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AN INDUSTRIAL ARTS CURRICULUM

FOR GRADES FOUR TO TWELVE

INCLUSIVE

A thesis submitted to the Graduate Faculty of the College of Education, University of Cincinnati, in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education

July, 1929

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Heber Allen Sotzin

B. A. George Washington University - 1923

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CHAPTER I

INTRODUCTION

THE PROBLEM

For several years the Director of Industrial Arts in the Cincinnati, Ohio, Public Schools has felt a growing need for a curriculum study of the industrial arts, with a view toward an organization of this subject that would function and integrate better among the elementary, junior and senior high schools.

The task of making such a study as was necessary to develop a curriculum that would meet more adequately the present needs and developments of the Cincinnati Public Schools and at the same time conform with modern educational theory and practice was suggested to the writer by the local Industrial Arts Director and members of the staff of the College of Education of the University of Cincinnati.

The plan was that an Industrial Arts program should be worked out with the assistance of the local Industrial Arts teachers.

This dissertation is a study of the theoretical and practical phases of Industrial Arts curricula, with a view of evolving an industrial arts program which shall take cognizance of the latest and most progressive thought in this field of education.

METHOD OF ATTACK

In beginning the work on this problem, it was considered necessary that the author should become acquainted with the various

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practices in curriculum construction. It was thought that a general review of such methods as (a) the consensus of opinion method, (b) the survey method, (c) the job analysis method, (d) the activity analysis method and (e) the social-philosophic method would be valuable in working out the guiding principles.

In addition to the formulation of objectives, or guiding principles, answers were sought to the following questions:

(1) What factors have been instrumental in the development of manual activities in our schools?

(2) In view of the present confusion relative to terminology, what term or terms shall be used to designate manual activities in general education?

(3) What factual evidence exists that a program of manual activities is worthwhile and desirable for the Cincinnati Public School curriculum?

(4) What are the aims, purposes, objectives, etc., of the manual activities in our schools as stated in courses of study, text-books, periodical literature, etc.?

(5) What criticisms have been leveled at the manual-activities program by school surveyors and educational leaders?

(6) What are the reactions of those who have taken manual courses in our schools and of those who employ these individuals?

(7) What criteria shall be used for the selection of the curriculum content?

METHOD OF SECURING DATA

In order to secure materials for this study the following plan and sources of information were employed:

(1) A thorough review was made of the literature in the

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field of curriculum construction and of the manual activities in the field of general education.

(2) A questionnaire was sent to each state department of public instruction requesting it to forward a state course of study in Industrial Arts. It was explained that Industrial Arts in this instance referred to general education and not to specific occupational training or Smith-Hughes vocational work. It was further requested that the state departments list approximately twelve towns or cities, that were likely to have courses of study in Industrial Arts. All but four of the forty-eight state departments complied with the request.

(3) A list of towns and cities suggested by the forty-four state departments, together with a selected group of cities within the states of the four state departments not replying, was compiled. These towns and cities were in turn circularized for courses of study.

(4) In order to determine some of the criticisms of the manual activities, as they are conducted at present, two methods of securing information were used: First, a request was sent to every member of the curriculum committee of the Twenty-sixth Yearbook, of the National Society for the Study of Education, together with a limited number of recognized Industrial Arts authorities, requesting them to summarize briefly their criticisms of the Industrial Arts, Second; a number of school surveys were reviewed in order to determine the defects of the Industrial Arts as revealed by these surveys.

(5) Questionnaires were submitted to the following: (a) to the boys of the twelfth grade of three of the five local senior

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high schools, (b) to the senior members (male of the Engineering, Law, Liberal Arts and Medical Departments of the University of Cincinnati, (c) to mature workers who had taken manual courses as elementary or high school students, (d) to local industrial and commercial firms.

(6) The local Industrial Arts teachers secured the following information: (a) A list of articles that their pupils desired to make, (b) a list of articles that could profitably and easily be made with their respective shop equipment, (c) a list of mechanical jobs, that the average householder is called upon to do, (d) a list of questions that are asked frequently by Industrial Arts pupils.

(7) In addition much valuable information was secured from such sources as, the Cincinnati Public Library Reports, the Cincinnati Vocational Bureau of the Public Schools, the Cincinnati Chamber of Commerce, the United States Chamber of Commerce, the United States Department of Interior, the United States Bureau of the Census Reports, magazine editors, catalogues, etc.

This study is divided into two parts. Part One consists of the basic philosophic assumptions and the attempt to answer the questions raised under the Method of Attack. Part Two consists of the content material of the course of study.

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CHAPTER II

RISE OF MANUAL EDUCATION

Because of man's innate tendencies to preserve life, manual activities of some form have been with us for countless ages. These activities have followed two general paths. They have been acquired either through imitation and in an informal manner or through a conscious and formal procedure.

The exact time when manual instruction of a formal nature began is in dispute. In general, it is held that it had its origin during the rise of apprenticeship, commerce and industry during the Middle Ages, following the Christian Crusades. This claim is supported by no less an authority than Adam Smith, who said;[1]

> 'Apprenticeships were altogether unknown to the ancients. I know of no Latin or Greek word (I might venture, I believe, to assert that there is none) which expresses the idea we annex to the word, apprentice.'

This position is untenable, because the Babylonian Code of 2250 B.C. makes reference to artisans adopting sons and teaching them their handicrafts.[2]

Again we find references and recommendations being made relative to the crafts by both Plato and Xenophon.[3] In addition, indentures were known in Egypt long before the Christian era.[4]

All of the above mentioned facts leads one to believe, then, that all of our formal manual activities, which play so prominent a role in our present day schools, had their early inception in apprenticeship training.

A brief resume of the changes in attitudes, ideas, objectives,

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1. Douglas, P.H. - American Apprenticeship and Industrial Education, p.12-13. Longmans, Green and Co., 1921.
2. Lee, E.A. - Objectives and Problems of Vocational Education, P.4 McGraw-Hill Book Co., 1928.
3. Douglas, P.H. - op. cit. p. 14.
4. Lee, E.A. - op. cit. p. 4.

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etc., that have occurred in manual education during a part of our history follows.

PRIMITIVE MAN

Today, we usually think of education as "adjustment". While primitive man's wants are comparatively simple he does, however, make "adjustment", hence is being educated. His education is acquired largely through imitation of his elders and consists principally of acquiring such necessities of life as food, clothing, and shelter. Since the barest necessities of life are so significant for him, it is essential that the hand be properly trained.

With the informal instruction received by man at the primitive stage of life he is enabled to fashion crude instruments for the "catch", construct weapons for both offense and defense and make what little clothing he may require. Thus, if man at the lowest stage of civilization fails to recognize the importance of acquiring a number of manual skills, he is not only severely handicapped, but runs a grave risk of a long survival period.

THE BARBARIC STAGE

At the Barbaric Stage, man knows the use and significance of fire. The use of fire is one of man's most valuable assets. With it he cooks his meals, smelts his ores, fashions his tools, etc. It likewise is instrumental in the division of labor, the rise of new social groups and classes, all of which necessitates instruction.

The instruction given at the barbaric level of society is mostly "through conscious imitation"; which distinguishes it from the more primitive type. Here, also, one finds manual instruction being very significant, not only for the welfare of the individual but for the larger group of society, that constitutes the tribe or nation.[1]

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1. Bennett, Charles - History of Manual and Industrial Education up to 1870. p.12 Manual Arts Press. 1926.

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THE ANCIENT WORLD

In turning to the ancient world we find the highest type of civilization developed by the Greeks. A people, who contributed much to the world in the fields of art, philosophy, and literature but little in the field of industry. Their formal education was chiefly for citizenship. This was a position to which a limited number could aspire. This type of training together with the fact that a large part of the population was composed of slaves made labor cheap and little attention was given to formal instruction in things industrial. In fact, an abhorrence toward labor arose among the upper class which has never been entirely obliterated.

The attitude of the Greeks toward the crafts is possibly best illustrated by their foremost philosopher, Socrates, who remarked:[1]

> 'The so-called Banausic arts have a bad name, and quite reasonably they are in ill-repute in the city-states. For they ruin the bodies of those who work at them and those who oversee them. They compel these men to remain seated and to work in gloomy places, and even to spend entire days before a fire. While their bodies are being enervated, their souls, too, are becoming enfeebled. More especially, also, the banausic arts offer men no leisure to devote to their friends or to the state, so that such men become base in relation to their friends and poor defenders of the fatherland. And so in some of the cities, especially in those which are considered strong in war, no citizen is permitted to work at any banausic craft.'

This statement by Socrates has merit. But it must be remembered, that the crafts which involve the products necessary for the wholesome maintenance of life such as food, clothing, and shelter possess a deep social significance and must be recognized. While it is true that many ills and evils are associated with industry, the causes are found usually as Dewey points out;[2] "Not in the occupations

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1. Ibid. p. 15
2. Dewey, John - Democracy and Education, p.234. The Macmillan Co.,1916

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but in the conditions in which they are carried on."

While handwork found no place in the training of the youths of the upper Greek classes, it did, however, find a place in the training program of the lower classes of society since apprenticeship had been handed down from a much earlier period.

THE ROMANS

The Romans were a practical people, who in addition to giving us precedents in law, order, and government contributed much to the field of engineering. The roads, bridges, viaducts, etc., that these people constructed, are, even at present, considered feats of marvelous skill.

But like the Greeks, they, too, absorbed other peoples and built up a system of slavery which in turn sapped the empire's strength. Occupational life deteriorated since most tasks, both physical and mental, were being done by slaves. This lack of interest in affairs of government, as well as industry finally caused the empire to crumple and to be over-run by hordes of Germanic tribes. The result was, a high stage of civilization was swept into chaos and for a thousand years civilization passed through a hectic period known as the Dark Ages.

ANCIENT JEWS

The early Jews were a pastoral and agricultural people, who gave the world a form of religion or a philosophy of life known as Christianity. While these people added little to the world in the form of art, government, and industry, they did, however, respect the value of labor. This is clearly shown by the following excerpts taken from the Talmud.[1]

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1. Bennett, Charles. op. cit. p. 14

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(a) 'Great is the dignity of labor; it honors man!
(b) 'It is well to add a trade to your studies. You will then be free from sin.'
(c) 'Beautiful is the intellectual occupation if combined with some practical work.'

It can be seen that these early people appreciated the value and dignity of labor, as well as the benefits to be derived from a combination of practical and theoretical instruction. The ideals held, practiced, and fostered by the originators of this faith, and whose who embraced it aided materially in saving civilization when it was tottering on the brink of destruction during the Dark Ages.

THE MEDIAEVAL WORLD(RELIGIOUS ORDERS)

After the fall of Greece and Rome and the rise of Christianity, a new attitude toward society arose. Religion and morality were combined and men turned away from the world and the material things of life, and shut themselves off from human affairs as much as possible. This attitude on the part of the Christians resulted in the establishment of numerous monasteries and nunneries. The majority of those established in Western Europe were founded upon the Benedictine Rule.

This rule stressed such virtues as "poverty", "chastity", "obedience", "manual labor", and "religious devotion".[1] The idea of manual labor" was a new conception which assisted greatly in rehabilitating the Old Roman Empire. The monks drained swamps, cultivated former barren wastes, resurrected the arts and crafts, built churches, monasteries, etc; and were instrumental in influencing the Germanic tribes to engage in agriculture and other useful occupational pursuits. Of the influences exerted by the monks, manual labor was doubtless the most important, since it assisted in putting an end to

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1. Cubberley, Ellwood - History of Education (unabridged) p.100, Houghton-Mifflin Co., 1922.

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much of the fighting, pillaging, and plundering. This resulted in a more stable character and aided in restoring some semblance of order.

THE EFFECT OF THE CRUSADES ON INDUSTRY

The outstanding figure of the Dark Ages was Charlemagne, King of the Franks. He attempted to bring order out of chaos, through education and, thereby, correct some of the abuses and practices of the times, as practiced by both the clergy and the nobles. After his death conditions became worse than before, if such a condition of affairs were possible. The empire fell into decay; fighting, murdering, pillaging, etc., became the nobles' vocation as well as avocation. Out of this was developed a form of society known as feudalism. This system continued in effect until the invention of gunpowder. After this invention, castle walls, moats, drawbridges and armour no longer sufficed.

With this organization of nobles, the Church assisted in devising a scheme of training known as chivalry. The purpose of the Church, of course, was to divert the restless energies of the nobles into more useful channels. The result was that in 1095 Pope Urban urged the kings and nobles of Western Europe to organize for the rescue of the Holy Land from the infidel Turk. The outcome of these various pilgrimages, or crusades, was the killing of thousands of nobles. This eliminated them from further fighting and brought them in contact with other peoples. These contacts had a beneficial effect upon Western civilization.

We find life taking on new aspects through the medium of, "the revival of trade, commerce, manufacturing and industry...with the consequent evolution of a new and important class of merchants bankers and craftsmen who formed a new city class and in time developed a new system of training for themselves and children." 1

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1. Cubberly, Ellwood, op.cit.p.202.

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With the rise of towns, cities, and new social classes, there arose a system of industrial training and manufacturing which was usually carried on in the home. The workers were known as masters, journeymen, and apprentices. From this early period, "up to the nineteenth century this apprenticeship education in a trade and in self-government constituted almost the entire formal education the worker, with his hands, received." [1] This type of education continued in practice until replaced by the invention and installation of power machinery. In the latter part of the nineteenth century it became such an obstacle to educational and industrial progress that it had to be supplemented, or replaced, by systematic vocational education. [2]

THE RENAISSANCE

The Italian Renaissance was a "rebirth" in so far as education and thinking were concerned. While the Renaissance itself had little or no direct effect upon manual activities, the results that accrued from it, in the development of "sense realism" gave manual education a great impetus. Beginning with Petrarch, the first modern scholar, an interest was aroused in old Roman and Greek education, which in many instances amounted to an obsession.

As the learning of the ancients was revived and schools were organized upon the old humanistic studies of Greek and Latin, a remarkable change and advancement was wrought. But like so many things educational, these studies after a time became formalized, standardized and stereotyped to the extent that the classroom subjects became ends in themselves, rather than means to an end. A class of

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1. Ibid. p. 211
2. Ibid. p. 211

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social reformers arose who demanded a change. The final outcome was a system of education that recognized the value of theory and practice being carried on simultaneously.

THE 16th AND 17th CENTURIES

During the latter part of the sixteenth century and throughout the seventeenth century the educational leaders began to stress the value of education through the senses. This new departure naturally aroused much comment and criticism. Two divergent points of view developed which have, in part, been with us ever since.

Among the leaders in this movement were such men as Luther, Rabelais, Bacon, Comenius, Ratke, and others.

The writings of several of these will indicate their point of view:

Luther: 'We must send the boy to school one or two hours a day and have him learn a trade at home for the rest of the day...It is desirable that these two occupations march side by side.' [1]

Locke: Advocated learning trades....'(a) because they afford good physical exercise, (b) because the skill gained is worth having - it may be useful, (c) because they provide diversions or recreations.' [2]

While most of the above leaders advocated some form of practical work in the curriculum, it is significant that their schemes were schemes in theory only. The value of their work for our concern is the influence that they exerted upon their followers who took these theories and organized schools with varying degrees of success and failure.

THE 18th AND 19th CENTURIES

During the eighteenth and nineteenth centuries a group of

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1. Bennett, Charles - op. cit. p. 31
2. Ibid. p. 62.

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men including Francke, Campe, Pestallozzi, Fellenberg and Froebel, who were influenced by their predecessors, established schools where handiwork was a part of the curriculum.

Many of these schools grew into prominence and attracted world-wide attention. People came from many countries to observe and study the procedures which they carried back to their home lands.

Possibly the most noteworthy of these schools was the one established at Hofwyl by Fellenberg. Some enthusiasts of this school consider it the greatest school that was ever established. But this school, like so many of its prototype, failed. Its failure came about not because of a faulty educational philosophy but due to the spirit of the times, social, and economic changes.

The Fellenberg idea was transplanted into the United States between 1820 and 1840 in the form of "Manual Labor Schools." A number of these schools were established throughout the New England and Middle Atlantic states. The failure of these schools was, likewise, not due to a faulty theory of education, but to "the unwise efforts of its too enthusiastic advocates to graft it on to a wholly unrelated type of education." 1

While these schools failed, their influence aided materially in arousing sentiment for agricultural and mechanical colleges which were established in 1862 by the passage of the Morrill Act. Thus, the remarkable state universities of our Middlewest and far Western states may be traced to the influence of the Fellenberg and Manual Labor Schools.

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1. Mays, A. B. - The Determining Factors in the Evolution of the Industrial Arts in America. p. 5, Bruce Publishing Co. 1925.

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MANUAL EDUCATION IN THE UNITED STATES

ITS INCEPTION:-

For many years there had been sporadic attempts made by both American and Europeans to make manual work a part of the school curriculum. It was not, however, until 1858, when Finland organized a state plan for manual training for its elementary schools, that we find a nation giving it recognition. Shortly thereafter, Sweden, also, established a system of handwork for her schools known as "sloyd" work. The "sloyd" system as developed by the Swedes was brought to the United States and used for many years. It served a purpose while it lasted, but became obsolete, chiefly, because it is not adapted to the needs of the average American boy.

The manual work established in Finland and Sweden had at first an economic purpose rather than an educational one, which was likewise true in this country when the work was first installed.

While manual work of a certain nature was found in our schools as early as the "academy movement", it was not until the Centennial Exposition held in Philadelphia, in 1876, that the work received much recognition. At this exhibition industrial products from European countries were displayed, which excelled the products of our American workmen. It was believed that the superiority of these products was due to the European system of trade and industrial training. In consequence the school authorities were asked to devise courses of an industrial nature which would meet this deficiency among our workers.

The result was the formulation and adoption of a form of industrial work called "Manual Training". It was the schoolman's idea of industrial training with the central purpose to train the hand and eye and thereby develop manual dexterity.

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It was natural that this new type of school work would arouse much adverse discussion and criticism. The more progressive educational leaders embraced it rather heartily, while the more conservative leaders, either avoided it or looked upon it with suspicion. This later group feared that practical work and academic subjects would not mix.

In discussing this subject at the National Education Association convention in 1880, Dr. E. E. White, President of Purdue University, stated the position of the advocates of "manual training" when he said: [1]

> "The state has the right to teach any branch of knowledge that will promote the public welfare... The primary and important duty of the public school is to provide training and to teach knowledge of general application and utility.... It recognizes no class distinctions social or industrial but provides a general education for all classes of youth....It is a common school, a school designed to import a common education - an education common to all and useful to all. The elements of technical knowledge which are of general application and utility may clearly be taught in the public school. These may include instruction in industrial or mechanical drawing, the practical application of geometry, the keeping of accounts, the elements of the physical and natural sciences, modeling in clay and those elementary mechanical processes which may be made an efficient means of general training. Such instruction is not only the basis of technical training but it is of great value to all youth whatever may be their occupations and positions in life. It is useful as a general preparation for all pursuits."

These sentiments parallel very closely the educational philosophy of many of our modern educational leaders in this field.

It is significant, however, that the American people usually resent experimentation with their children in our public schools. The criticisms one hears on every side relative to the "new type" of elementary education bears sufficient witness. This natural suspicion

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1. Proceedings of the National Education Association 1880. - p.223.

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on the part of school patrons, coupled with the reluctance of boards of education to appropriate sufficient funds, made it necessary for the enthusiasts for manual education to turn to private interests for support.

The first manual training school developed in this country was established in 1880 by Dr. Calvin M. Woodward at St. Louis, Missouri, in connection with Washington University. Three years later a similar school was established in Chicago. Others followed shortly afterward in the cities of Toledo, Baltimore, and Philadelphia.[1]

It should be noted that many of the supporters of the "Manual Training" movement were outside of the public schools. Some, at least, had motives other than education. They doubtless saw better trained pupils, which in turn meant a better and larger output of manufactured products, with increased profits to themselves. Woodward was cognizant of this situation as may be noted from excerpts of circulars sent out by him in 1879 and 1880 in which he stated: [2]

> 'In the next place, the scope of a single trade is too narrow for educational purposes. Manual education should be as broad and liberal as intellectual. A shop that manufactures for the market, and expects a revenue from the sale of its products, is necessarily confined to salable work, and a systematic and progressive series of lessons is impossible.'
>
> 'If the object of the shop is education, a student should be allowed to discontinue any task of process the moment he has learned to do it well. If the shop were intended to make money, the students would be kept at work on what they could do best, at the expense of breadth and versatility.'
>
> 'One great object of the school is to foster a higher appreciation of the value and dignity of intelligent labor, and the worth and respectability of laboring men. A boy who sees nothing but brute force in manual labor, despises both the labor and the laborer. With the acquisition of skill in himself, comes the ability and willingness to recognize skill in his fellows.'
>
> 'When once he appreciates skill in handicraft, he re-

1. Monroe, Paul - Cyclopedia of Education, p.125, The Macmillan Co.1925
2. Woodward, C.M. - The Manual Training Schools, p.6, D.C.Heath Co. 1887

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gards the skillful workman with sympathy and respect.'

'It is believed that, to all students, without regard to plans for the future, the value of the training which can be got in shop work, spending only eight or ten hours per week, is abundantly sufficient to justify the expense of materials, tools, and teachers.'

'The Manual Training school is not a mere workshop; the head is to be trained even more than the hand. Specific trades will not be taught; the tool - education will be liberal, extending impartially through all the shops.'

'It is not expected that every boy who attends the school will become a mechanic, but we have reasons to believe that a boy's experience in the school will clearly indicate whether he is fit to become a mechanic or not.'

While many of Woodward's followers stressed specific occupational training, he, on the contrary, clung tenaciously to the principle that Manual Training had as its primary purpose liberal or general education. His point of view is well illustrated in an address before the National Teachers' Association at Saratoga in July, 1883, when he said: [1]

"By manual training I do not mean merely the training of the hand and arm. If a school should attempt the very narrow task of teaching only the manual details of a particular trade or trades, it would, as Felix Adler says, violate the rights of the children. It would be doing the very thing I have always protested against. That or very nearly that, is what is done in the great majority of European trade schools. They have no place in our American system of education.

"The word 'manual' must, for the present, be the best word to distinguish that peculiar system of liberal education which recognizes the manual as well as the intellectual. I advocate manual training for all children as an element in general education. I care little what tools are used, so long as proper habits (moral) are formed, and provided the windows of the mind are kept open toward the world of things and forces, physical as well as spiritual.

