.<br>Basic Text, pp. 20-21. | How to form by using clay coils:<br>1. Rolling a clay rope<br>2. Method of forming object by coil method. | |
| 3. Pinch method.<br>Basic Text, p. 19.<br>Related Information, No. 2. | How to form objects by hand:<br>1. Use of the fingers to form from ball of clay. | |

Teacher will give a demonstration on the preparing and methods of forming clay.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Smooth a dried piece of pottery. Basic Text, p. 24-25. | Smoothing surface:<br>1. Use of a sponge<br>2. Use of a scraper or knife. | Ability to obtain a smooth surface in preparation for glazing. |
| List the basic composition of glazes. Basic Text, pp. 112-114. | Classification of glazes and their main ingredients:<br>1. Raw glazes<br>a. Lead, zinc, flint, clay and other minerals in natural form<br>2. Fritted glazes<br>a. Lead, zinc, flint, clay and other minerals that have to be fritted.<br>How colors are obtained in a glaze:<br>1. Addition of certain minerals:<br>a. Copper gives green<br>b. Cobalt gives blue<br>c. Iron gives yellow and brown. | A knowledge of the composition of glazes and why certain colors are produced by specific ingredients. |
| Apply a glaze. Basic Text, pp. 146-148. | Methods of applying a glaze:<br>1. Dipping object in a glaze<br>2. Pouring on a glaze<br>3. Brushing on a glaze<br>4. Spraying on a glaze. | Ability to apply a glaze properly. |

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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Fire a kiln.<br>Basic Text, pp. 105-9. | Pack a kiln correctly<br>Purpose of biscuit fire<br>Purpose of glaze fire<br>Use of Pyrometric cones. | Skill in packing and firing a kiln. |

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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| List the purposes and uses of machine drawings. Basic Text, pp. 54-55. | Machine drawing deals with:<br>1. Producing machines<br>2. Assembling machines<br>3. Installing machines<br>Steps in developing a machine drawing:<br>1. Sketch or design<br>a. Experimental assembly layout design<br>b. Final assembly design<br>Purpose of machine drawing:<br>1. Detailed drawings of parts of a machine<br>2. Shows relationship of part of a machine. | Knowledge of what machine drawing is.<br>How machine drawings are used in making a product of industry. |
| List the opportunities in the broad field of mechanical drawing. Basic Text, pp. 55-56. | Importance of machines in our society.<br>The necessity of drawing to machine production and operation.<br>Various branches of mechanical drawing:<br>1. Designers<br>a. College training<br>2. Draftsmen<br>a. Apprentice training. | Knowledge of opportunities in the field of mechanical drawing and the educational requirements. |

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

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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Draw arcs and circles with a compass or bow. Basic Text, pp. 68-69. | Method of adjusting compass<br>How to hold compass in making an arc or circle<br>How to draw a straight line tangent with the arc of a circle.<br>How to draw straight lines tangent with two arcs. | Skill in drawing arcs and circles.<br>Skill in drawing lines tangent to an arc. |
| Bisect an angle. Basic Text, p. 76. | Procedure in bisecting an angle. | Skill in bisecting an angle accurately. |
| Dimension correctly and accurately. Basic Text, pp. 70-72. | Dimension correctly the following:<br>1. Overall and inside lines of various views.<br>2. Drilled hole<br>3. Radius of a circle or arc<br>4. Pitch of a thread. | Skill in dimensioning a machine drawing correctly. |
| Indicate correctly machine operations to be performed on a drawing. Basic Text, p. 73-74. | Indicate correctly by words:<br>1. Drill<br>2. Ream<br>3. Type of finish. | Ability to indicate the operational procedure in making a machine part. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Draw a center line of a view. Basic Text, p. 77. | Correct position of a center line<br>Value of a center line. | Ability to use a center line correctly in a view. |
| Draw the symbols for various metals. Basic Text, p. 78. | Draw the symbols for:<br>1. Cast iron<br>2. Steel<br>3. Lead<br>4. Bronze, brass copper composition. | Ability to indicate the composition of a machine part in a sectional view by symbols. |
| Draw the conventional representation of a thread. Basic Text, p. 74. | External method of representing a thread.<br>Internal method of representing a thread. | Ability to represent a thread. |