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1. Ibid. p. 202-203.

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> "We do not wish or propose to neglect or underrate literary and scientific culture, we strive to include all the elements in just proportion. When the manual elements which are essential to a liberal education are universally accepted and incorporated into American schools, the word 'manual' may very properly be dropped.
>
> "I use the word 'liberal' in its strict sense of 'free'. No education can be 'free' which leaves the child no choice or which gives a bias against any honorable occupation; which walls up the avenues of approach to any vocation requiring intelligence and skill. A truly liberal education educates equally for all spheres of usefulness; it furnishes the broad foundation on which to build the superstructure of a happy, useful and successful life. To be sure, this claim has been made for the old education, but the claim is not allowed. The new education has the missing features all supplied. The old education was like a two-legged stool, it lacked stability; the new education stands squarely on three legs, and it is steady on the roughest ground.
>
> "I claim as the fruits of manual training, when combined as it always should be, with generous mental and moral training, the following: 1. Larger classes of boys in the grammar and high schools; 2. Better intellectual development; 3. A more wholesome moral education; 4. Sounder judgment of men and things and of living issues; 5. Better choice of occupations; 6. A higher degree of materials success, individual and social; 7. The elevation of many of the occupations from the realm of brute, unintelligent labor, to positions requiring and rewarding cultivation and skill; 8. The solution of "labor" problems.

Many of these claims, of "the father of manual training" in this country, which are fifty years old are the very claims that are made today for the manual activities in our school curriculum. Chief among which is the claim that it is an essential phase of general or liberal education.

The development of manual education in the American schools may be characterized as follows:

(a) From 1821-1876 A sporadic movement, dating from the inception of the American High School to the Centennial exposition held in Philadelphia in 1876.

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(b) From 1876-1900 A period of establishment and experimentation by both public and private enterprises.

(c) From 1900-1910 A period of rapid expansion of our high schools and programs of study that included the manual activities.

(d) From 1910-1917 A period that marks the reorganization of our high schools, bringing in the junior high school, and the passage of the Smith-Hughes Federal Vocational Act.

(e) From 1917 to the present time marks a reorganization, clarification, and expansion of manual activities on a basis of general education, with an elimination of much that was considered formerly specific occupational training.

Since manual training was first introduced into this country it has passed through five rather definite periods. These periods may be characterized as follows:

(a) The "exercise" period, in which abstract exercises were made for their disciplinary values.

(b) The "sloyd" period, in which useful articles were made that appealed to pupils' interests without much regard for design and beauty.

(c) The "arts and crafts" period, in which beautiful design and artistic expression, rather than tool manipulation, were stressed.

(d) The "industrial" period, in which an attempt was made to give specific industrial training in the field of general education.

(d) The "industrial arts" period or the present period, in which a sharp line of demarcation is drawn between manual work for general educational purposes and manual work that has as its primary purpose specific occupational training.

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SUMMARY

In summing up the various epochs herein considered, it may be stated briefly that manual instruction, either formal or informal, is found in even the lowest stages of civilization, since it is essential for the preservation of life.

It is significant to note that while education in both Greece and Rome was confined to a minority, since it trained primarily for citizenship and gave little consideration to instruction in manual activities, both these countries were destroyed.

During the Middle Ages the monks resurrected the arts and crafts of former times and thereby performed a great service in stabilizing the Germanic tribes.

With the rise of the Italian Renaissance, education was made practical through the establishment of humanistic schools, which in turn became very formal, causing a reaction known as "realism". This marked the early beginnings of modern education, which stressed an education combining the theoretical with the practical.

During the sixteenth and seventeenth centuries educational, social, and political reformers advocated changes of a practical nature in the educational programs. It was not, however, until the eighteenth and nineteenth centuries that schools were established in which manual activities were incorporated. And it was not until the twentieth century that such courses were firmly established.

Manual training was a foreign importation. At first we adopted the Russian system, then the Swedish, and finally evolved a system of our own. Since the passage of the Smith-Hughes Vocational Act, in 1917, the Industrial Arts have been particularly dominant in the field of general education. The passage of this act necessitated

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a reorganization of the manual activities in general education. The result, today, is a rather sharp line of demarcation between manual activities for general training purposes and those for specific occupational training.

Today, we believe that it is the duty of society, without regard to social standing, to provide such training for the individual, that he may extend himself to the limits of his capacity. And further, that every normal individual shall have the opportunity to equip himself with the necessary amount of liberal education and specific occupational training, that will permit him to take his proper place in society.

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CHAPTER III

TERMINOLOGY EMPLOYED IN MANUAL EDUCATION

It is doubtful whether any phase of education has had as many terms applied to it, than has the manipulative work, that is taught in our schools. This condition resulted from the fact that the work was new, unique, experimental, and to the diverse opinions held by the people who were interested in this phase of education. In consequence, many conflicting aims, purposes, and objectives arose, and accompanying them a large variety of terms were used to designate manual work.

While some progress has been made in the classification of the terms used in manual education, much confusion exists as may be seen by examining present nomenclature.

Payne lists twenty-eight terms that are being used in this field of education, viz: [1]

1. Manual Training
2. Manual Arts
3. Mechanical Arts
4. Industrial Arts
5. Sloyd
6. Arts and Crafts
7. Primary Handwork
8. Prevocational
    a. of the diagnostic type
    b. "Pre" to the chosen profession
    c. organized on the "Ettinger Plan"
    d. organized on the "Russell-Bonser Plan"
    e. organized on the "Gary Plan"
    f. organized on the "Pittsburgh Plan"
9. Industrial Education
    a. Smith-Hughes
    b. Non Smith-Hughes

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1. Payne, Frank A. "Classification of the Various Aspects of Practical Education". Industrial Arts Magazine, p.167-169. Vol. XIII May 1924.

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10. Technical Education
11. Practical Arts
12. Technical Arts
13. General Industrial
14. Opportunity Shop
15. The Reform School Shop
16. Dull Season Classes
17. The Co-operative courses
18. All Day Unit Trade School
19. Part-time Classes
    a. Trade Preparatory
    b. Trade extension
    c. General Continuation
20. Evening Industrial Classes
    a. Smith-Hughes
    b. Non Smith-Hughes
21. Vestibule School
22. Corporation School
23. Apprentice Classes
24. Training Department
25. Threshold Schools
26. "In and Outer" Classes
27. Rehabilitation
28. Trade Finding Classes.

At present, it is difficult to know exactly what type of work is being conducted in the various sections of the country, due to the loose use of terms. The old term "Manual Training" appears to be rather obsolete, for as Warner points out; [1]

> "Manual Training" is an old term and still clings, particularly in the smaller and older areas where shop work is taught. Originally, from 1868 on, it meant just what the term implies "hand skill", or training

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1. Warner, William E. - Policies in Industrial Arts Education, p.5-6. Ohio State University Press, 1928.

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> that involves the skillful production of some object with the hands. Many beliefs that have been associated with the term among them transfer of training are now frowned upon so that the term itself has fallen into disrepute".

Among some of the more common terms that are peculiar to different sections of the country are: [1] "Manual Education" used on the Pacific Coast; "Industrial Arts" used in the Middlewest; "Mechanic Arts" used in some of the Eastern cities; while the term "Industrial Science" has been introduced in various Canadian centers.

This disagreement is more noticeable when we stop to examine the titles assigned to the various executives who are directing the work. In a study made by Dr. Homer J. Smith,[2] of the University of Minnesota, he found one hundred thirty-four titles used by school officials. Of this number, one hundred six can be classified under direct titles such as, assistant, associate or deputy superintendent, director, assistant or associate director, supervisor, assistant supervisor, and head of department. The other twenty-eight titles consist of combination such as "Director of Vocational Education and Manual Training"; "Director of Manual Training, Home Economics, Supervisor of Educational Supplies and Director of Evening Schools, etc. The distribution of titles in the various fields in this study is shown in Table I.

Table I.

The Distribution of 134 Manual Activity Titles According to Fields.

TERM	FREQUENCY
(a) Vocational Education	42
(b) Manual Arts	20
(c) Manual Training	15
(d) Industrial Education	15

1. Snedden, David - Warner, William E. and others - Reconstruction of Industrial Arts courses, p.9, Bu. of Publications, Columbia Univ., 1927.
2. Smith, Homer J. - Industrial Education, Chpt. III, p.49-52. The Century Co., 1927.

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	Frequency
(e) Industrial Arts	14
(f) General Administration	9
(g) Vocational Schools	5
(h) Part-time Education	4
(i) Manual Education	2
(j) Special Classes	2
(k) Co-operation Education	2
(l) TechnicalWork	1
(m) Adult Education	1
(n) Practical Arts	1
(o) Trade and Industrial Education	1
Total	134

The extent to which the various terms are used within a single state is likewise significant, as is shown by Warner,[1] who found that three hundred fifty-eight shop and drawing teachers, in the state of Ohio, in 1927 designated the work that they were teaching as shown in Table II.

Table II

The Distribution of 28 Terms Used to Designate Industrial Arts Education by 358 Shop and Drawing Teachers in the State of Ohio, in 1927.

	TERM	FREQUENCY OF MENTION
1.	Manual Arts	113
2.	Manual Training	110
3.	Industrial Arts	74
4.	Vocational Teaching	45
5.	Industrial Arts Education	37
6.	Shop Work	30
7.	Industrial Education	26
8.	Trade Work	17
9.	PracticalArts	13
10.	Technical Teacher	13
11.	Farm Shop	11

1. Warner, William E. - op. cit. p. 5

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	TERM	FREQUENCY
12.	Mechanic Arts	9
13.	Construction Work	8
14.	IndustrialWork	6
15.	Arts and Crafts	6
16.	Hand work	5
17.	Woodworking	2
18.	Mechanical drawing	2
19.	Manual Arts Education	1
20.	"Pre" vocational	1
21.	Vocational guidance education	1
22.	Practical Manual Training	1
23.	Practical Training	1
24.	Craft work	1
25.	Coordinator	1
26.	Mechanical coordinator	1
27.	Industrial drawing arts	1
28.	Industrial science	1
	Total	537

Numerous terms are unnecessary and confusing. The training that is given in our schools, whether on a professional level, trade level or for general educational purposes, may be classified as follows:

(a) Voeational-Professional Education, which has, as its controling purpose, specific occupational training for a recognized profession, such as, law, medicine, engineering, etc.

(b) Vocational-Industrial Education, which denotes specific occupational training for entrance into industry, upon such levels as, carpentry, plumbing, molding, etc.

(c) Vocational-Commercial Education, which denotes specific occupational training, for entrance into business, upon such levels as, selling, typing, stenography, etc.

(d) Vocational-Agricultural Education, which denotes specific occupational training, for entrance in agriculture, upon such levels as, general farming, dairying, poultry-raising, etc.

(e) Vocational-Homemaking Education, which denotes specific occupational training, for entrance into household occupations, such as, cooking, sewing, baking, etc.

(f) Pre-Vocational Education (trade), which denotes preliminary training, prior to entrance into a trade, such as plumbing, bricklaying, drafting, etc. [1]

1. It should be noted that terms B, C. D.E. and F. denote specific occupational training of less than college grade. The distinction between a profession trade, and job is the difference in the length of the training period and the prerequisities for entrance.

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(g) Pre-Vocational Education (professional), which denotes preliminary training, prior to entrance upon a professional course of study, such as, "pre-legal", "pre-medical", "pre-dental", etc.

(h) Industrial Arts Education, which is based upon industrial pursuits, with the aim of enhancing the general intelligence and appreciation of pupils, toward things industrial and occupational.

Many are led to believe that most of the terms applied to manual activities are of recent origin. But such is not the case. For example the term "Manual Arts" dates back to Francis Bacon's first publication in 1605.[1]

Another term that is used frequently is "Industrial Arts". It has been in use in the Cincinnati, Ohio, Public Schools since 1905. It is the term that will be used throughout this study to designate manual activities in the field of general education. As used here, it has for its purpose social, economic, and utilitarian ends. Manipulative skill is of secondary importance but to be stressed within reasonable limits of pupil's ability and capacity.

The significance of the two words, "industrial" and "art" may be better understood, when the former is considered as that which has to do with things manipulative, while the latter is concerned with things that have an emotional appeal. [2]

To the average student this wide and loose use of terminology may be disconcerting and a sufficient basis for condemning the entire program. On the contrary it is a situation that should meet with approval, as it indicates progress, experimentation, and thought. Thus, the very elements that have caused confusion and disagreement have aided in fostering the work and in provoking thought.

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1. Bennett, Charles A. - op. cit. p. 35.
2. Winslow, Leon - An address before the Western Arts Association, May 1928, Indianapolis, Indiana.

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SUMMARY:

The terms employed in manual education are numerous, loosely used, and confusing. In the state of Ohio, alone, twenty-eight different terms were used to designate the work being done under the major heading of "Industrial Arts education". The whole field, however, may be included under the major divisions of (a) Vocational-Professional Education, (b) Vocational-Industrial Education, (c), Vocational-Commercial Education, (d) Vocational-Agricultural Education, (e) Vocational-Homemaking Education, (f) Pre-Vocational Education (trade), (g) Pre-Vocational Education (professional) and (h) Industrial Arts Education. The latter designation has been in use in the Cincinnati, Ohio, Public Schools for almost twenty-five years and will be the term employed in this study.

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CHAPTER IV

GUIDING PRINCIPLES FOR AN INDUSTRIAL ARTS CURRICULUM

One of the paramount issues that has confronted educational authorities for the past decade has been that of the curriculum. This situation has arisen from the numerous social and economic changes that have occurred and which in turn have affected our entire educational structure. Uhl points out ten reasons why curriculum changes have become necessary: [1]

1. Systematization of secondary education.
2. The extention of secondary education.
3. The new attitude toward secondary school pupils.
4. The new emphasis upon local conditions.
5. The rise of non-professional courses.
6. The reorganization of secondary education.
7. Changes in college entrance requirements.
8. Restatement and refinement of objectives.
9. The development of improved teaching procedures.
10. Increase and dissemination of knowledge of education.

In order to meet these changes, the curriculum-maker is required to solve four major problems: - (1) to determine the desirable objectives of development, for present and future needs; (2) to discover the activities through which the pupils may obtain these objectives; (3) to determine the learning processes involved in these activities; (4) to formulate effective methods for the selection and organization of subject-matter for the various grades.

Since the curriculum-maker is dealing with social and human relationships, for which a scarcity of factual evidence exists, he is handicapped. But, as the task of the educator is the maximal development of the individual, he cannot neglect or relinquish such an important duty, as attempting to keep the curriculum abreast of the times.

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1. Uhl, W. L. - Secondary School Curricula, pp. 518-542, Macmillan Company, 1927.

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While, today, we know more about human nature than ever before; there has not been a corresponding increase in our ability to use effectively this information. The situation is, however, by no means hopeless, for among the sources, that are available for curriculum-making, may be listed the following:-

(1) Race history and race experience.
(2) Past and current curriculum practices.
(3) Investigations of the objectives of education.
(4) The pupils' capacities, abilities, interests and needs.
(5) Local educational provisions.

All of the above sources are being considered in this study. But before proceeding further it will be necessary to establish valid claims for the inclusion of manual activities in our schools. For this purpose the work of a number of recognized educational leaders in the field of educational philosophy, curriculum construction, and industrial arts will be employed as an authoritative basis for the establishment of objectives. The frequency of mention of the claims of these authorities will be used as the underlying basis for the inclusion of Industrial Arts work in our school curriculum and as a guide for the construction of an Industrial Arts course of study.

The following educational authorities and specialists have been selected:-

1. Philosophy - a. Dewey
   b. Kilpatrick
2. Sociology - a. Snedden
3. Curriculum - (Theory and special methods)
   a. Bonser
   b. Rugg
   c. Bobbitt
   d. Charters
4. Industrial Arts Specialists
   a. Mays
   b. Edgerton
   c. Industrial Arts Committee of the Fifth Yearbook of the Department of Superintendence, 1927.
   d. Industrial Arts Committee of the Sixth Yearbook of the Department of Superintendence, 1928.

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The writings of the above mentioned men under (1), (2), and (3) have been critically reviewed. From this material, a list of claims for the industrial arts has been workedout. The authorities under (4) have been chosen for their general recognition among industrial arts teachers, and for their special researches and contributions. The results of this latter group are used herein for purposes of comparison and to show that the claims, as deduced from (1), (2), and (3), are those generally accepted.

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EDUCATIONAL PHILOSOPHIES APPLICABLE TO INDUSTRIAL ARTS.

JOHN DEWEY

Dr. John Dewey stands out today as our foremost American educational philosopher. It may safely be said that he has done more to philosophize and socialize our educational practices than anyone else. He defines education as;

> "That reconstruction or reorganization of experience which adds to the meaning of experience, and which increases ability to direct the course of subsequent experience." [1]

This implies that any educational experience to be effective is, "one in which instruction is conveyed and ability is increased". [2] He believes that education to be effective must be carried on in a practical situation. And that our schools must typify existing social conditions, if they really intend to educate and develop a well-rounded member of society. For this type of education Dewey advocates the industrial activities, which [3] 'are the most influential factors in determining the thought, the ideals and social organization of a people'.

The "natural resources" with which the teacher must work and upon which the child's growth is dependent are classified by Dewey under four main divisions:-[4]

(1) The Social: - This is the language instinct and consists of conversation, personal intercourse and communication. It is the simplest form of social expression and perhaps the greatest of all educational resources.

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1. Dewey, John - Democracy and Education. pp. 89-90 Macmillan Co., 1926.
2. Ibid, p. 90.
3. Cubberley, E.P. - The History of Education, pp.781, Houghton Mifflin, 1920.
4. The 26th Yearbook of the Nat. Soc. for the Study of Ed. The Foundation and Technique of Curriculum Construction, pp.167-169 Public School Publishing Co., Bloomington, Ill.

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(2) The instinct of making or the constructive impulse: - The child impulsively does things - first in random movements, gestures, play, etc. After a time this impulse takes more definite form and he seeks an outlet by shaping materials into definite forms. Apparently children like to do and make things, if for no other reason than to see what will happen. Advantage can be taken of these tendencies, which may be directed in useful channels or be permitted to go on at random.

(3) Inquiry: - This has to do with finding out things, or investigating. It is possibly an outgrowth of a combination of the constructional and communicative impulse.

(4) The expression impulse: - This has to do with the art instinct, which grows out of the tendency to make constructive and communicating materials real and vital in the child's desire to tell and represent something.

In order to give adequate expression to these innate impulses Dewey conceives, "The Ideal Home" [1], - a place where the child would have a workshop to work out his constructive ideas, a miniature laboratory, where his inquiries could be satisfied; a garden with surrounding fields and forests to give him a means for full and free expression. In addition, he would have the child participate in the activities of the home, in order to acquire . . . . "habits of industry, order, and regard for the rights and ideas of others and the fundamental habit of subordinating his activities to the general interest of the household".

Due to the economic factors involved and the congestion of our populace in the American urban community; a proposal, such as the

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1. Dewey, John, op. cit. pp. 166

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above, is impossible for most homes. How then may the problem be solved? Since the school is the social agency that reaches everyone, the school must assume the responsibility.

While Dewey depreciates, the 'old' or 'traditional type' of education, which was chiefly a storage system for future use and a type that was unwarranted, he sees, however, dangers lurking in the new or progressive type of education as practiced in some schools. He states his position, when he says:[1]

> "There is at present a tendency in so-called advanced schools of educational thought, to say in effect, let us surround pupils with certain materials, tools, appliances, etc., and then let pupils respond to them according to their own desires. Above all let us not suggest any end or plan to the students, let us not suggest to them what they shall do, for that is an unwarranted trespass upon their sacred intellectual individuality since the essence of such individuality is to set up ends and aims. . . . The child is expected to think things out or work things out for himself, without being supplied any of the environmental conditions which are requisite to start and guide thought. Nothing can be developed from nothing; nothing but the crude can be developed from out of the crude - and this is surely what happens when we throw the child back upon his achieved self as a finality and invite him to spin new truths of nature or of conduct out of that."

This viewpoint gives rise to three divisions of thought among educators, viz.:- (a) A group that advocates the permitting of pupils to make and do whatever they choose, (b) a group that contends that all subject matter must be taught in a logical and sequential manner and (c) a group that steers in a midway course. Dewey is a member of the last group. He believes that, [2]

> "....for the person approaching a subject the simple thing is his purpose - the use he desires to make of material, tool or technical process, no matter how complicated the process of execution may be. The unity of the purpose, with the concentration upon details which it entails, confers simplicity upon the elements which have to be reckoned with in the course of action."

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1. Dewey, John, op. cit. pp. 173,
2. Dewey, John, - Democracy and Education, pp. 234, - The Macmillan Co. 1926.

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Dewey thus contends that pupils shall begin practical activities with crude materials and that through "purposeful handling" they will acquire "the intelligence embodied in the finished material". For this reason he does not wish to have the industrial arts reduced to a series of sequential tool exercises, even though it is argued that certain skills are necessary before much progress can be accomplished. He believes that pupils will acquire the necessary skills through the construction of a "purposeful" project.

Again, the critics raise the question; "even though the problem is 'purposeful', pupils will select articles in excess of their abilities and crude work will result". To this argument Dewey replies in the following manner:- [1]

> "It is quite natural that children tend to exaggerate their powers of execution and to select projects that are beyond them. But limitation of capacity is one of the things that must be learned; like other things it must be learned through the experience of consequence. The danger that children undertaking too complex projects will simply muddle and mess and produce not merely crude results but acquire crude standards is great. But it is the fault of the teacher if the pupil does not perceive in due season the inadequacy of his performances, and thereby receive a stimulus to attempt exercises which will perfect his powers. Meantime it is more important to keep alive a creative constructive attitude than to secure an external perfection by engaging the pupil's action in too minute and too closely regulated pieces of work. Accuracy and finish of detail can be insisted upon in such portions of a complex work as are within the pupil's capacity."

Furthermore, Dewey believes that while manual activities and pursuits have an economic value, their "educational significance lies in the fact, . . . [2] that they typify social situations." This is due, because man's chief concerns are food, clothing, shelter, production, consumption, transportation, household furnishings, appliances, etc. And while it is not the purpose of the industrial arts to develop

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1. Dewey, John, op. cit. pp. 231-232
2. " " op. cit. pp. 234

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specialists, it does however present a means of approach to the knowledge of race experiences and industrial processes which occupy a place in our present social organization.

And for those who fail to see the larger socializing influence of manual activities, [1]

> "It is pertinent to note that in the history of the race sciences grew gradually out from useful occupations."..... "Physics developed slowly out of the use of tools and machines. The level, wheel, inclined plane, etc., were among the first great intellectual discoveries of mankind and they are none the less intellectual because they occurred in the course of seeking for means of accomplishing practical ends. These are all social ends and if they are too closely associated with the notions of profit, it is not because anything in them but because they have been deflected to private use"...."The age when scientific progress was slow were the ages when learned men had contempt for the material and processes of every day especially for those concerned with manual pursuit."

Thus it is the development of experience, motivated by purpose and need for which Dewey pleads. He believes that the functioning of the pupil's powers and interests are dependent upon the environment, the materials, and the stimuli that the school authorities provide.

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1. Dewey, John, - op. cit. pp. 235-237

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WILLIAM KILPATRICK

According to Kilpatrick, education must be made cognizant of our changing civilization and unknown future. Man's problem was, at first, nature, then economic want; today the big problem is man himself. The dominant question is, "What shall we teach?" The probable answer is, "We do not know." We are, however, aware that our curriculum changes have become necessary and for the following reasons: [1]

(1) The development of science.

(2) Education is no longer conceived of as taking place in school alone.

(3) The opportunities for development within the present family life is restricted.

(4) The lack of home responsibilities.

(5) A growing complexity in governmental affairs; capital and labor.

(6) A rapid increase in inventions and discoveries.

(7) The duty of the school to prepare young people for changes and adjustments.

When we compare the education of our forefathers with present conditions, we find that the opportunities of present family life are restricted. Children were formerly economic assets; today they are largely observers and economics liabilities. When society was comparatively simple, most of the members of the family participated in the affairs of the home. Today, the opposite condition prevails. Our present mode of living; the increased complexity of our social problems; and the lack of understanding on the part of parents,

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1. Kilpatrick, W.H. - Foundations of Method. Pp. 251-271 Macmillan Company, 1925.

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has given rise to a lack of experiences with concrete things for the average adolescent. This failure to provide the orginary and useful skills that the majority of people need is significant. As Kilpatrick points out:- [1]

> "The older life gave children enough first hand contact with things to supply them not only with the personal and homekeeping skills but also with the varied meanings of practical affairs necessary to practical thinking. Now, unless the schools take special pains, many city children would grow up mentally starved, so far as concrete things and their meanings to, not to mention the lack of useful skills."

In order to provide the necessary experiences for pupils, Kilpatrick suggests, first, the selection of an aim. This will furnish guidance and insure a correct start; tell us where we are at each step of the journey and finally bring us to a definite end. In order to reach successfully an ultimate goal, it is essential that we know certain facts, viz.:- [2]

(1) How learning takes place, (2) How learning enters life to improve it, (3) What kind of learning is good.

To know, "How learning takes place", and the type of curriculum that is necessary, he suggests, five things that should be recognized:- [3]

> (1) Practice is necessary. In order to acquire any skill whether motor, ideational or emotional it must be practiced.
> (2) The intent of the learner counts. The willingness to acquire way habit or any of behaving, shortens the time for such acquirement and retention persists much longer.
> (3) Learning may come by association. If two things happen together with sufficient strength either one may later recall the other.
> (4) Learning is never single. It cannot be expected that a pupil may be given a task and that he will learn only one thing. On the contrary many demands will be made upon him while he is learning a specified or particular task.

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1. Ibid. p. 260
2. The Twenty-sixth Yearbook of the National Society for the Study of Education, The Foundations and Technique of Curriculum Construction. Part II. pp. 121
3. Ibid. p. 127.

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(5) Isolated learning is always doubtful learning. Learning to be effective must be associated with something that is real, vital and 'purposive'.

In attempting to discover "How learning enters life", it is necessary to examine life outside of school. In spite of our schools and their great influence upon society, most of our learning actually takes place outside of school. It takes place through association, and the difficulties that we are obliged to meet and solve. For the responses we make; [1]

> ". . . vary from the motor type (as skating) to the intellectual (as problem solving in symbolic logic) with intermediate conbinations of the two in between. The commonest are such as learning to drive a car and the many instances where one "decides what to do" or "make up his mind". The essence of the matter is seen when one undertakes some enterprise large or small, either as a whole or as a part of a large whole, and finds a difficulty which he then contrives to oversome. This kind of a learning is the key conception to the new curriculum."

These experiences which the pupil meets and solves make him self-reliant, independent, and permit him to assume larger responsibilities and new obligations. This is not unlike re-making an individual. For [2]

> "such remaking of life is the aim of education for the new curriculum, to give more content and more meaning, to give the learner more control in life and over life."

Lastly, in attempting to discover, "What kind of learning is good", it is suggested that it be; [3]

> ". . . . a process of living as re-makes life. Re-makes it not once or occasionally at long intervals, but if possible continuously re-makes it. So that each learning experience leaves the learner at once with a broader outlook, at once more disposed and better equipped to go on to farthur like fruitful experiences. This is what we mean by saying, that education is such a process of associated living as continuously re-makes life, carrying it always to higher and richer levels, not only for the individual but also for all whom he influences."

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1. Ibid. p. 127
2. Ibid. p. 130
3. Ibid. p. 131

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When it comes to the actual choice of curriculum materials, Kilpatrick advocates the 'experimental method'. He believes in a flexible, rather than a standardized, fixed-in-advance type of curriculum. A curriculum that will develop characters which will stand the test of a changing and shifting civilization. The selection of the ideals, experiences, skills, etc., he things, should be left to the intelligent judgment of the teacher. His position in the matter is well illustrated when he says:- [1]

> "I believe the ideal is not to make the curriculum in advance but for the sake of the cause itself, I should oppose to the utmost having all the schools in the country suddenly shift tomorrow to that actual basis. They are not ready for such a step. Moreover, speaking for myself, I do not know what kind or degree of prepared-in-advance material will finally be best. I think the answer can come only out of wide experimentation. . . . . The point of view under consideration is entirely too new. We must experiment widely and that means we must move gradually."

In summarization of Kilpatrick's viewpoint, he considers the following factors of significance for the curriculum-maker:- [2]

(1)"Each learner should work reasonably near to the limit of his power and resources at enterprises which he feels in maximal feasible degree to be his own and for which he accepts responsibility."

(2) "Regard should always be had for the fact that learning is never single and due attention must be paid to making the attendant learnings as wholesome as possible."

(3) "As far as feasible, learning should take place in a situation of 'natural' connectedness".

(4) "Learning enterprises or experiences should so increase in social content and in organization as to mean optimal progress both in social

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1.Ibid. - p. 137
2.Ibid, - p. 139-141

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integration and in the organization of experiences for the control of further experiences."

(5) "Practice in socialization as well as considerations of finance alike demand that children be educated largely in groups."

(6) "On the one hand, curriculum-making cannot disregard administrative feasibility. On the other hand, administration itself exists exactly in order to make the curriculum (and the whole educative process) a success."

(7) "As far as feasible, the teacher should ascertain, preferably by comparative objective tests, what growing is being achieved by the pupils under his care."

(8) "The work of the school should be so conducted as to encourage and reward work and growth on the part of teachers as truly as of pupils."

(9) "At any one time there will be certain hindrances which for the time are beyond control. These must be given due consideration."

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HAROLD RUGG

Dr. Harold Rugg in "The Foundation and Technique of Curriculum-Construction" presents six defects in our present curricula that require correction:- [1]

(1) That it is not refinement of existing 'subjects' that is most sorely needed; it is rather, the radical reconstruction of the entire school curriculum.

(2) That the most fundamental basis of the reconstruction will be a comprehensive and scientific study of society. The study of adult society alone, however, will prove to be only a partial basis. Sound reconstruction will take equal cognizance of the interests and doings of children.

(3) That one of the most needed first steps in reconstruction is a new synthesis of knowledge and a re-departmentalization of the activities and materials of the school curriculum.

(4) That with the growing momentum of the movement for the construction of a child-activities curriculum, the central role of the printed word shall not be missed and that a thorough-going vivification of the materials of instruction be instituted.

(5) That because of current administrative handicaps the curriculum must be planned in outline form in advance; it cannot be made 'on the spot'.

(6) That the tasks of curriculum-making are manifold and difficult and can be carried on effectively only by professionally equipped specialists.

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1. The Twenty-sixth Yearbook of the National Society for the Study of Education, op. cit. p. 147-148. - Harold Rugg, Chairman.

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Rugg believes that the above problems have been forced upon us by our American industrial life. We no longer live in isolated communities where people are relatively independent, but we have developed into; [1]

> "....a heterogeneous congeries of people of less than eighth-grade education, sprawled over a huge continent of 70,000 communities, huddled (sixty millions of them) in towns and cities, existing on a bare living wage, engaged primarily in the quest for food, - many totally ignorant of and indifferent to their collective affairs."

Thus industrialism has transformed our lives from an independent and "individualistic order" to one of dependence and co-operation. Society and its agencies cannot ignore this situation. While it is evident that industry is "dynamic" and that our schools are conservative and slow to make changes, the latter must, however, recognize these changes and make adjustments accordingly.

Rugg makes three suggestions, which he believes will aid us to solve these curriculum problems: [2]

> (1) "The content of the school must be constructed out of the very materials of American life, - not from academic relics of Victorian precedents. The curriculum must bring children to close grip with the roar and clang of industry, with the great integrated structure of American business, and must prepare them in sympathy and tolerance to confront the underlying forces of political and economic life. Young America must awake to the newly emerging culture of industrialism and she must become articulate . . . . We must discover a sane method by which useless subject matter can be discarded from the school curriculum and, instead, major problems, institutions, and modes of living that are of social importance utilized and taught in the lowest school grades commensurate with the mental abilities and experiences of children."
>
> (2) [3]"It is necessary to reconstruct our entire organization of the school curriculum since our curriculum-making has been of the "piece-meal" variety. The materials of instruction from which children obtain their understanding of

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1. Rugg, Harold-A. Preface to the Reconstruction of the American School Curriculum. Tch. College Record, Mar., 1926. - p. 600-616.
2. Rugg, Harold - loc. cit.
3. Rugg, Harold - loc. cit.

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American life are presented in convential 'subjects' . . . These subjects are narrow academic compartments of knowledge representing bodies of technical facts and principles; they have been assembled for school use by specialists in subject matter . . . . We must invent a new synthesis of knowledge and make it the basis of the entire school curriculum. The conventional barriers must be ignored in curriculum-making. The starting point shall be the social institution, or the political and economic problems, - not the subject. Psychological forces must oust economic and political form as the directing themes of organization . . . Only one criterion should be permitted to dominate the organization of the materials of instruction; learning, not subject-matter, sequence or authentication."

(3) [1] "The materials of instruction, now thoroughly denatured of imaginative content, must become dramatic, vivid and compelling. . . . American life is enormously complicated and its ramifications are difficult to grasp. There are grave reasons for believing that it has reached an impasse, - there is urgent necessity that large numbers of our people, particularly our youth, be led to comprehend it fearlessly and sanely. . . . The school faces the task of building up in the minds and spines of children a huge array of meanings, concepts, generalizations, insights, and attitudes, to say nothing of the definite obligations to develop a mastery of needed skills. There is not time available from the moment the child enters the first school grade until he leaves at the eighth, ninth, or twelfth grade, to provide him with sufficient opportunity to build up an understanding of all the details of modern life. The school must select. We must discover a technique for bringing into conspicuous relationship the crucial institutions and psychological forces of our complex civilization."

The task of our schools then, as proposed by Rugg, is the construction and development of a curriculum that will lead our pupils to a clear understanding and comprehension of the problems and conditions of our complex civilization. The material content shall consist of thrilling and gripping experiences which have their foundations in "vivid human settings". It is held that a curriculum of this sort will develop an individual who is progressive, open-minded, free from prejudice, superstitution, and of sufficient mental flexibility and stability to withstand the inevitable social, political and economic changes of our times.

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1. Rugg, Harold. loc. cit. p. 156

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FREDERICK BONSER

Dr. Frederick G. Bonser points out four reasons why our curriculum is in need of revision:- [1]

(1) Our changing conceptions of education

(2) The changing conditions of life

(3) The early termination of the period of growth in teachers

(4) The changes in the forms of school organization

The first of these changes he says is due to a rising realization that much of our school work in the past was ineffective, since it was conducted in a logical, sequential and standardized manner, "without relationship to the activities" of life itself. The need for the second change has developed out of our evolution from a "local isolation and self-sufficiency to an almost world-wide interdependence - economic, social and political". The third change is necessary, because of the fixed habits of work, that are acquired early in the professional career of teachers. This fixation of habits tends to negate professional growth and adjustment to change. The fourth change is the inclusion "of the junior high school and related movements which attempt to provide for more flexible and democratic opportunities for pupils of early adolescent age".

If we are to have an education that is efficient, effective, wholesome and broadening it must provide for:- [2]

> (1) ". . . . supplying ourselves with the materials and products for health, comfort and satisfaction and using these with a maximum of economic and aesthetic efficiency.
>
> (2) co-operating by participation and sympathetic understanding with all who affect our lives or who are affected by our activities and attitudes.

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1. Bonser, F. G. - The Reorganization of the Curriculum of the Elementary Schools. N.E.A. Proceedings, 1924. Pp. 890-897.
2. Bonser, F. G. - The Place of Industrial Arts in an Efficient Education. An address given before the Industrial Arts Section of the Central Ohio Teachers Ass'n. at Columbus November 9, 1928 pp.1-9.

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(3) using the methods and instruments discovered or invented for communication and measurement - the three R's and other instrumental techniques and skills.

(4) participating in recreational activities, physical and mental, for enjoyment and the wholesome reflex influence of such enjoyment upon health, social life and vocation.

(5) contributing by the production of goods or service through a vocation.

(6) developing ethical character and spiritual life through all wholesome activities relating to growth in personal power, social co-operation and the refinement of life ideals."

A curriculum that will provide content to carry out the above objectives must contain:[1]

". . . . the sum total of the activities through which the needs of life are satisfied, arranged in that sequence which fits them to the progressively expanding interests and capacities of pupils. These activities are derived from an analysis of what people are engaged in doing in realizing their life purpose. This analysis means a detailed survey of each kind of life purpose and the meaning of attaining it. Having arrived at the activities by which the given life purposes is maintained, the problem is then one of arranging these activities in a sequence which will be in harmony with the immediate needs and capacities of pupils in various stages of growth - placing those activities in the first grade which first grade children can experience with profit and satisfaction in meeting their needs. Those in the sixth grade meeting the needs of sixth grade children, and so on. On the other hand, parallel with these activities are the results of race experiences as organized into subjects. These subjects provide the means for carrying out these activities. This survey of life purposes and activities is a very large and complex problem. It includes the actual finding out of what people do and also the careful weighing of each activity to find out its worth in serving some life purpose. Purposes themselves have to be weighed to find whether they really contribute to a richer and more worthy life. In life there is ever the conflict between higher or ideal purposes and lower purposes. Not only these activities in which people are found to engage, but those in which they might and out to engage to meet these and yet other unfelt needs must be included."

Bonser agrees with Dewey that we must recognize the instinctive tendencies of children, which he characterizes as:[2]

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1. Bonser, F. G. - The Elementary School Curriculum. pp.86-87 Macmillan, 1920.
2. Ibid. - p. 39.

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(1) The play impulses, (2) the social impulses, (3) the investigating impulses, (4) the constructive impulses, and (5) the art impulses. These impulses must be employed as the bases upon which to build the educative experiences.

Again, like Dewey, he would employ manual and manipulative activities to produce desirable human developments. Because mans' greatest concern is his economic want; and since, [1]

> ". . . . the needs of children and adults are much the same in kind, although they vary much in degree". . . and as "Much of their play is in imitation of the vocational, institutional and social activities in which their parents and neighbors are engaged"; he would make the industrial arts a prominent part of the curriculum.

He believes that Industrial Arts is a "social study" which will improve our efficiency on matters of health; selection and use of economic materials, artistic appreciation of materials, and co-operation and ethical character.

By industrial arts Bonser means: [2]

> ". . . a study of the ways and means by which we are efficiently supplied with the materials and products which we use in daily life. This includes the study of the changes we make in raw materials to increase their value for usage, the study of selection in relationship to purposes of usage, a study of the care and up-keep of products possessed, and a study of the social responsibilities we should share as a result of the methods and practices of industrial production and distribution. In learning how to select, use and care for our material supplies, and to share in the social responsibilities which methods of modern production impose upon us, we acquire some definite knowledge, some degree of manual dexterity, some forms of aesthetic and social appreciation. To acquire these several kinds of learning, very direct and intimate contract with materials, processes and products of industry and with the methods, of organized production, distribution and sale of commodities are necessary. Almost every known method of study has its place. At some point in the development of the abilities employed. Manual activities, observations, investigations, experiments, excursions and readings all have their part in the development

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1. Ibid. - p. 17,
2. Bonser, F. G. - The place of Industrial Arts in an Efficient Education. op. cit.

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> of industrial intelligence, insight and other practical behavior controls relating to the selection and use of materials and products."

It is thus, [1] "A study that enlists all of the learning and active impulses and abilities of children in manipulative, investigative, aesthetic and social. It represents fields of real need in both life and adult life. It uses the minds of children quite as much as their hands. It leads on to related fields of cultural content, giving a basis for an interest in and an appreciation for much of history, geography, science, literature and art for which children and students otherwise would have no approach nor any adequate means of understanding."

For the first six grades Bonser would provide a 'common-for-all' type of experience, which is beneficial for everyone, regardless of future vocation. For the Junior high school he suggests exploratory and vocational finding courses. And for the higher grades he advocates a more intensive type of work with larger projects andmore advanced types of construction.

It should be understood that Bonser considers the work of the Industrial Arts a part of the field of general education and not vocational education. While there is at times an over-lapping so far as manipulative process is concerned, these two types of work, however, should not be confused. Since, [2]

> ". . . . it is the consumer's point of view that primarily characterizes the study we call Industrial Arts. The study of any particular industry for the development of productive techniques and skills is vocational education."

In conclusion, Bonser contends that the Industrial Arts provide a curriculum with materials that are rich in content values, wholesome, attractive, and significant for inducting children "into the larger responsibilities of adult life. That they [3]

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1. IBid. p. 7
2. Ibid. p. 2
3. Ibid. p. 9

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". . . . contribute to that growth which makes for improved health; it contributes to growth in good taste; thus increasing the beauty of life and its surroundings; it contributes to the development of wider interests and a more enlightened understanding of the complex life of this scientific and industrial age; it contributes to a growth of social understanding and appreciation in an era of interdependence as worldwide as the distribution of the whole human family. It contributes much that in the very best sense is cultural and liberal. It opens avenues of interest, understanding and appreciation for much of the best that has been thought and done as found in the folds of literature, history, art, and music."

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DAVID SNEDDEN

According to Professor Snedden [1] the aims and objectives of education must come from sociology. He conceives the individual as being both a "producer" and a "consumer" and for this reason, he must have training for intelligent production and for consumption.

In the field of general education he distinguishes between two groups of subject-matter, viz: [2] an "A-group", or "hard work" subjects, and a "B-group", or "high grade play" subjects. The former, or "A-group", shall have as its underlying purpose the development of powers and capacities which will function in adult life and which are of the doing or executing type. The latter, or "B-group", shall consist of secondary subjects, whose purpose is the development of appreciations and interests through absorption and assimilation.

Of the subject-matter stressed by Snedden, the practical arts find an important place. He contends that the necessity for this type of work has developed out of our social situation. Where once the conditions of life were simple, they have now grown highly complex. Where once at an early age, the individual acquired a large number of utilitarian skills and participated in the economic processes of family life, today he participates less than ever before. This condition is due to the rise and development of modern industry and the growth of our urban communities. This has obliterated the economic activities which were formerly essential for economic independence.

Snedden's viewpoint regarding these changes is well illustrated when he says:- [3]

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1. Snedden, David - The Sociological Determination of Objectives in Education - Chapt. I, II, III, p. 11-77, Lippincott Co., 1920
2. Ibid. Chapt. III
3. Snedden, David - Vocational Education. pp. 462, Macmillan Co. 1920

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"It is inherently probable that if we possessed adequate knowledge of child development, of the physical, psychical and social processes by which the plastic infant becomes the matured man or woman we should find that early participation in practical arts activities constitutes, like physical play, as narrowly defined, also a highly desirable means to normal development, and, perhaps, an indispensable means to the highest forms of that development. We should expect this to be so, because of the many thousands of years of man's evolution during which children early began participation in the economic activities which always claimed so large a part of the attention of the adult members of the family group. For countless centuries, so far as we know, children matured in economic power through the apprenticeship of the family group - through that instinctive early sharing in useful work . . . . probably then, all forms of childish participation in the practical arts of the simple home, workshop, trading place, farm, mine, and fishing station have been important, even indispensable elements in the making of men and women. If so, when conditions arise that shut children away from opportunities for such participation society will find it necessary by some means to supply the missing opportunities for growth or development."

The need and significance of this type of work has been realized

[1]"Wherever sympathetic educators have brought city boys or girls - or others deprived of opportunities for participation in home work - into shops equipped with tools (including those appropriate to the household arts), they have almost instantly perceived in the avidity with which these young people entered upon constructive activities, manifestations of need for expression of workmanship instincts that are deep-seated, and that probably have a class relationship to all forms of fundamental development - moral and mental no less than physical, social and cultural no less than vocational."

School superintendents appear willing that this work should be retained and extended especially for pupils of early adolescent age.

[2]"Experience has taught them that such offerings do much good, even if pedagogical justifications for them are hard to diagnose and validate. Though they can as yet find no well-defined tested documental formulations of the desirable objectives for this division of school work, they feel nevertheless that some important values are there."

This difficulty that is encountered in finding justifiable educational

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1. Ibid. p. 463
2. Snedden, David and Warner, W.E. - Reconstruction of Industrial Arts Courses. p. 13. Bureau of Publications, Teachers College, Columbia, 1927.

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values for the industrial arts is not confined to this subject alone. But, as Snedden points out, any school subject hereafter must answer the following questions:- [1]

(1) "What are the actual values that individuals and society have a right to expect from the study?

(2) "For whom (or for what case-group of learners) is it of probable value?

(3) "How much of it is 'enough' (or of optimum service) for specified groups?

(4) "How valuable are other studies that could be given in the time taken by these learners for the subject under examination?"