Teacher will demonstrate the foregoing basic skills and operations to the students.

| | | |
|---|---|---|
| Make a working drawing that involves a sectional view. Basic Text, pp. 78-79. | Meaning of a sectional view:<br>1. Shows the interior of an object.<br>Types of sectional views:<br>1. Full section<br>2. Half section<br>3. Revolved section<br>Types of lines used in sectional views and their uses:<br>1. Detail line<br>2. Section line<br>3. Construction line<br>4. Cutting plane line<br>5. View line. | An understanding of sectional views and ability to draw a sectional view. |

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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make a simple assembly drawing. Basic Text, pp. 87-88. | Purpose of an assembly drawing:<br>1. Planning general structure<br>2. Assembling parts. | Understand what an assembly drawing is. |
| | Steps in making an assemble:<br>1. Determine main parts to be drawn<br>2. Sketch main parts, using a center line<br>3. Sketch indetail drawing<br>4. Draw the assembly, drawing from the sketch, place in all dimension lines. | 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, 1949.

#### 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 | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Explore history and manufacture of leather. Basic Text, pp. 11-15. | History of leather:<br>1. Used by:<br>a. Egyptians<br>b. Romans<br>c. Greeks<br>d. American Indians<br>Method of manufacture of leather:<br>1. Soaking pelts in lime water and removing hair<br>2. Soaking in bark of tree solution or chormium salts<br>3. Pressing and splitting leather<br>4. Polishing and dyeing of leather. | A knowledge of history and manufacturing methods of leather. |
| Select four kinds of leather. Basic Text, pp. 13-14. | Four types of leather by texture and their characteristics:<br>1. Suede<br>2. Calfskin<br>3. Steerhide<br>4. Goat | Knowledge of four common types of leather and their main use. |
| Identify and use the following leather working tools: | | |
| 1. Steel square. Basic Text, p. 23. | Use of steel square:<br>1. Used for layout and cutting leather. | Ability to use correctly the fundamental tools of leather craft. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| 2. Swivel knife.<br>Basic Text, p. 33. | Use of swivel knife:<br>1. Used to cut out a design. | |
| 3. Skining knife.<br>Basic Text, p. 40. | Use of skining knife:<br>1. Used to thin leather at edges or folds. | |
| 4. Square knife.<br>Basic Text, p. 23. | Use of square knife:<br>1. Used to cut leather. | |
| 5. Edge creaser.<br>Basic Text, p. 39. | Use of edge creaser:<br>1. Used to make a decorative depressed line along edge. | |
| 6. Modeler.<br>Basic Text, p. 17. | Use of modeler:<br>1. Used to trace design and emboss background. | |
| 7. Ball point.<br>Basic Text, p. 28. | Use of ball point:<br>1. Used to stipple or enrich background of a design. | |
| 8. Revolving punch.<br>Basic Text, p. 42. | Use of a revolving punch;<br>1. Used to punch holes for lacings. | |
| Perform the following operations:<br>1. Make a template pattern.<br>Basic Text, pp. 22-23.<br>Related Information, No. 2. | Purpose and use of a template in making a project. | Ability to make and use a paper pattern template. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| 2. Cut leather. Basic Text, p. 23. | Procedure cut cutting: 1. Place template on leather 2. Use steel square on edges 3. Hold knife at angle and cut through first stroke. | Ability to cut leather. |
| 3. Prepare leather. Basic Text, p. 24. | Procedure for preparing leather for tooling: 1. Sponge leather with water on unfinished side 2. Place leather on a flat surface. | Ability to prepare leather for tooling. |
| 4. Transfer a design. Basic Text, p. 25. | Procedure in transferring a design: 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. | Ability to transfer a design onto leather. |
| 5. Stipple a background. Basic Text, p. 28. | Procedure for stippling: 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. | Ability to stipple a background ona design. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | WHAT STUDENTS SHOULD |
|---|---|---|
| 6. Skive leather. Basic Text, p. 40. | Procedure for skiving leather: 1. Place leather on flat surface 2. Draw line width of skive 3. Shave leather from this line to edge. | Ability to skive edge of leather. |
| 7. Carve leather. Basic Text, p. 33. | Procedure in carving leather: 1. Hold and pull swivel knife 2. Cut one half thickness of leather 3. Never cut across another cut. | Ability to carve a design on leather. |
| 8. Punch holes in leather. Basic Text, p. 42. | Procedure in using the revolving punch: 1. Lay out holes on leather with awl. 2. Select size punch desired 3. Center tube of punch over hole. | Ability to lay out and punch holes in leather. |
| 9. Make an edge lacing. Basic Text, pp. 44-45. | Procedure in making an edge lacing: 1. Shine edge 2. Mark and punch holes 3. Make a single button hole. | Ability to finish a leather project with a suitable lacing. |