In following, then, the present trends of the Industrial Arts, Snedden is of the opinion that the purposes, values, etc., especially for pupils of junior high school age, are as follows: [2]

> "Primary controlling Purpose:- Developmental experience through manipulative and other activities introductory to the various accessible phases of the world's industrial work.
>
> Secondary aims, objectives, or values in greater or less degree:-
> (1) Exploratory or finding studies for the detection or discovery of interests and aptitudes.
> (2) General guidance values through broad occupational contacts and studies.
> (3) Consumers' or utilizers' knowledge and appreciations; the better choice and use of industrial products.
> (4) Household mechanics or the development of "handy-man" abilities.
> (5) Avocational activities of adolescent youth in the pursuit of hobbies, and in the construction of things to possess either permanently or temporarily.
> (6) Vocational purposes in the definite preparation for a future occupation (applicable to from 0 to 15 percent of the average junior high school group).
> (7) Correlation with other studies and interest both in and out of school.

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1. Ibid. p. 14
2. Ibid. p. 10

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> (8) The forming of social habits; development of social values (moral, civic, etc.) possible in every activity of junior high school but particularly in the industrial arts because of the socialized setting possible.

For children of the ages from about six to ten, Snedden would have "manipulative activities" that serve "free play" purposes. These are usually carried on in the regular classroom. But he sees no reason why, at a latter date, these children will not be given opportunity with several kinds of tool work. For pupils from twelve to fifteen years of age, the work should be concerned with aims, processes, and projects that are more purposive, but upon an amateur level. For large proportions of pupils between the ages of fifteen and eighteen he would make the work more intensive and either upon or approximating a trade level. And for those who expect to enter the professions he would have more advanced forms of industrial arts work with the view of enlarging their [1]

> ". . . . amateur interests that will transform in later life into advanced forms of development and re-creative activities."

To meet the junior high school industrial arts proposals of Snedden, he suggests that work should be provided for in the following activities: [2]

(1) Gross Woodwork, (2) Fine Woodwork, (3) Job Printing, (4) Bookbinding, (5) Pottery, (6) Bicycle Repair, (7) Rock and Soil Excavation, (8) Foundry Work, (9) Electrical Work, (other than radio), (10) Machine Dessembly and Assembly, (11) House and Furniture Repair, (12) Vulcanizing, (13) Photography, (14) Finishing Projects (painting and varnishing), (15) Weaving and Fiber Furniture Projects, (16) Steel and

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1. Ibid, 56
2. Ibid, 102-109

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Iron Working Projects (including edging and forging), (17) Decorative Metal Work Projects, (18) Radio, (19) Sheetmetal Work, (20) Tailoring, (21) Shoe Repair, (22) Leather Work, (23) Pipe Fitting and Pumps, (24) Concrete Brick and Stone work, (25) Gas-Engine Work, (26) Mechanical Drawing.

In summarizing, Snedden points out that:[1]

(a) ". . . . for children otherwise deprived of 'natural' opportunities for early and gradual induction into productive activities, the need is great that schools shall provide as part of their offerings toward general development, general training and general instruction.

(b) But it is now rarely practicable, even if it were important, to secure vocational competency through the means and methods of practical arts participation, because of changes in most fields of economic production.

(c) Neither is it practicable to hold as primary objectives of practical arts education such ends as self-expression, hand training, vocation finding, or provision of centers of correlation for instruction in other types of subject matter, except, possibly in the lowest grades.

(d) The final justification for the provision of abundant opportunities for practical arts participation in schools is to be found in the contributions such amateur participation makes to general development, in way analogous to the contributions of physical play."

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1. Snedden, David - Vocational Education. p. 470 Macmillan Co., 1920.

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FRANKLIN BOBBITT

Dr. Bobbitt is the originator of the method of "activity - analysis" used in curriculum construction.

As a preliminary step for the curriculum-maker he advocates the taking of, [1]

> ". . . . a broad-overview of the entire field of man's life by way of seeing the major factors in perspective and in relation. On the basis of this preliminary over-view, he will plan the general educational route to be followed. This general route must be laid out before he is ready to undertake the accurate surveys of the details."

A second point of emphasis is, [2]

> ". . . . that a curriculum-making group should not take its thought second hand. It should do its own seeing, thinking, judging and deciding. It should for itself lay out the general routes to be followed by children and youths as they travel their educational journey."

After surveying "the broad fields of human experiences", it is then necessary to analyze these experiences and classify them into major divisions or fields. While each curriculum-making group should make its own classification, and upon a basis of their own particular needs, the following classification has been found helpful: [3]

1. Language activities; social intercommunication.
2. Health activities.
3. Citizenship activities.
4. General social activities - meeting and mingling with others.
5. Spare-time activities, amusements, recreations.
6. Keeping one's self mentally fit - analogous to the health activities of keeping one's self physically fit.
7. Religious activities.
8. Parental activities, the upbringing of children, the maintenance of a proper home life.
9. Unspecialized or non-vocational practical activities.
10. The labors of one's calling.

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1. Bobbitt, Franklin - How to make a curriculum - p. 2. Houghton Mifflin, 1924.
2. Ibid. p. 4.
3. Ibid. p. 8.

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After a classification, such as the above has been made, it is necessary to further analyze and subdivide these major objectives into specific objectives or abilities. These minor objectives should be stated in human and definite terms in order that educators may have definite aims toward which to work.[1] In addition it is essential that: [2]

> ". . . . the objectives should be stated, as far as their nature will permit, in the every day language of common sense. They should be easily intelligible to everybody concerned, especially to parents and pupils."

The following is an example of Bobbitt's scheme for listing the "Unspecialized Practical Activities" in order that they may be understood readily: [3]

1. Ability to use all common kinds of measuring devices; measures of lengths, area, volume, capacity, weight, time, value, temperature, specific gravity, etc.
2. Ability to sharpen, adjust, clean, lubricate, replace worn or broken parts and otherwise keep household garden tools and appliances in good order and good working condition.
3. Ability to make repairs, adjustments and additions to the house and its equipment.
4. Ability to make repairs, adjustments, and sometimes to construct household furniture or other equipment.
5. Ability to participate intelligently in the original planning of one's home.
6. Ability to operate household equipment.
7. Ability to keep the house, premises, and equipment clean and sanitary.
8. Ability to keep the house in good order.
9. Ability to care for and operate the electrical system and appliances in one's home; and to make simple repairs, adjustments, or replacements.
10. Ability to protect the home from fire.
11. Ability to perform the operations involved in the care of the premises and garden.
12. Ability to care for pets or other live animals.
13. Ability to perform the various activities involved in traveling and outdoor life.

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1. Ibid. p. 32
2. Ibid. p. 32
3. Ibid. p. 28

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14. Ability wisely to select garments.
15. Ability to design, select the materials, make, mend and alter clothing.
16. Ability to care for one's clothing.
17. Ability to perform the laundry and other cleaning activities of the home.
18. Ability to perform the various activities involved in providing the family with food.
19. Ability to perform the several activities involved in a proper care of the person.
20. An amateur ability to do productive, creative, or interpretative work in the field of fine arts. (Semi-specialized).
21. Ability to perform the simple business operations involved in the conduct of personal and family affairs.

By an "ability" Bobbitt means, [1]

> ". . . . a complex thing composed of many ingredients". As "for example, the ability to use language which is grammatically correct. This ability involves certain habits, skills, valuations, attitudes, desires, knowledge, sensitiveness to the expectations and criticisms of others, watchfulness over one's language, ability to self-judge, dislike for grammatically incorrect language, a feeling for right and wrong forms, and interest in language matters, and doubtless many others, - all referring specifically to one's use of language."

The question may be raised, How scientific are these selected abilities? To this inquiry, Bobbitt says, that while he is aware of the necessity for a scientific technique, [2]

> ". . . . we must admit that as yet we lack a technique which is adequate for the satisfactory analysis of any of the ten fields; and that trained investigators are not yet available for doing such work."

> "Until such time as the objectives can be scientifically established, practical workers will employ less vigorous methods in formulating their working objectives. As a matter of fact, innumerable things are proved by practical experience. Take for example, the ability to read. No scientific study has been made which proves that this is a needed human ability. But practical experience has proven it with finality. And what is thus proved takes its place as scientific verity. One does not employ the refined methods of research to demonstrate the obvious."

This assumption might be construed as being unscientific. But such is not Bobbitt's purpose. He says, [3]

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1. Ibid. p. 30
2. Ibid. p. 34
3. Ibis. p. 35

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". . . . we should use the exact methods of science to discover what is proved by practical experience where there is any doubt of the matter; also to be sure that vital matters are not omitted by oversight; and finally to introduce the quantitative element when standards of achievement are to be definite."

Bobbitt believes that, [1]

"all education should proceed upon the assumption that nothing should be done by the schools that can be sufficiently well accomplished through the normal process of living. Only those abilities which are so complex that they are not sufficiently developed through the normal processes of living will be included among the objectives of systemmatic education."

He therefore divides his "general training program" which is to be the program of any effective school system into two divisions:- [2]

(1) "The Basic General Training. This is training for those human qualities and abilities the need or desirability of which is universal, evident and generally accepted.
(2) Additional Opportunities or Extras. These are designed to train for human activities that are not specialized and yet not universal; for things that appear to be relatively remote from fundamental human activities; and for things upon which there is no relatively unanimity of judgment."

The curriculum content included in "the basic general training" would consist of the following courses:-. [3]

(1) English language; reading, oral and written expression.

(2) Citizenship attitudes, judgments, and activities. Social studies.

(3) Literature: English and general.

(4) The several science fields.

(5) Everyday mathematics.

(6) Physical training, hygiene, sanitation.

(7) Unspecialized practical arts.

(8) Musical appreciation and judgment.

(9) Art appreciation and judgment.

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1. Ibid. p. 35
2. Ibid. p. 69
3. Ibid. p. 69

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Since Bobbitt would include in the curriculum only such activities and abilities that cannot be learned outside of school, evidently he has included item 7 in the above classification (Unspecialized practical arts) on the assumption that the home, as an agency for providing basic manipulative skills, no longer suffices. And since the school is the only social agency that serves everyone, it is the duty of the school to provide this training.

Bobbitt makes a very clear distinction between the "specialized" and "unspecialized" activities of labor. He points out that possibly most of the world's work will be done by specialists but that also much unspecialized work will always be performed by the average householder. He sees no valid reason for calling a specialist to make some minor repair or alteration about the home and its equipment. But on the other hand, he recognizes the fact that possibly some preliminary training is essential. He states his position as follows: [1]

> "We live in such an age of specialization that the unspecialized practical activities have until recently been largely overlooked by education. It has been assumed that training is needed for vocational skill and understanding but that these unspecialized labors are either unjustifiable or they are so simple as to be sufficiently taken care of incidentally through the normal processes of living. Undoubtedly this is the case with a large number of them. On the other hand, there are many which require a certain amount of training before they can be properly done.
>
> "The feeling is common that all practical labors of men should be specialized; that the specialized groups have the right to perform all of the labors which pertain to their fields and that the ordinary citizen has no right to perform labors outside of his own speciality. This is to assume that we are to attain such specialization that every nail to be driven about the premises must be driven by the carpenter; every post to be painted in the back fence must be painted by a painter; every cotter-ball which gives way in the plumbing faucet should be replaced by a plumber; every wire which jolts loose in the electric iron or motorcar is to be replaced and tightened up by an electrician."

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1. Ibid. p. 178

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Between the two extreme view-points, (specialized vs. unspecialized) Bobbitt presents six reasons for unspecialized practical activities. [1]

(1) Beyond a certain point specialization is not economical.
(2) The person who must depend upon others for all minor repairs, emergencies, etc., is helpless.
(3) Specialized service tends toward inefficiency and parasitism if they are not supervised by those who have some understanding of the matter.
(4) It is not good for a man to be too much of a specialist.
(5) They are needed to prevent the disintegration of the home.
(6) They are needed for the purposes of health.

While Bobbitt stresses the "unspecialized practical arts" as a part of the pupil's general training, he feels that to date the whole training program has been largely a failure. He basis his claims upon the fact that manual training failed as a vocational preparation and hence disappointed the layman; failed to justify the schoolmen's claims of "formal discipline" and failed to provide vocational guidance values as claimed by its advocates. For these failures he pictures a disgruntled group of patrons and the possible disappearance of this type of work, unless radical changes in aims, purposes, content, procedures, etc., are inaugurated.

In his opinion, practical arts work is justifiable upon two major basès:- [2]

(1) Training for the development of abilities listed under "unspecialized practical activities".

(2) "It gives a certain amount of concrete insight into the nature of tools, machines, forces, appliances, raw materials, processes, etc; employed in a member of occupational fields. As a portion of the social training it is obvious that men should be brought to an understanding of the broad differentiated world of production and districution. This understanding is to developed mainly through observation, reading and discussion.

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1. Ibid. p. 180-185
2. Ibid. p. 200-201

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Rightly, however, to know the solid realities, one needs laboratory or workshop contacts with them. It is not practically possible to put boys for short periods into a large number of occupations by way of familiarizing them with the machinery, raw materials and processes. It is however possible in the schoolshops, which under the circumstances would best be called laboratories, to give them short intensive courses for two weeks, a month, or other short periods, for bringing them into contact with things involved in different occupations. It is laboratory experience for the sake of the social studies and in part possibly for the applied sciences."

"It is easily possible to combine the two purposes which we have just mentioned in the organization of a single series of courses which can develop a certain amount of concrete occupational understanding at the same time that it trains for unspecialized practical arts."

"The knowledge of occupations referred to prepares one for choice of occupation. So far as the laboratory portion of the study of occupations assists one to a genuine knowledge of these occupations, it can be of service for vocational choices and guidance."

"If the major purposes here presented are justified by analysis of community needs, then the practical arts courses for boys should be continued in the public school curriculum. It is clear, however, that the courses should be very different from the older and still persistent type of manual training for boys. The courses needed must bear relatively little resemblance to these older courses. The objectives are different. The procedures must be different. The whole spirit and relation of the work must be different."

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WERRETT CHARTERS

Charters advocates the method of "job-analysis" for constructing a curriculum. This plan proposes as its first step the formulation of a definite aim for the selection of content material, and of the activities that are carried on by the various members of society. He points out, however, that while the aims have changed from time to time, it is significant to note that curriculum changes have not paralleled or closely followed these changes. The reasons for these deficiencies are:-[1]

> (1) "Those who have formulated the aims of education have not taken into account the activities which individuals carry on. Rather they have laid stress merely upon ideals from which a curriculum can be derived. As the result of this failure (2) the curriculum has been under the domination of the idea that the youth should be given a bird's-eye view of the knowledge of the world rather than a compendium of useful information. Furthermore, (3) when the material in this curriculum has been criticised as lacking practicalness, the school administrators, with whom the defense of the curriculum rests, have until quite recently, justified it by an appeal to the doctrines of formal discipline and the transfer of training.
>
> "The standards of our day demand that our course of study be derived from objectives which include both ideals and activities, that we should frankly accept usefulness as our aim rather than comprehensive knowledge and that no fictitious emphasis should be placed upon the value of formal discipline."

Briefly, then, the criticism of Charters is that while educational leaders such as Plato, Comenius, Spencer and others, have had an aim, they were, nevertheless, unable "to derive a curriculum logically" from a statement of aim alone. In each instance there occurred,[2]

> ". . . . an arbitrary mental leap from the aim to the subject matter, without providing us with adequate principles such as would bridge the gap - without presenting steps which irresistibly leads us from aim to selection of material."

Charters believes in an education that is practical. Such an education not only equips the individual vocationally but provides

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1. Charters, W.W. - Curriculum Construction. p.4 Macmillan Co. 1923
2. Ibid. p. 6-7

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training, that will enable one to select intelligently his clothes, beautify his home, select his reading materials, appreciate art and music, perform the duties of citizenship, etc. Further, he does not believe that an abridgment or abstract of the organized knowledge that has accumulated during the ages is the best material for training well-rounded individuals. He bases his claims upon the following assumptions:-[1]

> (1) That the organized fields of knowledge are undergoing a constant change. Hence the viewpoints of each generation and age are likely to be different.
>
> (2) It is more difficult to apply knowledge than to acquire it.
>
> (3) Unless a feeling of need for a particular item of knowledge exists it is difficult to motivate a desire to acquire it.
>
> (4) One of the chief defects in our educational system lies in the fact that our courses of study are "composed of the systemmatized fields of knowledge." in order, "to equip youth properly for the problems of maturity, instruction must be given in the current, unorganized social problems of the day. For instance, we have facing us now the problems of labor, direct action, governmental control, and the participation of workers in the profits and administration of business, but the facts concerning these are not usually taught in the grades or in the high school. Whether they can be taught with complete adequacy or not is beside the point; the student must face the problems either with inadequate information or with none."

To overcome some of these educational short-comings mentioned above, and in order that we may make our educational content practical and worthwhile, Charters would have us employ the method of "job-analysis" or "the analysis of activities". This method is not an innovation. It has been used for many years. For example, such simple formulae as cooking recipes are a form of "job-analysis". In application, however, to methods of instruction is a thing of recent origin. Possibly its greatest use and value is found in

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1. Ibid. p. 17-20

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formulating subject-matter for specific occupational training, or in curriculum content that lends itself particularly to concrete and objective evidence. It should be noted, [1]

> "That an analysis may result either in a list of duties or in a list of methods of performing duties. There is no line of demarcation between duties and their performance, because the methods of performing any duty are simply the details constituting a larger activity called the duty."

Four methods may be employed in making job-analysis, viz: [2] (1) Introspection, (2) Interviewing, (3) Working on the job and (4) The Questionnaire. Of these four methods "interviewing" is considered the best plan to be followed. It is Charters' contention that without an analysis, one is at a loss to know what activities, information, difficulties, etc. will be encountered in giving instruction, and that without such information, it is impossible to construct a curriculum intelligently.

Before selecting the activities that shall comprise the curriculum, Charters would have the curriculum committee select the ideals which he hopes will accrue from participating in the various activities selected. He defines ideals as "the standards of action" and finds them difficult to evaluate. Since they lack objectivity, he suggests: [3]

> ". . . . either an individual decision or a faculty decision concerning the ideals which are to dominate in each specific situation."

Further, there are three methods suggested for selecting the ideals which shall dominate any subject matter:- [4]

(1) Listing the activities and determining which ideals

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1. Ibid. p. 37
2. Ibid. p. 38-39
3. Ibid. p. 43-44
4. Ibid. p. 43-47

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are best for acquiring the desired duties.

(2) Permitting the faculty to choose the ideals by consensus of opinion and then selecting the activities which will best produce the desired ideals.

(3) Preparing a list of generally accepted ideals and submitting it to the teachers, asking them to decide which ideal should be stressed for each individual pupil. When a decision has been reached in each individual case it is best to make up a final list through frequency of mention.

The suggested procedure to be followed in curriculum construction, when the "job-analysis" plan is used, is as follows: [1]

(1) Determine the major objectives of education by a study of the life of man in his social setting.

(2) Analyze these objectives into ideals and activities and continue the analysis to the level of working units.

(3) Arrange these in order of importance.

(4) Raise to positions of high order in this list those ideals and activities which are high in value for children but low in value for adults.

(5) Determine the number of the most important items of the resulting list which can be handled in the time allotted to school education, after deducting those which are better learned outside of school.

(6) Collect the best practices of the race in handling these ideals and activities.

(7) Arrange the material so obtained in proper instructional order according to the psychological order of children.

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1. Ibid. p. 102

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"Job-Analysis" as a plan for determining curriculum content may be used effectively in constructing courses of study for industrial art work. Especially, content material relating to community needs, home mechanics courses, "handy-man" courses, etc. may be determined by this method.

This method is used quite extensively today in constructing Industrial Arts courses. The first recorded study of this nature was made by L. R. Fuller, at Columbia, Missouri, for establishing a "Manual Arts" course of study "based on home repair." [1] A recent industrial arts course of study in which this method was used is the Denver, Colorado, course of study, 1928. [2]

1. Fuller, L. R. - Manual Arts based on Home Repair. Jr. of Educational Research, p. 173-179, March, 1921.
2. Denver, Colo., Public Schools - Research Monograph, No. 4, Industrial Arts, 1928.

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SUMMARY OF AUTHORITIES CLAIMS FOR INDUSTRIAL ARTS WORK

Dewey:-

(1) It has a socializing influence.

(2) It provides for the needs of the primary impulses or instincts.

(3) It has an economic value.

(4) It develops worthwhile skills.

(5) It develops appreciations for things industrial and for people engaged in industry.

(6) It develops pupils powers and interests through practical experiences.

(7) It is an essential phase of the pupils' general training.

Kilpatrick:-

(1) It affords necessary training or experiences with concrete things which can no longer be learned in the home.

(2) It develops useful skills.

(3) It deals with practical things which is necessary for practical thinking.

(4) It should be incorporated in our curriculum because children like to work with materials and tools.

Rugg:-

(1) Due to our industrial civilization children must be brought in contact with things industrial.

(2) Pupils must be adequately equipped to meet social and economic changes.

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(3) Recognition must be given to pupils' interests.

(4) Instruction materials must be dramatic, vivid and compelling and should consist of thrilling and gripping experiences which have their foundations in vivid human settings.

Bonser:-

(1) It is an essential part of the individual's general training.

(2) It provides for the instinctive tendencies of the individual.

(3) It provides for the social needs of life.

(4) It provides materials for the development of abilities connected with economic want.

(5) It provides training for intelligent consumption and production of economic products.

(6) It promotes industrial intelligence.

(7) It provides finding and explorating experiences.

(8) It contributes much that is cultural and liberal.

Snedden:

(1) It is a necessary part of one's general training due to our present social and industrial situation.

(2) it serves the demands of the innate or instinctive human tendencies.

(3) It supplies necessary economic training opportunities which the home no longer provides.

(4) It provides opportunities for exploring and discovering one's abilities, aptitudes and capacities.

(5) It contributes vocational and educational guidance values.

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(6) It provides training for more intelligent consumption and production of economic products.

(7) It provides for the development of "handy-man" abilities.

(8) It correlates with other subjects and with interests both within and without the school.

(9) It has a high social value.

Bobbitt

(1) The development of "unspecialized practical activities" is a requirement for everyone.

(2) The school should provide for unspecialized practical activities, and no other social agency makes such provision.

(3) It gives an insight into industry and a broad understanding of the world's production and distribution of goods.

(4) It provides for a knowledge of occupations and hence has vocational choice and guidance values.

Charters

(1) People learn by doing. (It is more difficult to apply knowledge than to acquire it.)

(2) Practicalness by analysis of pupils' needs, interests, activities, etc. that is useful should provide the curriculum content.

(3) Instructional materials should be provided that will equip pupils to meet the requirements of modern social life.

Out of the reflections of these summarizations, then, the following claims may be deduced to serve as guiding principles for the construction of an industrial arts curriculum.

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CLAIMS FOR THE INDUSTRIAL ARTS CURRICULUM

1. It is an essential part of the pupil's general or liberal education (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt, Charters)
2. It serves the needs of the primary impulses or instincts of individuals. (Dewey, Kilpatrick, Rugg, Bonser, Snedden).
3. It provides necessary training and experiences with concrete things which are no longer furnished by the home. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt, Charters)
4. It assists in equipping pupils to meet social, economic, and industrial problems in our present industrial civilization by giving them an insight and appreciation of things industrial. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt).
5. It has an economic value, in that, it provides for more intelligent ideals relative to production and consumption of economic products and in the development of handyman skills. (Dewey, Kilpatrick, Bonser, Snedden, Bobbitt, Charters)
6. It provides opportunities for exploring and discovering one's abilities, capacities, aptitudes, etc. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt, Charters)
7. It contributes occupational and educational guidance values. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt, Charters)
8. It provides opportunities for developing avocational or recreational abilities. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt)
9. It correlates with and aids in vitalizing other school subjects. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt)

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10. It has a high socializing value. (Dewey, Kilpatrick, Rugg, Bonser, Snedden, Bobbitt, Charters)

That these ten claims have validity and may be accepted, can be seen by examining the claims and objectives of the specialists in the field of industrial arts listed under (4) page 30.

ARTHUR MAYS

Professor Mays of the University of Illinois says:[1]

"There have been numerous attempts to formulate statements of these objectives which will command general acceptance but thus far none has fully succeeded in satisfying all concerned. There are, however, certain well-defined developments in the character of modern school-shop equipments, in recent revisions of courses of study and in the current expressions of the aims of the industrial courses in the new juniorhigh schools, industrial arts courses are approximately these:

(1) To provide training in the common skills needed in the use of the hand tools necessary for the upkeep of the house, including the repair of the machines, appliances and equipment usually found in modern homes.

(2) To provide training in the designing and construction of various articles which meet a personal or social need realized by the pupils, and which call for the solving of such technical and mechanical problems as will and in the development of habits of analysis and constructive planning in dealing with mechanical and technical problems.

(3) To provide opportunity for the exercise of the normal constructive mechanical tendencies of boys through the making of useful articles in an orderly manner, by approved, modern methods of mechanical work.

(4) To teach the methods of production, transportation, and preparation of the raw materials and the processes of manufacture in the basic industries of America.

(5) To develop appreciation of good design and construction in the commonly used products of manufacture to the end that the boys may become intelligent consumers of such things.

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1. Mays, Arthur B. - The Problem of Industrial Education, pp.198-2oo The Century Co., 1927.

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(6) To develop an understanding of the methods of production, transmission and application of power, to the end that the boys may become intelligent consumers of such power, and that they may become able to deal intelligently with the mechanical and economic problems involved in this important factor of modern life.

(7) To afford opportunity for the discovery of general mechanical or specific trade aptitudes through work in shops representing the typical trades and industries.

The Senior High School probably add to this list of seven objectives one more.

(8) To give technical training which prepares in part for the positions in industry of the "junior engineer" or "non-commissioned officer" grade, and for entrance to engineering colleges.

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ALANSON EDGERTON

In a study made by Professor Edgarton,[1] relative to industrial arts objectives he found that,[2]

> ". . . . in the 303 most progressive schools reporting on their main objectives that . . . . . the main objectives is rather to help all pupils, regardless of their social status or possible life work, to develop industrial intelligence and thinking power in connection with life situations. Therefore, each activity not only includes contact with typical materials, tools and machines but, also is organized with the intention of (1) giving,demanding more respect for the various workers and their work; (2) preparing for more intelligent judgment and use of industrial products and service; (3) helping to develop insight and to promote more efficient production; (4) offering opportunity for testing the interests and aptitudes of students, both in negative and positive ways, in order that worthy needs and capacities may be developed through specific training."

This same study also shows the reasons for offering industrial activities and the stress that is placed upon the various claims in different towns and cities.

Table III

MAIN REASON GIVEN FOR OFFERING INDUSTRIAL ACTIVITIES AND RELATED STUDIES IN EACH OF 303 INTERMEDIATE AND JUNIOR HIGH SCHOOLS. 3

CHIEF EMPHASIS AND CLAIM	SCHOOLS NUMBER	SCHOOLS PERCENT
Contributing to the general experience, all-around development and industrial intelligence	118	39
1. Understanding and appreciating economic production in some form; 2. Gaining respectful attitudes towards the various workers and their work. 3. Having ability to judge industrial products and do simple repair and construction work,etc.		
Aiding in the intelligent selection of industrial occupations with encouraging early choices	101	22

1. Edgerton, A. H. Professor of Industrial Education at the University of Wisconsin.
2. Edgerton, A. H. - Industrial Arts and Prevocational Education in Junior High Schools, pp.14-17, Bruce Publishing Co.,1922.
3. Ibid. p. 16

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MAIN REASONS GIVEN FOR OFFERING INDUSTRIAL ACTIVITIES AND RELATED STUDIES IN EACH OF 303 INTERMEDIATE ANDJUNIOR HIGH SCHOOLS (con't.)

	SCHOOLS	
	number	percent
1. Trying out individual inclinations, interests, and capacities for industrial pursuits through typical experiences. 2. Making reliable studies of the conditions, demands, and opportunities in related occupations; etc.		
Enriching the school experience of the pupil through concrete situations.	78	26
1. Having science, mathematics and other subjects profit from a better understanding of materials, processes, tools and machines. 2. Providing for the individual needs of pupils who would not remain for academic education alone. 3. Helping pupils more wisely to choose future courses in secondary and higher education, etc.		
Preparing for entrance into industrial vocations	6	2
1. Extending the tryout activity to meet the preparatory-vocational needs of pupils who find it necessary to leave shool with a minimum of preparation. 2. Offering greater opportunities for commercial experiences in shop work by co-operating with outside productive plants during the ninth year.		

The significance of Edgerton's study is the fact that, in the majority of instances, industrial arts work was given for general educational purposes. In only six of the 303 schools studied was the work given with a definite vocational aim.

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DEPARTMENT OF SUPERINTENDENCE FIFTH YEARBOOK * COMMITTEE ON INDUSTRIAL ARTS (1927)

Objectives of the Manual Arts: [1]

1. "To develop handiness

2. To promote the carrying over of ideas into action.

3. To help, through exploratory,courses,in the discovery of special interests and attitudes important for proper educational and vocational guidance.

4. To provide a means for developing technical skill.

5. To provide a means for providing technical knowledge.

6. To enable the pupil to apply the test of practice to some of his thinking.

7. To develop the mind by providing constructive problems in materials which demand a vigorous mental reaction.

8. To interest in school work, through the concrete application of theory to practice, those pupils to whom the academic studies do not appeal strongly.

9. To create interest in the arts and industries without any reference to their vocational significance.

10. To enable the pupil, through the making of minor repairs and the undertaking of minor construction in the home to contribute to its economic and material upkeep.

11. To enable the pupil through participation in co-operative problems to perform better his duty as a member of his home, his school and country.

12. To serve as an introduction to vocational and pre-vocational training."

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1. Department of Superintendence Fifth Yearbook - The Junior High School Curriculum. - pp. 406, National Education Association, 1927.

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DEPARTMENT OF SUPERINTENDENCE SIXTH YEARBOOK - COMMITTEE ON INDUSTRIAL ARTS (1928)

General Objectives of All Industrial Courses: [1]

"In order that industrial courses may be of the greatest possible service to the pupils of any particular school level, they must contribute to each of the three general objectives of secondary school subjects as follows:

1. To provide general industrial experiences of common value to all pupils of whom required.

2. To offer exploratory industrial activities to aid in revealing interests, aptitudes, and vocational possibilities for all concerned.

3. To offer opportunity for beginning specialized preparation for entrance into chosen industrial persuits."

The more specific aims or objectives in this same study are listed as follows: [2]

1. "To develop 'handy-man' abilities through repair and construction work for home, shop and office.

2. To assist in better choice and use of industrial products and service.

3. To gain sympathetic attitudes toward other workers and their work.

4. To appreciate economic production by first-hand experience in production work.

5. To try out individual interests, inclinations, and abilities for industrial pursuits through typical experiences.

6. To make reliable studies of the conditions, demands, and opportunities in related occupations.

7. To provide for the individual needs of pupils who would not remain for academic education alone.

8. To provide more wisely to choose future courses in secondary and high education."

1. Department of Superintendent Fifth Yearbook - The Development of the High SchoolCurriculum, pp. 420, National Education Association, 1928.
2. Ibid. p.420-421

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While there is a marked similarity of aims and purpose between the claims, as summarized from the writings of the theorists and those listed by the specialists, it would be impossible to find any large group who would agree with the exact wording of the ten claims listed on pages 70 and 71 that are being used as guides in this study.

As Mays points out:[1]

> ". . . . a strong tendency still prevails to state the aims of industrial arts in terms of generalized habits and character traits but usually such statements when analyzed, prove to be the expresion of claims or of earnest hopes rather than definite aims which determine the course outlines and methods of instruction. . . . . Only in recent years have educational leaders insisted on definite statements of aim or purposes. Industrial arts, along with other school subjects, is experiencing considerable difficulty in abandoning the customary, attractively worded claims for definite specific aims which fall clearly within the bounds of reasonable expectation of realization. Whatever the character of the lists of objectives, it is clear that the aims, while having to do with industrial facts, materials, processes and problems, are still not specifically vocational but are of the nature of those of general education. Industrial arts is not designed definitely to train mechanics for the trades but in so far as it is possible to do so through industrial courses, to produce the insights, skills, habits, and attitudes which would characterize all men living and working in a modern industrial environment."

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1. Mays, Arthur B. - op. cit. pp. 200-201

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Chapter V

CINCINNATI AS AN INDUSTRIAL CENTER AND HER OCCUPATIONAL PROBLEMS

Cincinnati is the second city in point of population in Ohio and is represented by many large and diversified industries. The extent of her industry may be seen by a review of Table IV which lists the major manufactures as found in the Census of Manufactures of 1925.[I]

Table IV
CINCINNATI OHIO
CENSUS OF MANUFACTURES, 1925

Summary for all manufacturing industries combined, 1925 and 1923, and for individual industries, 1925.

(This table presents statistics for all industries for which separate figures can be given without disclosing the operations in individual establishments. Some of the "All other industries", are, however of greater importance than certain industries which are shown separately. The statistics refer only to establishments actually located within the political boundaries of the city. No statistics for coffee roasting and spice grinding are included for either 1923 or 1925. The 1923 totals differ, therefore, from those heretofore published. No data are included for establishments having products valued at less than $5,000.)

INDUSTRY	Number of establishments	Wage earners (average number)	Wages	Cost of Materials	Value of Products
All Industries					
1925	1,751	63,715	$80,996,027	$241,128,941	$457,538,652
1923	1,660	65,336	78,399,494	(a)	428,576,932
Artificial Limbs.	3	10	14,134	13,306	51,139
Awnings, tents, sails, and canvas covers.	6	65	85,114	125,698	378,901
Bags, paper, exclusive of those made in paper mills. . .	6	189	205,019	1,366,379	2,065,158
Beverages	16	337	510,735	1,005,996	2,246,955
Bookbinding and blank-book making	16	114	144,296	141,100	480,620
Boots and shoes, other than rubber	24	4,231	4,652,170	6,406,930	14,256,284
Boxes, cigar, wooden. . .	4	84	67,873	83,760	206,856
Boxes, paper, and other, not elsewhere classified . .	19	769	687,088	1,659,059	3,097,619
Boxes, wooden, except cigar boxes.	10	311	338,734	722,449	1,617,690

I Biennal Census of Manufactures, 1925, Dept. of Commerce, Bureau of the Census, p. 1392-1394

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CINCINNATI OHIO

Summary for all manufacturing industries combined, 1925 and 1923, and for individual industries, 1925 -- continued.

INDUSTRY	Number of establishments	Wage Earners (average number)	Wages	Cost of Materials	Value of Products
Brass, bronze and other non-ferrous alloys, and manufactures of these alloys, and of copper, not specially classified	18	1,004	$1,348,774	$1,492,805	$4,740,772
Bread and other bakery products	127	2,020	2,625,468	8,875,981	16,547,466
Brushes, other than rubber	6	141	167,837	231,030	574,805
Butter, cheese, and condensed and evaporated milk.	13	243	259,214	8,345,682	9,673,017
Canning and preserving; Fruits and vegetables; pickles, jellies, preserves and sauces.	8	283	250,638	1,705,357	2,698,870
Car and general construction and repairs, steam-railroad repair shops.	7	1,332	2,096,686	1,284,054	3,734,403
Chemicals, not elsewhere classified	8	140	214,540	829,434	1,851,210
Clay products (other than pottery) and nonclay refacteries	4	144	173,946	98,640	429,912
Cleaning and polishing preparations	8	36	32,239	317,554	1,045,419
Clothing, men's, not elsewhere classified	91	7,667	9,196,047	22,300,769	45,289,778
Clothing, women's not elsewhere classified	28	600	550,908	1,968,994	3,398,080
Concrete products	6	47	61,946	62,803	187,432
Confectionery	28	1,016	872,451	2,992,152	5,119,662
Copper, tin and sheet-iron including galvanized-iron-work, not classified elsewhere	28	784	1,169,296	2,885,024	5,813,901
Electrical machinery, apparatus, and supplies	35	1,718	1,912,681	5,320,288	10,190,677
Electroplating	6	57	68,489	21,792	184,207
Flavoring extracts and flavoring sirups.	14	97	126,375	1,487,972	2,159,360
Flour, feed and other grain-mill products	5	21	30,838	514,002	599,754
Food preparations, not elsewhere classified.	15	161	221,552	3,200,497	4,075,180

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CINCINNATI OHIO

Summary for all manufacturing industries combined, 1925 and 1923, and for individual industries, 1925 -- continued.

INDUSTRY	Number of establishments	Wage earners (average number)	Wages	Cost of Materials	Value of Products
Forgings, not made in steel works or rolling mills	5	135	178,155	462,142	813,428
Foundry and machine-shop products, not elsewhere classified	122	4,433	6,188,637	10,260,136	27,235,396
Foundry supplies	4	57	84,723	248,354	558,006
Fur goods	5	26	26,803	93,246	169,276
Furniture	41	1,401	1,850,549	2,459,087	6,283,476
Glass cutting, staining and ornamenting	6	110	127,040	205,822	477,294
Grease and tallow, not including lubricating greases	6	160	210,962	646,148	987,008
Hand stamps and stencils and brands	6	37	51,880	38,798	190816
Hardware, not elsewhere classified	9	253	297,350	379,811	1,001,512
Hats and caps, except felt and straw	14	296	269,653	827,905	1,538,437
House-furnishing goods, not elsewhere classified	4	163	150,080	935,558	1,405,304
Ice Cream	17	233	321,624	1,592,037	3,265,659
Ice, Manufactured	19	142	271,089	214,648	1,128,924
Ink, printing	7	376	572,946	2,977,677	5,467,465
Jewelry	21	329	499,688	904,770	2,066,115
Knit goods	6	195	175,003	565,148	874,302
Lamps and reflectors not including electric bulbs	5	572	893,398	2,060,529	3,814,908
Leather goods, not elsewhere classified	6	39	66,466	151,926	276,013
Leather, tanned, curried and finished	7	471	588,752	2,882,517	4,256,535
Lithographing	10	384	612,947	757,996	2,086,134
Lumber and timber products not elsewhere classified	3	92	113,775	327,595	604,618
Lumber; Planing-mill products, not made in planing mills connected with sawmills	20	640	928,005	3,406,136	5,765,456
Machine Tools	35	3,171	4,691,711	4,590,613	13,114,208
Marble, slate and stone work	19	181	311,244	342,998	1,089,205

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CINCINNATI OHIO

Summary for all manufacturing industries combined, 1925 and 1923, and for individual industries, 1925 - continued.

INDUSTRY	Number of establishments	Wage Earners (average number)	Wages	Cost of Materials	Value of Products
Mattresses and bed springs, not elsewhere classified	10	144	170,199	607,909	1,102,303
Millinery and lace goods, not elsewhere classified	16	414	352,562	1,141,193	1,946,380
Mirrors, framed and unframed	8	139	167,053	587,518	1,019,943
Models and patterns, not including paper patterns	18	152	205,674	92,139	492,828
Motor-vehicle bodies and motor-vehicle parts	21	567	773,929	1,083,477	2,982,063
Motor vehicles, not including motorcycles	7	1,037	1,761,585	16,639,649	24,789,775
Mucilage, paste, and other adhesives, not elsewhere classified	3	7	7,707	115,292	182,678
Paints and varnishes	23	637	841,223	7,156,100	11,116,211
Patent Medicines and compounds	19	144	126,851	796,793	1,802,528
Pens, fountain and stylographic	3	44	55,482	113,304	295,095
Photo-engraving, not done in printing establishments	16	179	340,234	87,339	932,726
Plumbers' supplies, not including pipe, or marble, slate, and porcelain sanitary ware	7	201	244,994	431,139	882,736
Printing and publishing, book and job	160	3,115	4,052,397	5,149,814	17,433,597
Printing and publishing, music	5	17	24,452	67,266	619,193
Printing and publishing, newspaper and periodical	50	1,341	2,744,451	4,896,884	15,686,770
Pumps (hand and power) and pumping equipment	4	263	349,606	916,620	1,958,877
Safes and vaults	4	181	213,382	211,061	518,667
Shirts	12	1,043	750,154	2,476,216	4,412,233
Signs and advertising novelties	16	382	419,057	776,742	1,628,798
Slaughtering and meat packing wholesale	38	1,434	2,006,425	34,686,092	40,371,774
Soap	11	472	347,393	2,666,861	6,127,517
Stamped and enameled ware, not elsewhere classified	7	355	465,772	682,412	1,750,760
Stereotyping and electrotyping not done in printing establishments	6	271	477,054	439,100	1,236,531

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CINCINNATI OHIO

Summary for all manufacturing industries combined, 1925 and 1923, and for individual industries, 1925 -- continued.

INDUSTRY	Number of establishments	Wage earners (average number)	Wages	Cost of Materials	Value of Products
Stoves (other than gas, oil or electric) and hot-air furnaces	9	996	1,486,111	1,678,168	4,490,966
Structural and ornamental iron-work, not made in rolling mills	16	299	406,904	1,063,091	2,421,650
Surgical applicances	5	182	160,288	433,146	918,327
Tin cans and other tinware, not elsewhere classified	4	564	558,208	2,418,464	3,554,794
Tobacco;Cigars and Cigarettes	34	1,286	1,061,515	1,581,855	3,658,205
Tools, not including edge tools machine tools, files or saws	7	52	78,406	50,782	208,606
Trunks, suitcases and bags	8	90	103,249	224,064	482,015
Window shades and fixtures	3	65	30,848	239,906	312,259
Wirework, not elsewhere classified	6	108	131,049	413,470	755,773
All other industries	241	10,017	12,494,245	38,414,571	74,261,446

a/ Not tabulated for Cities

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As noted above, these industrial establishments refer only to those within the city boundaries. Cincinnati is peculiar in the fact that a number of large manufacturing plants, such as the Proctor and Gamble Company, manufacturers of Ivory Soap; the Globe-Wernicke Company, manufacturers of office and library furniture, and others, are located in suburbs, that are surrounded by the city proper, and employ hundreds of people who reside within the city limits. It is for this reason that these data might be questioned, since they do not include all the manufactures in what is commonly termed "Greater Cincinnati".

It should also be noticed that, in 1923, there were more establishments and more employees than there were in 1925. But accompanying this decrease there was an increase in wages and value of manufactured products. This paradox may be explained in part by the following statement.[I]

> "It should be stated that in a large number of manufacturing industries of all sorts there is a noticeable trend towards a smaller number of establishments, slightly increased number of wage earners, and greatly increased volume of production. The principal explanation for this phase of the phenomenon is found in the fact that the increasing efficiency of American industries generally permits a smaller number of units to fill a larger demand. This has the general tendency of causing certain other units that were formerly engaged in an industry either to go out of business or turn their attention to other lines."

The fact that certain industries and businesses may either go out of existence or turn to other lines raises an important social and economic problem.

I McCullough, E.W. - U.S. Chamber of Commerce; Dept. of Manufacture. Private Correspondence. Nov. 15, 1928.

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If a worker has been trained for a particular occupation and that occupation in turn becomes obsolete, what shall be the procedure in training that individual for another job? It is certain that we must train and educate people who will be more versatile and adaptable in meeting present industrial demands.

The eighty-five industries listed in Table IV suggest a large number of manual activities that might be included in our school curriculum. It is obvious, however, that it is necessary to choose those adapted to the age of the pupils, school equipment, and other essential factors. Large, expensive, and dangerous projects, such as iron and steel-making, slaughtering and others, could not be very well included. Hence, while Cincinnati like most large city school systems attempts to give as large a variety of manual experiences as possible, it confines itself out of necessity to such basic industries as woodwork, metalwork, drawing, electricity, and printing.

Edgerton found that the number of industrial subjects offered depended greatly upon the size of the community. In a study of three hundred seventy-nine cities, he discovered that:[I]

(a) 76 cities from 5,000 to 10,000 offered in over 97% of the cases bench woodwork and drawing alone.

(b) 185 cities from 10,000 to 25,000 offered in over 93% of the cases from three to six activities.

(c) 118 cities from 25,000 to 200,000 and over offered in over 96% of the cases from six to sixteen activities

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I Edgerton, A.H. - op.cit.p. 15

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Again, we find that even though we knew what occupations students would follow, our industrial curriculum would consist of a large and diversified list of activities, as is shown by Table V.[I] This table shows the occupations entered by boys and girls, sixteen and seventeen years of age, during a four year period, extending from September, 1924, through August, 1928, who left school to enter employment.