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

1. Smith, Robert E.; Units in Patternmaking and Founding. Portland, The McCormick-Mathers Publishing Company, 1939.
2. Harcourt, Robert H.; Elementary Forge Practice, Peoria, The Manual Arts Press, 1938.

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).
2. Aluminum Company of America; Forming Aluminum, Pittsburg, Aluminum Company of America, (pamphlet).
3. United States Steel; Suiting the Heat Treatment to the Job. Pittsburg, United States Steel, 1946, (booklet).
4. Bethlehem Steel Company; Heat Colors. Bethlehem, Bethlehem Steel Company, (a chart).
5. Stimpson, William C., Burton, Gray L. and Grennar, John, Foundry Work. Chicago, American Technical Society, 1940.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Explore the importance and opportunities of foundry work. Basic Text 1, p. 2. Related Information, No. 5, p. 1 B. | What foundry work is:<br>1. Pouring of moulten metal to form casting.<br>Importance in our society:<br>1. Persons employed<br>2. Place in our industry<br>a. Production of many objects of iron and alloy steel for industry and home.<br>Type of work and training required:<br>1. Patternmaker<br>a. Makes wood patterns of object desired. | A general understanding of foundry work as to type of work and vocational opportunities. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Molder<br>a. Makes and pours molds<br>3. Apprenticeship training<br>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:<br>1. Draft<br>Basic Text 1, pp. 4-5. | Meaning and use of the following terms:<br>1. Draft<br>a. Taper of a pattern to facilitate removal of pattern from sand. | An understanding of the meaning of elementary foundry terms and equipment. |
| 2. Drag | 2. Drag<br>a. An impression of lower or drag half of mold. | |
| 3. Cope | 3. Cope<br>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: | |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| 1. Flask. | Flask is a frame to hold molding sand. | |
| 2. Molding sand. | Molding sand is a special type of sand used in molding. | |
| 3. Sprue pin. | Sprue pin is a tapered pin to form a pouring hole in sand. | |
| 4. Parting dust. | Parting dust is a powder used to smooth the surface of a sand mold. | |
| 5. Crucible, | Crucible is used to melt and pour molten metal. | |
| 6. Crucible tongs. | Crucible tongs are used to hold and carry a crucible. | |

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

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| 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:<br>1. Make wood pattern<br>a. Make surfaces smooth and true<br>b. Allow for drag on edges.<br>2. Attach tapered knot to center of cope side<br>3. Sand and shellac. | Ability to make a simple pattern. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Make a mold from a pattern. Basic Text, 1, pp. 34-36. | Steps in making a mold: 1. Prepare sand to 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 partind dust and replace cope. | Ability to make a simple mold. |
| Pour a mold. Basic Text, p. 58. | Steps in pouring a mold: 1. Heat metal to 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. | Ability to pour a simple mold. |

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

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| Explore the meaning and importance of forging. Related Information Units 1 and 2. | What forging is: 1. Forming heated metal by hammering or exerting pressure | A general knowledge of forging as it relates to our society. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | Importance in our society:<br>1. Used more and more in industry.<br>a. Automobile engines<br>b. Tools<br>c. Machinery of all kinds | |
| List the types of work in forging. | Type of work and training required:<br>1. Drop hammer operators<br>2. Heat treatment technicians<br>3. Tool makers<br>4. Blacksmiths<br>5. Apprentice training for craftsmen, college for technicians. | A knowledge of vocational opportunities in forging. |

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

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| Use the following forge tools:<br>1. Forge.<br>Basic Text 2, p. 16. | How to operate a forge:<br>1. Start a fire<br>2. Use air controls<br>3. Supply fire with coke. | Know and use the elementary tools of forging. |
| 2. Anvil.<br>Basic text 2, p. 19. | Purpose of an anvil<br>Use of square and horm end. | |
| 3. Blacksmith's hammers.<br>Basic Text 2, pp. 21-23. | Recognize and know purpose of following hammers:<br>1. Ball pein | |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Cross Pein<br>3. Straight pein<br>4. Sledges | |
| 4. Tongs.<br>Basic Text 2, pp. 22-23. | Recognize and know purpose of the following tongs:<br>1. Flat jawed<br>2. Curved lip<br>3. Pick up. | |
| 5. Handie.<br>Basic Text 2, p. 25. | Method of cutting metal with a handie. | |
| Teacher will demonstrate the proper use of these tools. | | |
| Perform following operations:<br>1. Cut stock.<br>Basic Text 2, pp. 33-34. | Procedure for cutting stock:<br>1. Using a hardie on cold stock.<br>2. Using a hardie on hot stock. | Ability to perform the elementary operations of forging. |
| 2. Upset method.<br>Basic Text 2, pp. 46-47. | Purpose and method of upsetting:<br>1. Purpose is to decrease length, increase width of stock.<br>2. Method:<br>a. Heat properly<br>b. Hammer on face of anvil. | |
| 3. Draw stock.<br>Basic Text 2, p. 31. | Purpose and method of drawing stock:<br>1. Purpose is increased length | |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Method:<br>a. Hammer square<br>b. Drawn by hammering on horn of anvil. | |
| 4. Square or true stock.<br>Basic Text 2, p. 33. | Method of squaring and truing stock:<br>1. Use of hammer and anvil. | |
| 5. Swage stock.<br>Basic Text 2, p. 27. | Purpose and method of swaging:<br>1. Purpose is to round stock<br>2. Method:<br>a. Proper heating<br>b. Proper use of a swage. | |
| 6. Heat stock.<br>Basic Text 2, p. 106. | Procedure for heating stock:<br>1. Position of stock in forge<br>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 of:<br>1. Wrought iron<br>a. Carbon content .04 percent<br>b. Used in forging<br>c. Breaks easily when formed cold<br>2. Mild steel<br>a. Carbon content .05 to 25 percent<br>b. Excellent forge material<br>3. Tool steel<br>a. Carbon content .6 to 1.5 percent<br>b. Used for tools. | Know the properties of three common forms of iron. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Perform following heat treating operations:<br>1. Anneal stock.<br>Basic Text 2, p. 101. | Purpose and method of annealing:<br>1. Purpose of annealing is to soften steel.<br>2. Method:<br>a. Heat cherry red and cool off in lime. | Ability to temper tool steel correctly. |
| 2. Harden tool steel.<br>Basic Text 2, p. 101. | Purpose and method:<br>1. Purpose is to make steel very hard before tempering.<br>2. Method:<br>a. Heat to cherry red<br>b. Immerse in cold water. | |
| 3. Temper steel.<br>Basic Text 2, p. 101.<br>Related Information, No. 3 and 4. | Purpose and method of tempering steel:<br>1. Purpose is to soften and toughen a hardened steel object.<br>2. Method:<br>a. Heat to a determined temperature<br>b. Cool in oil quickly to desired color. | |

Teacher will give a demonstration on annealing, hardening, and tempering of tool steel. 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.

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2. Smith, Robert E.; Units in Bench Metal Work. Bloomington, McKnight and McKnight Publishers, 1939.

3. New York Herald Tribune Home Institute; America's Housekeeping Book. New York, Charles Scribner's Sons, New York, 1947.