Under the Ohio School Law, pupils must remain in school until they reach the age of sixteen. They may, however, under certain exceptions enter gainful employment before sixteen. Since industrial arts work begins in the sixth grade, and in some instances in the fifth grade in the Cincinnati Public Schools, the majority of boys receive some manual and industrial experiences. While these experiences doubtless assist some students in making an occupational choice, the extent of their influence cannot be definitely stated. Snedden[2] if of the opinion that it is "applicable to from 0 to 15 percent of the average junior high school group". The local (Cincinnati) director of vocational education believes, while there is some correlation, that the parent exerts the greatest influence in a boys' occupational decision.

Hence, while the affect that the industrial arts in the Cincinnati Public Schools may have in diverting boys into mechanical pursuits is not known, it is, however, significant to note that the enrollment in the vocational schools has shown a steady increase during the past five years.[3]

I Annual Reports - Vocational Bureau; Attendance Dept., Cincinnati, Ohio Public Schools, Sept., 1924, through Aug., 1928.
2 Snedden, Davis and Warner, Wm. E., op city p.10
3 Annual reports - Director of Voc. Ed. Cin'ti, O., Public Schools, 1924 to 1928 inc.

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YEAR	NO. BOYS ENROLLED
1923 - 1924	883
1924 - 1925	934
1925 - 1926	1076
1926 - 1927	1147
1927 - 1928	1648

As previously stated, the majority of these students have had industrial arts work, since the age of fourteen years and eighth grade graduation are prerequisites for entrance to the vocational schools. These figures, however, must not be taken too literally, as approximately forty percent of these boys come from parochial and other schools where industrial arts subjects are not offered.

Another factor that enters into the local need for industrial experience and information is the use that is made of the city library facilities. The extent to which the "Useful Arts" department is used is a fair criterion of the interest in things industrial and mechanical.

The annual report of the Cincinnati Public Library for 1926-1927 states that in the Technical Department;[I]

> "the home use of books amounted to 31,806, an increase of six percent over last year's circulation. . . .There was also a steady growth in the reference work. Readers came to the department last year in sufficient numbers to increase the number of volumes consulted 32 percent over that supplied to them in the year closing June, 1926. During the last four months the department answered, on an average, forty-five questions daily."

In a personal interview with the head of this department April 1, 1929, it was stated that at the present time this department contained 5400 books on the open shelves; 23,300 in the stacks;over 400 different magazines were available to the readers and for the year nineteen hundred twenty-eight 68,304 books were consulted and circulated.

I Annual Report Public Library of Cincinnati and Hamilton County. 1926-1927 - pp. 51-52

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SUMMARY:

The city of Cincinnati has many large and diversified industries into which hundreds of young people find their way as wage earners. Since many do not care to serve a trade apprenticeship but leave school as soon as the law permits and seek employment in the city's industries.

While many more industries are in operation than the eighty odd listed by the United States Census Report of Manufacturers of 1925; manual experiences in the public schools for reasons of administration, equipment, expense, type of building,etc; must necessarily be limited to a small number of basic industries.

Reports from the technical division of the city public library and other sources shows a growing need and interest for things technical and industrial. As the school is the only social agency that reaches everyone it should be alive to its responsibility and furnish such guidance and experiences as will aid individuals in making a wise occupational choice.

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Chapter VI

OBJECTIVES OF THE INDUSTRIAL ARTS AS SHOWN BY STATE AND CITY COURSES OF STUDY

Requests for industrial arts courses of study were sent to every state department of public instruction and to 325 towns and cities that were considered likely to have printed, typed, or mimeographed courses. Forty-four of the state departments replied, and of these, seventeen had materials which they forwarded. Of the 325 towns and cities circularized, materials were received from seventy-four; twenty-seven reported that their courses were under revision; thirty-two reported that they had no materials available; while one hundred ninety-two failed to respond.

Of the ninety-one state and city courses of study received and reviewed, it was found that 13 of the state courses and 45 of the city courses were usable so far as definite aims and objectives were concerned. Many of the courses received were indefinite and meagre relative to aims, content, and materials, while others were not in the field of industrial arts, but dealt with such subjects as "fine art", "domestic art", "domestic science", "fine and industrial arts", etc. In consequence, materials for the objectives listed below were taken from 13 state and 45 city courses of study.

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STATE COURSES OF STUDY

ALABAMA

OBJECTIVES

Grade I and II

1. "A greater appreciation of father's and mother's work and of our dependence upon them."
2. "A more intelligent interest and participation in family activities."
3. "Some notion of our dependence upon the outside world."
4. "A beginning in the forming of right habits of living."

Grade III and IV

1. "A clearer conception of world intercourse and our dependence upon other people."
2. "A greater sense of responsibility for our share of the home activities."
3. "An increased interest in health and some idea of the relation of food, clothing, and personal habits of living to health."
4. "The beginning of an appreciation of values in relation to use and cost."
5. "A general idea as to how other people live and do their work."

Grade V and VI

1. "A clear conception of the development of industry."
2. "Some notion of the conditions under which other people work for us."
3. "Some notion of the things that have brought people closer together."
4. "An appreciation of the cost of living."
5. "An appreciation of the beauty around us and its application to common things."
6. "An increase desire to have good health."

Time:-

No definite time is to be set aside on the school schedule for the teaching of Industrial Arts.

Method:

"The material may be offered in any order or other material substituted if it better assists in obtaining the desired results. Industrial Arts is not to be taught as a separate subject but is to be used to enrich the work in other subjects. Language, nature study, and health will find much helpful material here. Special day and morning classes will find it a source of help."

HIGH SCHOOL

1. "To impart general and not particular knowledge of mechanical processes; appreciation and not special skills."
2. "To handle tools and materials."
3. "To plan and to do jobs in order to gain a general knowledge of constructive work."
4. "To sample, as it were numerous manual activities in this sampling process serving as a guide to selection of a vocation."
5. "To serve many recreational ends."
6. "To set up ideals of accuracy, neatness and honesty in work."

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IDAHO

INDUSTRIAL ARTS

"Formalized manual training is rapidly passing out of use and the emphasis is being placed upon the practical features of industrial work. Schools can do much to increase the value of the industrial arts department if they will omit the outworn formalized impractical work, and approximate as nearly as possible industrial practices of the various trades."

"In all phases, life-sized and practical jobs should be used. The trade should be broken into its units and enough practice given on each unit to develop skill. The units and practice should conform to the best practice in the present industrial world."

"In order to be practical the teacher must have real industrial experience as well as being technically and professionally trained. Working at the trade during the summer will do much to increase the value of the course, for in this way, the instructor will not only get the improved methods but will become and stay vocationalized. Administrators should recognize the value of summer trade experience for trade teachers as well as summer school for other teachers."

"A period of ninety minutes is necessary and the same credits should be given as for any other subject. The standing and credit should be based upon the amount of practical work successfully done."

KENTUCKY

INDUSTRIAL ARTS

"Manual training in all its forms from cabinet-making to machine shop work is installed in the public schools for the purpose of general training and improvement, and not for the purpose of preparing a person for a particular trade. It is often the case, however, that a boy who studies cabinet making or some other work in the manual training course makes this work a means of livelihood, but the manual training in this case serves merely as vocational guidance, for no manual training course devotes sufficient time to the work to turn out competent workers in any trade. School authorities who have a problem in their communities of training boys or girls for entrance into trades should resort to the trade school organization for such training, under which adequate time is given for teaching the trade, or what is probably much better, organize the class on a cooperative basis."

MISSOURI

FOREWARD

"Everyone is affected by and interested directly or indirectly in the industries of our country. Countless thousands earn a livelihood in the various vocations of this field while many more enjoy the comforts and conveniences of the present era because of the contribution the industrial world has made and is making to civilization. Progress in the field of industry stimulates a like movement in all society because of its universal influence upon the social order."

"The introduction of industrial studies into our schools is fully justified because of their value not only in guiding the minds

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of students towards some vocation, but because they encourage an appreciation of the field of industry on the part of all students. The hope for social solidarity must be realized from mutual appreciation. it is essential to the common good that we understand the work and problems of our fellow man and thereby learn of our interdependence."

"A further value from the pursuit of industrial studies in our schools is realized because boys can thereby learn to perform serious and necessary pieces of work for themselves which involve such a knowledge as their study of this work will provide. Likewise, even though they may never have need to perform such work they will obtain a valuable training in perspective and in correlation of muscles which will be a valuable asset throughout life."

"Industrial studies have a value in drawing power. Such work will attract students to school and cause a regularity in attendance impossible to attain by other means. Such studies furnish every student an opportunity to express an idea in a way impossible otherwise. The student's creative ability is highly stimulated and can have ample opportunity to develop. Furthermore, such work furnishes wholesome relaxation and recreation. Because it is productive it offers a field of accomplishment to each student in which he or she may fully obey their instinctive urge to construct."

"While the introduction of industrial studies into the curriculum of many schools on a wide scale is as yet not possible because of the expense it entails, still such work is essential and should be taught to some extent in the smaller systems where they can possibly afford a unit of it."

NEBRASKA

"The direct objectives of a course in Manual Arts are":-

1. "To give students experience in the more fundamental processes of several of the more common trades; and an opportunity to handle the materials of those trades; and a chance to discover aptitudes, abilities and interests to the end that they may better be able to judge of different trades or industrial pursuits and possibly be better able to select a life work."

2. "To give students training in the use and repair of industrial products, or service, common in home life and leisure-time activities which are not vocational in character."

3. "To give certain select groups of students fundamental trade experience of an intensive nature, which will enable them to enter upon a trade as an advanced beginner."

NEW HAMPSHIRE

MANUAL TRAINING

"Manual training leads to worthy home membership by enabling the pupil to acquire such skill in the use of tools and such standards of workmanship that will contribute to the maintenance of the home by constructing many useful articles and making minor repairs."

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"In making free-hand sketches and in adapting materials to the project at hand, there is application of fundamental processes in arithmetic."

"In the use of tools to construct articles of beauty and utility, many boys find an opportunity for the worthy use of leisure time."

"This type of work with the hands may stimulate vocational ideas and affect later vocational choice. The use of certain tools, especially the hammer, saw and plane exercise the large muscles upon which growth, nervous control and good health depend in large measure."

OKLAHOMA

MANUAL TRAINING

Basic Text: Busch-Conway's "Shop Work"

"The course as outlined will take one year to complete. The time is divided approximately, two days weekly for drawing and three days weekly for shop. The instructor may adjust this to best satisfy the needs in his particular community.

"The outline gives several samples of lessons which are typical of a well planned recitation. This plan should be carried on throughout the course. Where the lesson plan is not completed it is understood that the teacher will work out the details according to sample lessons.

"It is not intended that a lesson as outlined is necessarily completed in one recitation but it may take two, three or even more recitations to complete.

"New lesson assignments must be specific as to reference so that the student may well prepare himself for the recitation the day to follow. Encourage the student to look up other references on the topic at hand."

PENNSYLVANIA

AIMS STATED

1. "Worthy aims of instruction in industrial arts subjects may well be:"
   (a) "To increase the general intelligence of the pupil."
   (b) "To stimulate the pupil's powers of wise utilization."
   (c) "To help the pupil lay the foundations of vocational choice."
   (d) "To assist the pupil to a proper interpretation of contemporary life."

TENNESSEE

MANUAL TRAINING (NON-VOCATIONAL)

Agriculture (non-vocational) (1) One unit in five double recitation periods of at least forty minutes each per week throughout the year. This time should be used for recitations, lectures, supervised study and general laboratory and field work. The subject matter of the first unit should be plant production, the home

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orchard and the home garden. There should be much practice in seed testing, pruning and spraying. Notebooks must be kept reporting in full all laboratory and field work.

(2) Second unit - A second unit will be given for a second year's work on the same time basis. The subject matter of the second unit should be animal husbandry and poultry. This course should afford practice in stock judging, milk testing, incubation of eggs, etc; Laboratory and field work is for the first unit.

TEXAS

SHOP WORK IN ACCREDITED HIGH SCHOOLS

GENERAL AIMS OF COURSE:-

(a) "To develop in the boy the capacity for organized thinking and doing through the planning and execution of interesting work from the boys point of view."

(b) "To broaden the industrial intelligence and mechanical ability of boys for general use in every-day life, through a course of training in the use of ordinary tools and methods of repair and construction in and about the home."

(c) "To develop an appreciation for and application of the fundamental subjects taught in the other departments of school work through their application and use in the projects done by the student in the school shop."

(d) "To develop an understanding of the industrial phases of our economic organization and an appreciation for the man who works with his hands as well as his head through the study of our economic life and the doing of productive work."

(e) "To build character through the development of self-esteem and pride in doing worthwhile constructive work in self-respect through worthwhile achievement from the boys point of view."

(f) "To give as large a variety of industrial experiences as the shop facilities will permit for vocationsl guidance values."

(g) "To give the beginning of vocational training to those boys who eventually enter the trades and industries as their life's work."

(h) "A knowledge of the fundamental processes applied to hand wood-working tools."

(i) "A knowledge of materials used in the woodworking industry."

(j) "To make the student an intelligent judge and consumer of woodworking products."

(k) "To develop an appreciation of good workmanship."

(l) "To develop an appreciation of good design."

(m) "To develop an appreciation of order and neatness in care of material things."

(n) "To develop habits of industry."

(o) "To develop an appreciation of industry and industrial processes."

UTAH

INDUSTRIAL ARTS (JR. HIGH SCHOOL)

TRAINING PURPOSES AND OBJECTIVES

"The spirit of exploration, guidance, try-out and self-discovery elsewhere manifest in the junior high school will be found especially significant in the industrial arts subjects. From every direction comes the challenge of modern industry for understanding and appreciation; every new mechanical devise introduced into our homes requires

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intelligent care, operations and repairs; every principle of science and mathematics calls for interpretation and application; and every boy is filled with the curiosity to know, and the urge to achieve. These same boys will soon be knocking at the doors of industry to enter and find their places."

"The functions of industrial arts instruction in the junior high school is to bring together the boys and the problems that await and intrigue them. The work, therefore, must meet the following standards:-"

1. "It must be widely representative of the fields of modern life and industry."
2. "It must have practical value for home and farm mechanics."
3. "It must illustrate the application of science and mathematics to industry."
4. "It should include instruction in the work and the qualifications and the opportunities for employment in each of the several fields covered."
5. "It should stimulate the boy to look forward to finding his own place in the world's work, and to prepare for participation in the same."
6. "It should develop interest and otherwise lay the foundation for worthwhile avocational activities."
7. "It should be planned to increase respect for labor and develop an appreciative understanding of the contribution of fellow workers to our modern life."
8. "It should give a knowledge of and appreciation for materials and standards of quality and workmanship that enter into many of the utilities of modern life."
9. "It should develop self-confidence and sane judgment. After receiving the training outlined in the industrial arts course, boys should be neither foolhardy, nor afraid in attacking problems that arise in the field of mechanics."
10. "It should cultivate the ideal and habit of constructiveness."

WISCONSIN

MANUAL ARTS

Aims:-

(1) "To develop ideals (ethical)"
(2) "To make the individual socially efficient (Socio-psychological)"
(3) "To promote industrial or vocational efficiency (Physio-sociological)"

WEST VIRGINIA

GENERAL PURPOSE OF THE INDUSTRIAL ARTS

"The industrial arts should contribute to worthy home membership through developing the desire and ability to maintain the home in good repair and to do those types of work which will not involve an extensive investment in tools and equipment. The industrial arts should seek to build in the student the right attitude towards the home and his place and part in it. They should establish firmly in his mind that he has a definite responsibility to this membership

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and his progress in this should be measured by his acceptance and fulfillment of this responsibility through suitable work performed in or about the home, duly reported, certified to, and recorded in his favor."

"In the same way they should make their contribution to the social and economic life of the home and community, through leading the pupil to see and share his obligations and responsibilities in everyday life. They should develop in him a respect for manual labor and those who labor with their hands through knowledge and experience gained in school."

"Through his contact with various media in the shop the pupil should gain some idea of the various skilled trades. He should learn the requirements and character of work demanded of those in the trades. His potential skill should be indicated and he should determine to what extent his interest is in the field of the trades. His industrial arts work should be used as a means of giving vocational guidance and may readily serve as a background for the study of other vocational activities."

"There is an outstanding need for the American people to become more intelligent consumers. This will come through a clearer understanding of and appreciation for good workmanship and a knowledge of what is good style and sound construction principles."

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TABLE VI

INDUSTRIAL ARTS TERMINOLOGY, OBJECTIVES, NUMBER OF SUBJECTS OFFERED, DISTRIBUTION OF COURSES BY GRADES, AND TIME ALLOTMENT FOUND IN 13 STATE COURSES OF STUDY

NAME	TERMINOLOGY	OBJECTIVES		NO. OF SUB JECTS	GRADES OFFER ED	TIME
		GENERAL	SPECIFIC			
1. Alabama	Manual Arts	x	x	7	1 - 12	---
2. Idaho	Industrial Arts	x	x	9	7 - 12	---
3. Kentucky	Industrial Arts	x	x	16	9 - 12	---
4. Missouri	Industrial Subjects	x	x	11	8 - 12	45-90min. per day
5. Nebraska	Manual Arts	x	x	9	-	---
6. New Hampshire	Practical Arts	x	-	7	7 - 8	140-180min per week
7. Oklahoma	Manual Training	-	-	2	9 - 12	1 yr to complete
8. Pennsylvania	Industrial Arts	x	-	9	7 - 9	---
9. Tennessee	Manual Training	-	x	2	9 - 12	80 min. per day
10. Texas	Shopwork	x	x	5	8 - 12	1 hr. per day
11. Utah	Industrial Arts	x	-	7	7 - 9	---
12. Wisconsin	Manual Arts	x	x	13	7 -10	---
13. West Virginia	Industrial Arts	x	-	9	7 -12	5 hrs per week recom.

x ---Listed
- ---Not Listed

The above data show the following facts:-

(a) Three of the 13 state courses of study do not differentiate closely between Industrial Arts and Vocational Education.
(b) Six of the 13 courses state both general and specific objectives for the Industrial Arts or for particular Industrial Arts subjects. Five courses list general objectives only; one course lists specific objectives only; and one course fails to state either a general or specific objective.
(c) All of the courses list suggestive subjects to be taught. These vary from two to sixteen subjects.
(d) Twelve of the 13 courses list the grades in which Industrial Arts subjects are taught. These offerings range from the first to the twelfth grade inclusive.
(e) Seven of the 13 courses fail to list the time allotment. The time varies considerably and is stated in minutes per day, hours per day, hours per week, etc.

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CITY COURSES OF STUDY

OBJECTIVES

ABERDEEN, SOUTH DAKOTA

The objectives are divided into two divisions; Main and secondary. The former consists of the following:- (1) Vocational, (2) Home Building, (3) Character formation, (4) Worthy use of leisure, (5) Physical Development. While the latter consists of (1) General education, (2) Sense training, (3) Utilitarian, (4) Pre-vocational, (5) Cultural.

It is not expected that the aims and objectives will be the same for everyone. For instance one pupil may take the work for specific occupational training, intending to use it as a means of livelihood. While another may choose it for its general educational values.

ALBANY, N.Y.

"The controlling aim of the Industrial Arts is industrial intelligence and not a high degree of manipulative skill. Not everyone is a producer of industrial products but everyone is a consumer of industrial products. Hence an intelligent knowledge of labor, industry, industrial processes, material, etc., will make better members of society."

AMARILLO, TEXAS

GENERAL AIMS

1. "To develop in the boy the capacity for organized thinking and doing through the planning and execution of interesting work from the boy's point of view."

2. "To broaden the industrial intelligence and mechanical ability of boys for general use in every day life through a course of training in the use of ordinary tools and methods of construction in and about the time."

3. "To develop an appreciation for an application of the fundamental subjects taught in the other departments of school work through their application and use in the projects done by the pupil in the school shop."

4. "To develop an understanding of the industrial phases of our economic organization and an appreciation for the man who works with his hands as well as his head through the study of our economic life and the doing of productive work."

5. "To build character through the development of self-esteem and pride in doing worth-while constructive work - self-respect through worthwhile achievement from the boy's point of view."

6. "To give as large a variety of industrial experiences as the shop facilities will permit for vocational guidance values."

7. "To give the beginnings of vocational training to such boys who will eventually enter trades and industries as their life work."

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AUSTIN, TEXAS

"The course of study in Manual Training is designed to serve a twofold purpose: (1) To satisfy the demands of academic and cultural aims in Manual training; and (2) to conform with the ideals of Manual Training for vocational ends."

BALTIMORE, MD.

"The purpose of Industrial Arts in the junior high schools is to lay a broad foundation of experience and information that will assist each pupil to interpret the social and industrial forces at work in his environment, to the end that he may make a wise and intelligent choice of his life work and thus develop into an efficient and loyal citizen."

BAYONNE, NEW JERSEY SHOPWORK

Objectives:

1. "Ability to perform those unspecialized activities about the house, car, garden, etc., that cannot be learned at home."
2. "Ability of a pupil to express himself by means of a drawing"
3. "Ability to judge properly, as a consumer, of the quality and worth of such work and such products of industry as contribute to home or family maintenance."
4. "Ability to choose an occupation more intelligently after proper exploratory experiences in school."
5. "Ability to think of labor intelligently. The ability to think of an occupation in terms of its rewards, compensations, and hazards, both present and future, and mental and physical."
6. "Ability to comprehend and intelligently follow in literature the world's progress industrially."

BERKELEY, CALIFORNIA

OBJECTIVES

ELEMENTARY:-

"For the average boy. . . training in the elementary grades serves as a basis for judgment in selecting his course in higher training. In the fourth, fifth and sixth grades, therefore emphasis should be given to the values that manual training has in developing physical, civic, moral and avocational efficiency."

JUNIOR HIGH SCHOOL:-

"The fundamental basis for industrial courses in this level is "finding". The major objectives are vocational efficiency, civic efficiency, physical efficiency, avocational efficiency, and moral efficiency."

SENIOR HIGH SCHOOL:-

"The industrial work in the senior high school consists of two types. One of which is specific trade training; the other for general educational purposes. Both types have as their major objectives, which are the same in kind only different in degree; vocational efficiency, avocational efficiency, physical efficiency, moral efficiency, civic efficiency."

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BOISE, IDAHO

"The aim of the Industrial Arts courses is to train students in the skillful use of the various trades, to have a working knowledge of the principles and methods of the industrial world, and to be better prepared for a useful and profitable vocation in life. One who has had work in this department should have a broader appreciation of good workmanship and of the men engaged in the skilled trades."

BRISTOL, TENN.

(1) "To develop a general industrial intelligence by acquainting the pupil with the essential features of his industrial environment."

(2) "To assist the pupil in determining his life work."