4. Smith, Robert E.; Units in Sheet Metal Work, Bloomington, McKnight and McKnight Publishers, 1939.

5. Jones, E. W., General Electricity, Portland, The McCormick-Mathers Publishing Co., 1937.

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Upholster a chair. Basic Text 1, pp. 128-129. | Procedure in upholstering a chair:<br>1. Weave and tack webbing across open frame<br>2. Cover webbing with muslin<br>3. Spread and sew padding to webbing<br>4. Cover with muslin (tightly stretched and tacked down)<br>5. Cover muslin with thin layer of cotton.<br>6. Place on covering of tapestry or leather and tack securely down. | Ability to do a simple upholstering project. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| Refinish marred furniture. Basic Text 1, pp. 123-125. | Procedure in refinishing furniture:<br>1. Removing varnish or lacquer<br>a. Brush on varnish or lacquer remover<br>b. Remove varnish or lacquer with putty knife or steel wool<br>c. Sand surface (No. 00 sandpaper)<br>2. Applying finish<br>a. Apply spirit stain to wood<br>b. Apply wood filler (let dry twelve hours)<br>c. Apply coat of shellac (let dry six hours)<br>d. Apply lacquer or varnish. | Ability to refinish marred wood finishes. |
| Set and sharpen a saw. Basic Text pp. 38-39. | Procedure in setting and filing a saw:<br>1. Setting a saw<br>2. Clamp saw in bench vise, teeth up<br>a. Even all teeth with flat mill file<br>b. Bend pints of alternate teeth as formerly were<br>3. Filing teeth of crosscut<br>a. Clamp saw in a saw clamp<br>b. Grasp three cornered file in both hands.<br>c. File should be:<br>1. Pointed toward the heel of saw (sixty-five degrees with band) | Ability to sharpen a cross cut saw and rip saw. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Handle about fifteen degrees below teeth<br>3. File every other tooth<br>4. Reverse saw and file remaining teeth<br>4. Filing teeth of ripsaw<br>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.<br>1. Cutting a pipe:<br>a. Measure length desired<br>b. Place pipe in vise and cut with hacksaw or pipe cutter<br>c. Ream out<br>2. Threading pipe:<br>a. Select collar and die of size desired and put together.<br>b. Slip collar over pipe<br>c. Press die against pipe and turn until die begins cutting<br>d. Apply oil liberally while cutting desired length of thread. | Ability to cut and thread a water pipe. |
| Solder seams and holes in utensils. Basic Text 4, pp. 38-39. | Procedure in soldering seams and holes:<br>1. Seams<br>a. Scrape surface until bright. | Ability to solder metal utensils (aluminum excepted). |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 2. Apply flux (zinc chloride)<br>3. Sweat solder into seam with well tinned hot copper<br>Holes:<br>1. Clean surface around hole<br>2. Apply enough solder to cover hole with well tinned hot copper. | |
| Repair a toaster. Basic text 5, pp. 40-41. | Procedure in repairing a toaster:<br>1. Test electric cord with test lamp<br>2. Repair cord if necessary<br>3. Dismantle frame from heating unit<br>4. Rewrap wires at terminal posts if broken<br>5. Replace any broken wires in heating element. | Ability to repair an electric toaster. |
| Read an electric house meter and figure cost of electricity for a month. | Procedure in determining kilowatt hours used in a month:<br>1. Record reading on watt meter as follows (from left to right)<br>a. Units<br>b. Tens<br>c. Hundreds<br>d. Thousands<br>2. Subtract these figures from previous month's reading<br>Procedure in determining cost for the month: | Ability to determine the cost of electricity used for a month. |

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | 1. Determine the cost per kilowatt hour on a rate basis<br>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.

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| Repair a faucet. Basic Text 3, pp. 464-5. | Procedure in repairing a faucet:<br>1. Replacing washer<br>a. Unscrew packing nut<br>b. Turn handle until it comes out<br>c. Unscrew set screw at bottom of stem<br>d. Replace old washer<br>e. Reassemble parts of faucet<br>2. Replace packing<br>a. Unscrew packing nut<br>b. Turn handle until it comes out<br>c. Take out old packing<br>d. Place in new packing (candlewicking), wind same way as handle screws into faucet<br>e. Reassemble faucet. | Ability to repair a water faucet. |
| Sharpen a kitchen knife. Basic Text 3, p. 224. | Procedure in sharpening a knife:<br>1. Put a drop of oil on a natural oil stone<br>2. Place knife edge against stone (back raised about twenty degrees) | Ability to sharpen a kitchen knife. |

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

| WHAT STUDENTS SHOULD BE ABLE TO DO | WHAT STUDENTS SHOULD KNOW | OBJECTIVES AND OUTCOMES |
|---|---|---|
| | | 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 encompases 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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