(3) "To develop an appreciation of the beautiful in the common things of life."

(4) "To develop the maximum amount of manipulation consistent with recognized educational principles for the purpose of giving preliminary training for industrial occupations and that the pupil may be more, resourceful, and acquire the ability to do things for himself."

CANTON, OHIO

1. "To increase the pupils power of self-expression in some concrete and tangible form."

2. "To enlarge his field of vocational choice by helping to discover aptitudes and special interests positively or negatively inclinated to vocational arts andtrades, and to learn the language of industry."

3. "To broaden his social vision through an interpretation of the industrial world, using as a means the productive work of some industry or a number of allied industries, and to utilize this organized industrial activity as a factor in general education."

4. "To render service to the home, to the school, and to the community."

CLEVELAND, OHIO

Example: - (9th Grade Shopwork)

1. "To contribute to general intelligence and education."

2. "To provide the basis for educational and vocational guidance."

DALLAS, TEXAS AIMS

1. "To cultivate and develop the mechanical ingenuity of the individual."

2. "To enable students to apply physical principles to practical work."

3. "To develop ability to read blue prints and adapt them to practical work."

4. "To develop the power of visualization."

5. "To develop ability to interpret the ideas of others as expressed in drawing."

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6. "To train the pupil to plan and execute necessary repairs and necessary or desirable simple constructions."
7. "To develop habits of observation and appreciation and a just pride in personal accomplishment."
8. "To give a practical knowledge of simple mechanical devices and of materials in common use."

DETROIT, MICHIGAN

The Detroit course of study publishes each activity in separate booklet form. Hence each activity has its own specific aims listed separately.
EXAMPLE - - - AUTO MECHANICS
Aims:-
1. "To discover the possible aptitudes of the students for automobile work."
2. "To familiarize the students with the essentials of automobile construction, maintenance and repair, as an aid in making an intelligent choice of a vocation."
3. "To give the students information that will help them in later life to intelligently operate and maintain an automobile."
4. "To develop intelligence, insight, initiative and thinking power in connection with their life experiences."

DULUTH, MINNESOTA

1. "To provide a means of general educational development."
2. "To provide a medium for educational guidance."
3. "To provide subject matter of value not only in itself but which will also provide the student with the equipment necessary to perform those duties of labor and citizenship which he is most likely to perform anyway."
4. "To provide sufficient variation in courses to meet the specific needs due to the difference between individuals."

ELIZABETH, NEW JERSEY

"The purpose of the practical arts course is to furnish means for expression, to provide opportunity for investigation and exploration, to develop the ingenuity of the boy, and to assist in the choice of a vocation, to the end that pupils may become efficient producers and more intelligent consumers appreciative of their relations to others and conscious of their duties and responsibilities as citizens."

EL PASO, TEXAS Aims of the work

1. "To acquaint boys with the common tools and their uses."
2. "To provide in the school course work that will appeal to the natural instincts of the pupil and at the same time be of some practical value to him when he becomes a man."
3. "To promote accurate thinking which may be brought about by accurate and orderly operations."
4. "To teach the boy how to read blueprints and working drawings."
5. "To acquaint the boy with woods, as to properties, growth and uses."

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6. "To train in habits of neatness and systematic work."
7. "To instill in the boy a desire to do good work."
8. "To make every boy honorable and self-reliant."
9. "To teach an appreciation of good design."
10. "To develop the mind and body to work in harmony, and to stimulate initiative and inventiveness."

FORDSON, MICHIGAN

1. "To develop handiness."
2. "To promote the immediate carrying over of ideas into action."
3. "To help through exploratory courses in the discovery of special interests and attitudes important for proper education and vocational guidance."
4. "To provide a means for developing technical akill."
5. "To provide a means for imparting technical knowledge."
6. "To enable the pupil to apply the test of practice to some of his thinking."
7. "To develop the mind by providing constructive problems, in materials which demand a vigorous mental reaction."
8. "To interest in school work through the concrete application of theory to practice, those pupils to whom the academic studies do not appeal strongly."
9. "To create interest in the arts and industries without any reference to their vocational significance."
10. "To enable the pupil, through the making of minor repairs and the undertaking of minor construction in the home to contribute to its economic and material upkeep."
11. "To enable the pupil through participation in cooperative problems, to perform better his duty as a member of his home, his school, and his country."
12. "To serve as an introduction to vocational and prevocational training."

FRESNO, CALIFORNIA

JUNIOR HIGH SCHOOL

1. "To discover and direct human industrial abilities and interests."
2. "To give the adolescent child a more definite understanding of his industrial environment."
3. "To give information and training which will function directly in relations to the home."
4. "To develop an appreciation and respect for industry and labor."
5. "To aid the pupil in vocational choice."
6. "To expose the boy to as many manipulative experiences as time permits."
7. "To offer work which will be valuable as the pupil grows older, regardless of the vocation they may follow."
8. "To develop character and good citizenship through proper school student and teacher relationships in the shop."

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GRAND ISLAND, NEBRASKA

HOME MECHANICS

1. "To acquaint the pupil with the devices commonly found in the home."
2. "To develop a certain amount of skill in making home repairs."
3. "To develop an interest in the home and an appreciation of its responsibilities."
4. "To give a practical working knowledge of the fundamentals of a number of industrial occupations."
5. "To train the pupil to plan and execute necessary repairs and necessary or desirable simple constructions."
6. "To develop self-reliance, confidence and initiative in an emergency."
7. "To develop habits of observation and appreciation and a just pride in personal accomplishment."
8. "To teach habits of thrift and a wholesome respect for the furnishings and appliances of the home, the school and the community."
9. "To give opportunity to try out simple processes in a variety of simple industrial activities."
10. "To give a practical knowledge of simple mechanical devices and of materials in common use."
11. "To teach the typical uses of common tools."
12. "To train the pupil to work from verbal and written directions and from drawings."
13. "To give an insight into a variety of industrial occupations which may discover interests, aptitudes and skills which will be suggestive in guidance."

HAMTRAMCK, MICHIGAN

TRY-OUT COURSES - JUNIOR HIGH SCHOOL

"The purpose of these tryout and finding courses is to give the pupil a working experience in various occupations, which along with occupational study and vocational counseling will better enable him to intelligently choose the vocation for which he is best adapted, and in which he is most interested. The courses should also develop in the boy the proper attitudes of service, safety first, cooperation and economy that have educational value. The student will develop the ability to intelligently use and care for the common tools of the trade."

GENERAL SHOP - JUNIOR HIGH SCHOOL

"The controlling purpose of instruction given in this course shall be to increase the vocational intelligence of the student and provide for his social and economic adjustments. The course is general in nature serving the needs of tryout, trade preparatory and trade extension. The phases of industry included are sheetmetal, plumbing, electric wiring, shoe repair, and other miscellaneous material."

SENIOR HIGH SCHOOL COURSES

Example: - Auto Mechanics

"The aims and purposes of these courses is to provide training through the medium of the automobile, the general and technical educational value of which should so develop the student that he will be better able to meet the vocational and social problems of his environment."

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HURON CITY, SOUTH DAKOTA

(Home Mechanics)

"To teach boys to master as many as possible of the common skills necessary to the solution of everyday problems in the allotted time. No attempt is made to prepare for, or introduce, any vocation."

HOUSTON, TEXAS

Objectives (8th Grade)

1. "To gain general information about lumber. Calculation of board measure."
2. "To learn the general uses of lumber; the various kinds and grades."
3. "To gain a knowledge of common tools used in wood working trades."
4. "To acquire some proficiency in the proper care and use of tools and tools processes."
5. "To learn about the various kinds of finishes and finishing materials."

ITHACA, NEW YORK

(1) "To teach through practice those principles and processes in manual arts which will function in actual life use.
(2) "To familiarize the pupils with the materials and conditions existing in the major fields, thus aiding them in appreciation and judgment of industrial products.
(3) "To assist pupils in finding what type of educational work is best adapted to their individual needs. (This stresses educational guidance rather than vocational guidance.)"

KANSAS CITY, MISSOURI

1. "To introduce the child to the great world of work through experience, study and visitation, as a means of assisting him in a future vocational choice."
2. "To cultivate in the mind of the child a wholesome respect for work and a recognition of its place in our social structure."
3. "To cultivate proper habits of work which will be carried over into future activities."
4. "To acquire certain motor skills as contributing agencies to general handiness."
5. "To discover initiate and develop latent aptitudes and abilities in the industrial field."
6. "To teach the child those facts and principles which will enable him to become a more intelligent consumer of industrial products."

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LANCASTER, PA.

"It is essential that the students should know the purpose of tools, their handling and proper care, so that their work may be accomplished not only with the greatest ease but in a workmanlike manner."

"We should impart to the students the worthiness of being good mechanics and in conjunction with the guidance offered by the academic department, they should be assisted to the greatest extent possible in determining the best field for which they are adapted in earning a livelihood."

LARAMIE, WYOMING

1. "Aid through concrete relationship, in giving meaning and purpose to other school subjects."
2. "Add to the pupil's educational and social development through acquaintance with industrial activities."
3. "Develop personal traits of patience, perseverance, industry, responsibility."
4. "Develop habits of accuracy, thoroughness, and neatness."
5. "Provide opportunity for development of the creative instinct and originality and initiative in selection, design and execution."
6. "Develop appreciation of good workmanship and good taste in house furnishing."
7. "Contribute to the economy of home."
8. "Give knowledge of practical working tools."

LOS ANGELES, CALIFORNIA

GENERAL EDUCATION OBJECTIVES (JUNIOR HIGH SCHOOL)

1. "To satisfy that desire in every boy to express himself through the medium of tools and materials."
2. "To develop "Handy man" abilities through repair and construction work for home, shop and office use."
3. "To assist in better choice and use of industrial products and services."
4. "To gain a sympathetic attitude toward the laboring man with an appreciation of the importance of his work."
5. "To give the boy an avocation or hobby."
6. "To develop habits of neatness, orderliness accuracy, cleanliness, etc."

NORFOLK, VIRGINIA OBJECTIVES: Example: Metal Work

1. "Add to the pupil's educational and social development through acquaintance with several different industrial activities."
2. "Develop desirable personal traits, particularly persistence in meeting difficulties."
3. "Cultivate habits of precision and an appreciation of the extreme accuracy of measurement required in mechanisms."
4. "Give acquaintance with various metals in common use, their properties and action."

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5. "Give practical working knowledge of the use of some of the essential metal working tools."
6. "Contribute to the economical upkeep of the home."
7. "Contribute to educational guidance and vocational outlook through knowledge of the various metal working industries."

OAKLAND, CALIFORNIA

Example of specific objectives (7th and 8th Grades)

1. "To arouse and hold the interest of the pupils."
2. "To teach correct methods of handling tools so that good technique may be acquired by the pupils."
3. "To accompany the tool work with a study of materials and tools in their relation to industry. In the woodworking shop, attention is to be given to the study of trees, their growth, classification, characteristics, and use; also, to the proper method of staining and finishing the project."
4. "To give mechanical drawing only as related to the work done."
5. "To teach the principles of construction in wood through observation, illustration and experience."
6. "To give problems which involve invention and design, thereby stimulating individual initiative on the part of the pupils."

OKMULGEE, OKLAHOMA

Example: ELECTRICITY (BROADENING AND FINDING COURSE-JUNIOR HIGH SCHOOL)

1. "To help the boy discover the opportunities offered in the electrical field."
2. "To exhibit a cross section of the electrical work as carried out in the senior high school so that the pupil may be able to choose the curriculum for which he is best fitted."
3. "To give the student an opportunity to experiment with and to study electrical apparatus not ordinarily found in the home."
4. "To discover any special ability in the field of electricity."

PITTSBURGH, PA

Example: TENTATIVE EXPLORATORY COURSE IN MECHANICAL DRAWING.

1. "To make quickly, neat, free-hand isometric or perspective and working drawing sketches."
2. "To develop the power of visualization."
3. "To make neat mechanical drawings and to prepare for more advanced technical training."

PUEBLO, COLORADO

1. "To provide a means for a general development and education."
2. "To provide a medium for educational guidance."
3. "To provide for laying the foundational for vocational training in industry."

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ST. CLOUD, MINNESOTA

THREE COMMONLY ACCEPTED AIMS

1. "To provide opportunities for boys to make and do the things they like to do."
2. "To give training in the common usable skills everyone should possess."
3. "To provide technical exploratory or tryout experiences in the shops representing typical industrial occupations, in order to help the boy determine whether they possess general mechanical aptitudes or possibly some special one."

FIVE SPECIFIC ADDITIONAL AIMS

4. "To give related or industrial art training in order to develop an appreciation of art as applied to industry and to develop intelligent, discriminating consumers of industrial products."
5. "To give information about occupations represented in the various shops, and other occupations closely allied with them."
6. "To provide educational guidance, in which occupations study forms a background."
7. "To give an insight into present day industrial problems of a social and economic nature faced by capital, labor and the general public."
8. "To give training in problems solving, as opposed to the students copying models and blindly following directions."

ST. LOUIS, MISSOURI

GENERAL OBJECTIVES

1. "To acquire industrial knowledge for general information rather than for specific vocational training."
2. "To acquire information which will form a basis for entrance into technical courses in engineering college or industry."
3. "To develop the ability to analyze plan and perform mechanical tasks."
4. "To develop such habits as neatness, accuracy and perseverance in the performance of mechanical tasks."
5. "To develop initiative and reliance in attacking mechanical problems."
6. "To develop a sense of the appropriateness and an appreciation of the best mechanical construction and design."
7. "To develop the powers of attention, observation, imagination and judgment."
8. "To develop the power of individual expression through knowledge of and the use of materials, processes and tool manipulation."
9. "To develop an appreciation of and a demand for good workmanship."
10. "To develop the desire to attain a high standard in the performance of mechanical activities."
11. "To acquire knowledge which enlarges the scope of activities for one's profitable use of leisure."
12. "To develop a desire to do simple tasks in and about the home which contribute to its economic upkeep."

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13. "To develop a desire to participate in school and community activities."
14. "To develop the power of visualization."
15. "To acquire and use a technical vocabulary."
16. "To acquire a knowledge of some of the materials and processes used in industry."
17. "To develop an interest in the economic and social problems of industry."

ST.PAUL, MINNESOTA

"Manual training work in the high schools of St.Paul is carried on for the purposes of general education and culture."
"Incidentally the work functions somewhat along the lines of vocational guidance and trade preparatory work. The informational side of the work is emphasized, and the relation of the training to life in general is brought out."

SANTA BARBARA, CALIFORNIA

1. "General development and education through experience with the tools, materials, and processes employed in economic fields."
2. "Guidance
a. Vocationa - "Courses which make the intelligent choice of a vocation not only possible but probable."
"Vocational guidance, properly conceived organizes school work so that the pupil may be helped to discover his own capacities, aptitudes, and interests may learn about the character and conditions of occupational life, and may himself arrive at an intelligent vocational decision."
b. Educational
c. Moral
3. "Experience necessary for appreciating all forms of labor in the economic world."
4. "Intelligent appreciation of the value of the well appointed home and of the labor and skill required to make such a home."
5. "Preparation for the performance of many kinds of unspecialized activities about the house, garden, motor car, etc."

SCHENECTADY, NEW YORK

"The general objectives are not stated in the course of study as it is considered unnecessary to include them for the use of experienced teachers. In lieu of these the abilities and information considered essential for pupil development are listed so that pupils, parents and teachers may have a definite understanding as to attainments and requirements."

SIOUX CITY, IOWA

GENERAL OBJECTIVES
JUNIOR HIGH SCHOOL (METAL WORK)

1. "To provide information and a wide range of experience that equip the pupil for citizenship."
2. "An agency of selection to aid pupils to find themselves."
3. "To make intelligent use of materials."

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THE PREVOCATIONAL SHOP

"To lay a good foundation for an earning career and develop a wholesome attitude toward life, its problems, rights and duties."

SENIOR HIGH SCHOOL

Example: MECHANICAL DRAWING

1. "To acquire industrial knowledge for general information rather than specific vocational training."
2. "To develop the power of attention, observation, imagination, and judgment."
3. "To develop the desire to attain a high standard in the performance of technical activities."
4. "To furnish an agency of selection to aid individuals to find themselves economically."

SUPERIOR, WISCONSIN

OBJECTIVES (METALWORK - 8th and 9th Grades)

1. "Present relationships giving meaning and significance to other school activities, particularly mathematics."
2. "Develop the social spirit through cooperative relationship with other departments of the school."
3. "Add to the pupils educational and social development through acquaintance with industrial activities."
4. "Develop desirable personal traits, particularly persistence in meeting difficulties."
5. "Cultivate habits of precision and an appreciation of the extreme accuracy of measurement required in mechanism."
6. "Give acquaintance with various metals in common use, their properties and action."
7. "Give practical working knowledge of the use of the essential metal working tools."
8. "Contribute to the economic upkeep of the home."
9. "Render service to the school, the home and the community."
10. "Contribute to educational guidance and vocational outlook through knowledge of the various metal working industries."

TACOMA, WASHINGTON

1. "It appeals to the desire to create things, a fundamental interest of man."
2. "It provides opportunities for developmental experiences."
3. "It provides information about industry and manufacture and presents experiences and information of value to buyers and users of the products of industry."
4. "It assists the boy to determine his likes and dislikes and helps him to determine upon a vocation."

TOPEKA, KANSAS

"The general objectives of manual arts instruction are the same as the general objectives of the instruction in all other subjects."

"The manual arts contribute in a very definite way to a realization of the seven principle objectives of education. While the method of contributing to these aims differs from the methods followed in other subjects we believe that this difference in the type and method of contribution aids materially in developing the highest type of self reliant citizens."

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WALLA WALLA, WASHINGTON

SPECIFIC OBJECTIVE - Example. (Elementary Electricity)

"First, that every modern home is supplied with it for light, heat and power. It therefore, behooves every boy in this day and age, to know something about it, how to control it, how to use it intelligently and to know how to use and repair electrical equipment and appliances which are so commonly used in the home."

"Second, it prepares the student for training in the electrical trades. There is always room for boys and men with good training in the electrical field."

WHEELING, WEST VIRGINIA

"It is simply general training and industrial appreciation which includes design and construction with theory and practice in as many subjects as possible; while terms and processes used in industrial work are brought to the student's notice."

WILLIAMSPORT, PA.

"The basic objective at present is exploration, and consequently the activities correspond approximately to the activities offered in the senior high school industrial courses. Since the latter are selected on the basis of careful surveys of the industries, the junior high school activities represent the basic industries of the city."

YORK, PA.

No aims are stated for the work given below the high school.

HIGH SCHOOL CO-OPERATIVE INDUSTRIAL DEPARTMENT

AIM:-

"It offers to all high school boys an opportunity to learn a trade and at the same time to acquire, with the omission of a few branches, the usual high school education."

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TABLE VII

INDUSTRIAL ARTS TERMINOLOGY, OBJECTIVES, NUMBER OF SUBJECTS OFFERED, DISTRIBUTION OF COURSES BY GRADES AND TIME ALLOTMENT FOUND IN 45 CITY COURSES OF STUDY

NAME	TERMINOLOGY	OBJECTIVES		NO. OF SUB-JECTS	GRADES OFFERED	TIME
		GEN'L	SPECI-FIC			
1. Aberdeen, S.Dak.	Manual Arts	x	x	8	7 - 12	- -
2. Albany, N.Y.	Industrial Arts	x	-	5	7 - 8	- -
3. Amarillo, Texas	Industrial Arts	x	x	5	7 - 10	3¾-7½ hrs. per week
4. Austin, Texas	Manual Training	x	x	9	7 - 12	per week 2¼-7½ hrs.
5. Baltimore, Md.	Industrial Arts	x	x	7	7 - 9	1 semester
6. Bayonne, N.Y.	Manual Training& Industrial Arts	x	x	10	7 -9	2-6 Periods per week
7. Berkeley, Calif	Manual Training Pre-Vocational Industrial Vocational & Non-Vocational	x	x	29	4 - 6 6 - 9 9 - 12	2 to 7 one hour periods per week.
8. Boise, Idaho	Manual Arts	x	x	6	8 - 12	10 hrs. per week
9. Bristol, Tenn.	Industrial Arts	x	x	1	4 - 7	- - -
10. Canton, Ohio	Industrial Arts	x	x	2	7 - 8	2 hrs. per week
11. Cleveland, Ohio	Manual Arts	x	x	6	7 - 12	1 semester
12. Dallas, Texas	Manual Arts	x	x	7	8 - 12	- - -
13. Detroit, Mich.	Industrial And Manual Arts	-	x	12	7 - 12	- --
14. Duluth, Minn.	Manual Arts	x	x	15	7 - 12	9 weeks.
15. Elizabeth, N.J.	Practical Arts	x	x	5	7 - 9	- - -
16. El Paso, Texas	Manual Arts	x	-	8	4 - 12	1½-5 hrs. per week
17. Fordson, Mich.	Industrial Education	x	x	7	6 - 9	2-7 one hr periods per wk
18. Fresno, Calif.	Industrial Education	x	x	12	7 - 12	- --
19. Grand Island, Nebr.	Home Mechanics	x	x	6	8	6 weeks per unit
20. Hamtramck, Mich.	Vocational Education	x	x	10	7 - 12	3-15 hrs. per week
21. Huron City, S. Dak.	Home Mechanics	x	-	6	-	6 weeks per unit
22. Houston, Texas	Industrial Arts	-	x	1	8	-- -

x --- listed
- --- not listed

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TABLE VII (Continued)

INDUSTRIAL ARTS TERMINOLOGY, OBJECTIVES, NUMBER OF SUBJECTS OFFERED, DISTRIBUTION OF COURSES BY GRADES AND TIME ALLOTMENT FOUND IN 45 CITY COURSES OF STUDY

NAME	TERMINOLOGY	OBJECTIVES		NO. OF SUB-JECTS	GRADES OFFERED	TIME
		GEN'L	SPECI-FIC			
23. Ithaca, N.Y.	Manual Arts	x	x	8	7 - 9	- - -
24. Kansas City, Mo.	Industrial Arts	x	x	14	6 - 9	3 hrs. per week
25. Lancaster, Pa.	Industrial Arts	x	x	6	7 - 9	1-2 periods per week
26. Laramie, Wyo.	Manual Arts	x	-	1	5 - 8	2 periods per day
27. Los Angeles, Calif.	Industrial Arts	x	x	35	7 - 12	5-20 prds. per week
28. Norfolk, Va.	Manual Arts	x	x	6	7 - 12	2 periods per day
29. Oakland, Calif.	- - - - -	x	x	3	7 - 12	1 yr.
30. Okmulgee, Okla.	Industrial Arts	x	x	28	7 - 12	- - -
31. Pittsburgh, Pa.	- - - - -	-	x	5	9 - 12	1 semester
32. Pueblo, Colo.	Industrial Arts	x	x	7	6 - 12	- - -
33. St. Cloud, Minn.	Manual Arts	x	x	8	7 - 9	1½ hrs. per day
34. St. Louis, Mo.	Manual Arts	x	x	8	10-12	- - -
35. St. Paul, Minn.	Manual Training	x	x	14	7 - 12	3/4 hrs. per day
36. Santa Barbara, Calif.	Industrial Arts	x	x	7	7 - 9	10-15 wks per semester
37. Schenectady, N.Y.	Industrial Arts	-	x	6	7 - 9	- - -
38. Sioux City, Iowa	Manual Arts	x	x	5	7 - 12	- - -
39. Superior, Wis.	- - - - -	x	-	1	8 - 9	- - -
40. Tacoma, Wash.	Practical Arts	x	x	11	7 - 12	½ -6 semester 5-10 pds per week
41. Topeka, Kansas	Manual Arts	x	x	6	5 - 9	1 semester each
42. Walla Walla, Wash	Vocational Dept.	x	x	12	7 - 12	1½ hrs per day.
43. Wheeling, W. Va.	Industrial Arts	x	-	11	5 - 12	24-135 hrs. per semester
44. Williamsport, Pa.	Industrial Arts Industrial Educa	x	x	7	7 - 12	2 hrs per wk 15 hrs per wk
45. York, Pa.	Manual Training	-	-	1	6 - 8	- - -

x --- listed
- --- not listed

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These data show that,

(a) Thirteen of the 45 City Industrial Arts Courses which are presumably given for general educational purposes, include vocational work or some of its aims in their objectives.

(b) Thirty six of the 45 courses list both general and specific objectives, either for the Industrial Arts as a whole or for the particular subjects. Six of the courses list general objectives only; four courses list specific objectives only; and one course fails to list either general or specific objectives.

(c) All of the courses list a certain number of subjects to be taught. These subjects vary from one to twenty eight in number.

(d) All but one of the courses lists the grades in which Industrial Arts are offered. These offerings range from the first to the twelfth grade inclusive.

(e) Fifteen of the courses fail to state a time allotment. The time alloted to the Industrial Arts, in the remaining thirty courses, shows considerable variation. These allotments are stated in minutes per day, hours per week, weeks, semester, year, etc.

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SUMMARY AND CONCLUSIONS RELATIVE TO STATE AND CITY INDUSTRIAL ARTS COURSES OF STUDY

1. There are comparatively few courses of study available in this field of education.
2. More than twenty five per cent of the courses reviewed, show a tendency to include aims and objectives, that belong to vocational education.
3. A large number of courses are indefinite relative to objectives, the grades in which the work is offered, the time allotment, informational materials, references, etc.
4. There appears to be a growing tendency to either work out new courses of study, revise old courses, and to take a critical attitude toward much of the content material that is found in present Industrial Arts Curricula.

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Chapter VII

OBJECTIVES, RECOMMENDATIONS AND CRITICISMS OF THE INDUSTRIAL ARTS, AS REVEALED BY SCHOOL SURVEYS, TEXTBOOKS AND EDUCATIONAL LEADERS.

In order to determine past procedures, claims, and criticisms, in the field of industrial arts education, the writer turned to three sources, viz. - the school survey, textbooks in the field of secondary education and a limited number of recognized educational authorities.

(a) The School Survey - All the available school surveys were examined and of these fifteen were selected for their particular mention of manipulative work.

(b) Textbooks - As the major portion of industrial arts work falls in the field of secondary education, some forty odd books were examined in this field of which fifteen were selected that definitely mentioned such work as "industrial education", "practical arts work", "manual arts", "manual training", "Industrial arts", etc.

(c) Educational Authorities - In order to secure valid criticisms of the industrial arts, letters were sent to the twelve members of the Curriculum Committee of the 1926 Year-book of the National Society for the Study of Education and eight authorities in the field of industrial arts, asking them to list the defects of the present industrial arts work. Replies were received from fourteen of these men; eight of whom suggested references in books which they had written, while six forwarded definite statements which appear below.

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SCHOOL SURVEYS

BALTIMORE, MD.[1]

Commendations

1. A few teachers of exceptional ability who were using the local industries industrial products, libraries, and field trips to vitalize school work.

Criticisms

Grades 1 to 6

1. No definite time allotment.
2. Little work done.
3. Course of study obsolete and unjustifiable.
4. Work not unified.

Recommendations

1. The elementary school
   a. The introduction of a unified practical arts course of study that will represent such fields, as have to do with textiles and clothing, foods, cooking, drawing and the fine arts.
2. The junior high school
   a. The introduction of a curriculum in which industrial arts courses are on a par with the other subjects.
   b. The introduction of the 'general shop'.
   c. The introduction of guidance and 'life career classes'.
   d. Part-time cooperative classes for those who must leave before graduation.
   e. A one year trade or vocational course following the eighth grade.
   f. More industrial work for slow and subnormal students.
   g. Evening trade or vocational classes for young men and women who are working and desire to improve themselves.
3. The senior high school (Baltimore Polytechnic Institute)
   a. Retention of present curriculum.
   b. Addition of a course to prepare for immediate entrance into industry.

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1. Strayer, G.D. Baltimore School Survey. 1920-1921. Vol.II. p.140-141; p.248-249; p.263

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BOISE, IDAHO[1]

Commendations

1. A fine coordination between the work in agriculture, manual training and mechanical drawing in the high school.

Criticisms

1. Inadequate course of study for grades 5 to 8B inclusive.
2. Educational and vocational guidance neglected.
3. Insufficient subjects offered.

Recommendations

1. Provide an adequate course of study.
2. Substitute some academic subjects for industrial subjects.
3. Connect the industrial life of the community with the schools.
4. Provide a "reasonable" program of educational and vocational guidance.

BUTTE, MONTANA[2]

Commendations

1. A high grade of workmanship.
2. An excellent teaching staff.
3. Good equipment.

Recommendations

1. Increase the time allotment.
2. Extend the work through the grades.
3. Introduce new lines of work.
4. Add several more centers and equipment.
5. Emphasize the content value and the thought element in the work.

CLEVELAND, OHIO[3]

Findings

1. An average amount of time is alloted in the grammar grades.
2. Below the seventh grade less than the average amount of time is alloted.
3. A single sample is considered sufficient for all, except those who

1 Sears, J.B. - The Boise Survey. P.232; p.73; p.260-61. The World Book Co., Yonkers-on-Hudson. New York, 1920

2 Report of a survey of the school system of Butte, Mont., June 2, 1924 p.59-60

3 Ayres, L.P. - The Cleveland School Survey. p130-31. Summary Vol. The Survey Committee of the Cleveland Foundation. 1917

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expect to enter a technical or special school. Joinery and cabinet-making have been chosen as the sample.

4. It is given for its disciplinary values.
5. The work is not valued highly by the teachers.

Recommendations

1. "That manual training be continued, extended, and diversified with the double object of helping solve the problems of vocational guidance and acquainting boys with the nature of work and work responsibility through experience".

FORT LEE, N.J.[1]

Recommendations

1. Pupils should have opportunities to engage in activities in which they are likely to succeed.
2. Shop work and vocational training should be given in the junior high school.
3. Some of the older pupils in the junior high school can profitably begin definite vocational training.
4. Definite work in guidance should be provided.
5. Short shop try-out courses should be provided.

GARY, INDIANA [2]

Findings

(Aims as stated by Gary, Indiana, school authorities)

1. Every boy throughout his school career shall have ample opportunity to participate in numerous forms of industrial work.
2. For pupils below sixteen years of age, it bears but incidentally upon direct occupational preparation. Its primary purpose is the general development of the pupil.

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1 Report of the Survey of the Schools of Fort Lee, N.J. p.104-5, Bureau of Publications, Teachers College, Columbia University, New York, 1927.

2 Richards, C.R. - The Gary Public Schools - Industrial Arts Work. p.106-22. General Education Board, 61 Broadway, New York. 1918

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3. In so far as possible, the activities shall be representative of the work done by men and women in the commercial and industrial world.
4. All the teachers shall be skilled craftsmen in their various trades.
5. Much of the work done by teachers and pupils shall have a commercial value.
6. It is impractical at present to do much work for the home or market that will have a commercial value.
7. In order to secure practical work that has a commercial value, the teachers and pupils shall be responsible for the maintenance, repair and upkeep of the plant, and manufacture such commodities as are needed by the schools.
8. In order that manual experiences may reach their full educational value, they shall be supplemented by sufficient related information to make them worthwhile and illuminating.

Commendations

1. Pupils showed an interest and enjoyment in their work.
2. A find spirit exists between the pupils and the teachers.
3. Pupils gain first hand contacts with industry.

Criticisms

1. No provision is made for specialization.
2. School shops cannot parallel commercial shops on any large bases.
3. The character and nature of the work is too limited.
4. The methods are too empirical.
5. The nature of the work permits little time for instruction.
6. The nature of the work (maintenance and repair) sometimes takes the instructor away from the shop for long periods of time.
7. Little provision is made for supplying related information, related materials and appreciations.
8. There is no correlation between shops and related work.

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9. No notes are taken or test given.

10. There is a lack of supervising control.

Recommendations

1. Represent the cultural point of view, as this tends to make a rich contribution to educational practice.
2. Introduce a greater breadth of instruction.
3. Provide for proper supervision.
4. Provide for some election of subjects when boys reach the age of fourteen.
5. Permit specialization for those who must enter industry at an early age.

HAMMONTON, N.Y.[1]

Recommendations

1. Include work in the course of study in the vocations in which the majority of the people are engaged (light manufacturing and the raising of small fruits, vegetables and cranberries) and in which a large proportion of the pupils will doubtless engage when leaving school.

PHILADELPHIA, PA.[2]

Findings

1. There is little in common between the fifth and sixth grades, and the seventh and eighth grades. There are distinct sets of teachers, supervisors, shops and no unity of purpose.
2. The work of the seventh and eighth grades is confined entirely to woodwork.
3. Each teacher constructs his own course of study.
4. The equipment is sufficient to meet the present needs of the course of study.
5. Industrial Arts (mechanic arts) is offered in the high school.

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1 Report of the Survey of the Schools of the Town of Hammonton, N.J. p. 84. Bureau of Publications. Teachers College, Columbia University, New York city, 1926

2 Pa. Dept. of Public Instruction - Philadelphia School, 1921, Survey Book III. Part III, p. 180-293

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6. Drawing is given throughout the four years of high school and varies as to aim and content in the different schools.

Recommendations

1. Provision for better articulation between the elementary school, junior and senior high schools.
2. Extension of shop work in the junior high schools.
3. A longer school day for the junior high schools.
4. The establishment of a vocational guidance program.
5. Pre-vocational and vocational work for those who will not finish the regular course or must leave school early.
6. Only those who are mentally and physically fit should be permitted to enroll in the industrial courses.

PORT ARTHUR, TEXAS[1]

Commendations

1. A splendid equipment of high school shops, their arrangement and content of the courses offered.

Criticisms

1. A lack of proper guidance before pupils enter high school.

Recommendations

1. The inclusion of 'broadening and finding' courses in the curriculum in order that pupils may:-
   a. Discover where their interests and aptitudes lie.
   b. That some of them may find their life's work.
   c. For the broadening effect of coming in contact with various fields of work.
2. These courses should be six weeks in length and a requirement for everyone.
3. Pupils should take six of them in the seventh grade; six, four, or two in the eighth grade, while differentiation should take place in the ninth grade.

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1 Report of the Survey of the Schools of Port Arthur, Texas. p. 260-63 Bureau of Publications, Teachers College, Columbia University, New York City, 1926

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PORTLAND, OREGON [1]

Criticisms

1. The shop facilities and courses are inadequate
2. The work is elected by too small a number.
3. An unbusiness-like air pervades the manual training shops.
4. It is an addition rather than an integral part of the school program.
5. It fails to make itself felt as one of the vital and active factors in school work and school life.

Recommendations

1. Primary manual arts should be introduced into the first, second, and third grades, and the work in manual training in the upper grades made less formal.
2. Begin drawing in the fourth grade and extend it through the high school.
3. Begin manual work for boys in the fifth grade as sloyd, and combine it in the high school as general wood-shop and machine shop work.
4. Provide academic mechanical drawing in the high school.
5. Provide for specialization in vocational branches for some of the junior high school pupils.
6. Appoint a vocational guidance director; organize and articulate the work of guidance.
7. The Portland School of Trades should be merged into a technical high school, which should retain the trade courses.

RACINE, WISCONSIN [2]

Recommendations

1. That one supervisor or director of industrial arts be placed in charge of all industrial arts work in the elementary grades,

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1 Cubberley, E.P. - The Portland Survey. p. 244-249. The World Book Co. Yonkers-on-Hudson. N.Y., 1916

2 The Racine School Survey, Racine, Wis., Vol.II. p.439-440. Racine, Wis. Board of Education, 1926

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junior and senior high schools.

2. That the supervisor or direction of industrial arts be made directly responsible to the superintendent for the organization of courses of study, instructional materials, and expenditures.
3. That provision be made for more diversification of the industrial arts in the upper elementary grades.
4. That exploratory and try-out courses be established in the junior high schools, in subjects other than woodwork and mechanical drawing
5. That the objectives, aims and methods of instruction in the industrial arts be more clearly defined; especially in the senior high school.
6. That provision be made for additional teachers and subjects in the upper grades of four of the elementary schools.
7. That provision be made for better coordination of shopwork and mechanical drawing in the junior and senior high schools.
8. That more uniformity of time be devoted to the industrial arts in all the grades.
9. That a teaching load of fifteen students as a minimum and twenty students as a maximum be established. That teachers be given at least one free hour daily.

ST.LOUIS, MISSOURI[1]

Commendations

1. The high school shops and equipment are of a high order.
2. The work accomplished is of excellent quality.
3. The purpose of the work is, a part of general education.

Criticisms

1. The chief emphasis is formal discipline.
2. There is no provision for initiative or choice of projects on the part of the pupil.

1 Judd, C.H. - Survey of the St.Louis Public Schools. Part II,p.111-115; p.333-34. World Book Co.,Yonkers-on-Hudson,New York, 1918

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3. The course of study is inadequate.
4. Try-out courses are confined to one subject, viz., woodwork.
5. Wood turning in high school receives too much attention.
6. Mechanical drawing is only incidentally related to the work of the shop.
7. The work is not coordinated with other subjects.

Recommendations

1. Provide more activities below the high school.
2. Give pupils more freedom in selection of projects.
3. The shop work should be accessible to all pupils.
4. The pupils in all courses (curricula) should have an opportunity to take at least two years of drawing.

SPRINGFIELD, ILLINOIS[1]

Findings

1. Approximately one half of the boys expect to enter industrial work, for which general industrial training with few additions to present equipment can be given.

Criticisms

1. The work is too formal, inelastic, uniform and prescriptive.
2. The work takes little or no account of the individuality of the pupil or teacher.

Recommendations

1. That the junior and senior high schools establish preparatory industrial courses.
2. To utilize for educational purposes the work that is necessary for the maintenance of the school plant.

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1 Ayres, L.P. - The Public Schools of Springfield, Ill. p.136-140. Russell Sage Foundation, 130 E 22nd St.,New York City.

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SPRINGFIELD, MASSACHUSETTS [1]

Criticisms

1. It is unwise to offer three curricula at the beginning of the junior high school.
2. It is essential that the senior high school curriculum be revised.

Recommendations

1. Junior high school - That 'broadening and finding' courses be provided, so that students may discover their needs, aptitudes, interests, capacities, etc.
2. Senior high school - That gradual differentiation shall take place until the pupil is informed of the specialized curricula and the schools become acquainted with the aptitudes, capacities and needs of the pupil.

TAMPA, FLORIDA[2]

Recommendations

1. That 'broadening and finding' courses be added to the regular curriculum.
2. That these courses should be from nine to eighteen weeks in length and open to everyone.
3. That seventh grade pupils shall be compelled to take four of these courses and those in the eighth grade from two to four. The only requirement is, that one of these courses in each year's work be science.
4. That the work in these courses be closely correlated with vocational guidance for their vitalizing effect.

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1 Report of the Survey of certain aspects of the public school system of Springfield,Mass. p.161; 173. Division of Field Studies. Institute of Educational Research, Teachers College, Columbia University. School year., 1923-1924

2 Report of the Survey of the Schools of Tampa,Fla.,p.156-57.Bureau of Publication, Teachers College, Columbia University,N.Y., 1926

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SUMMARY

1. Only a few of the above named cities that were surveyed, are commended for their work in industrial arts. Most of the commendations are either for good workmanship or for good equipment.
2. The criticisms are quite numerous and varied. Among the outstanding faults listed are the following:
   a. No definite time allotment.
   b. Courses are formal, obsolete and lack unity.
   c. No provision for guidance.
   d. The work is limited and narrow.
   e. No provision for specialization.
   f. No provision for pupil initiative.
   g. No corrlation and coordination between shop work and other subjects.
   h. Lack of proper supervision.
3. The recommendations are likewise varied and rather extensive. The more frequently listed are:-
   a. Extension and diversification ofcourses.
   b. Proper provision for educational and vocational guidance.
   c. Connecting the work of the school with the industrial life of the community.
   d. Emphasis on thought and content values rather than upon skill.
   e. Granting pupils more freedom of choice in the selection of courses and projects to be constructed.
   f. Better articulation between the elementary school, junior, and senior high school.
   g. Greater breadth of instruction and proper supervision.
   h. Provision for specialization for those pupils who leave school early.
   i. Emphasis upon the cultural point of view.

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SECONDARY SCHOOL TEXT BOOKS

BELTING[1]

"The function of the elementary school, junior and senior high school in relation to the practical arts should be such as to emphasize the content value of these subjects of study."

BENNETT[2]

1. Manual training is a cultural subject to be taught to boys more for an avocation, than for vocational purposes.
2. Vocational subjects are taught with the purpose of making a student proficient for the work of an occupation.
3. The occupational work taught in the junior high school will not make the pupil highly proficient in a particular occupation, but will serve to give some training in the fundamentals and thereby shorten the period of apprenticeship.

BRIGGS[3]

1. It has a cultural value and "contributes to the general integration essential in a democracy".
2. It is not trade training or trade instruction.
3. Try-out courses with a rotating scheme of subjects are recommended.
4. It develops mechanical skills that the average householder needs and gives an insight into occupations.
5. The work of the shop should be supplemented by a study of the occupations and field trips.

BRUNNER[4]

1. 'Broadening and finding' courses should be provided.

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1 Belting, P.E.- The Community and the High School. p. 292. D. C. Heath & Co., 1923.

2 Bennett, G.V.-The Junior High School. p. 127, Warwick & York, Baltimore, Md.

3. Briggs, T.H.-The Junior High School. p. 37-39, p. 49, p. 171-74. Houghton Mifflin Co., 1920

4. Brunner, H.B.- The Junior High School at Work. Chapt. 5. Bureau of Publications. Teachers College, Columbia University, N.Y. Contributions to Education. No. 177- 1925

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2. Pupils should be acquainted with occupational possibilities through guidance and 'life-career' classes.
3. Only those materials and processes should be presented that are justifiable from a pedagogical standpoint and that will insure a broadening effect.

BU. OF EDUCATION BULL.[1] #35, 1918(The Cardinal Principles of Secondary Education)

1. Opportunity must be given to pupils to develop an appreciation of the labor and skill to maintain a home.
2. Opportunity must be given to pupils to select intelligently an occupation in which they will be happy; maintain a proper relationship with their fellow workers and render the greatest service to society. This requires that pupils have an opportunity to explore their capacities, interests and needs, in order that they may choose their occupation wisely.

DAVIS[2]

1. To give all pupils some appreciation of the nature of the practical activities that comprise the industrial and commercial world in which they live.
2. Through try-out courses, to permit pupils to explore their capacities and ambitions and give them some practical training in the more common affairs of home, garden, garage, shop and play-ground.
3. To give specific training in some vocation to those who have special aptitudes for such vocations, to those who cannot profit by other courses, and to those who must leave school early.

GLASS[3]

1. They add practical elements to the "core curriculum".
2. They provide exploratory and guidance opportunities for two

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1 Bulletin,#35,1918 - p.13. Dept.of Interior.Bu of Education.
2 Davis,C.O.-Junior High School Education.p.230-246. World Book Co. Yonkers-on-Hudson,N.Y., 1924
3 Glass, J.M.-Curriculum Practices in the Junior High School and Grades five and six. p.83-88. University of Chicago,Press.Chicago Ill.,1924

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groups of pupils:

a. Those who will continue their education to the senior high school

b. Those who will not go beyond the junior high school, but will enter employment.

HINES[1]

1. It enriches the curriculum.
2. It provides for a limited amount of skill in the handling of a few typical industrial tools, materials and processes.
3. It aids in the development of social intelligence.
4. It has direct educational and vocational guidance values.

INGLIS[2]

. . . . "the value of industrial subjects in the program of the secondary schools are to be determined by their direct and specific contributions to the economic-vocational aim of secondary education."

KOOS[3]

1. To provide opportunities for boys to make and do the things they like to do.
2. To develop common skills everyone needs.
3. To provide technical exploratory and try-out courses.
4. To develop an appreciation of art for consumer values.
5. To provide educational and occupational guidance.
6. To give an insight into social and economic problems.
7. To give training in problem solving.

NUTT[4]

1. It serves in giving the adolescent a wide range of experiences in relation to materials, tools, and constructive operations.

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1 Hines, H. C. - Junior High School Curricula. p. 131-34. The Macmillan Co., New York, 1925

2 Inglis, Alexander - Principles of Secondary Education, p. 596. Houghton Mifflin Co., 1918

3 Koos, L. V. - The Junior High School, p. 281-282. Ginn & Co., 1927

4 Nutt, W. H. - Principles of Teaching High School Pupils. P. 68. The Century Book Co. New York, 1924

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2. It should be made to contribute to the physical development of the pupil.
3. The mastery of mechanical skill may be commercialized but this should not be stressed as information is the dominant aim.
4. Opportunity for vocational training should be provided in the middle and upper grades of school.

SNEDDEN[1]

1. It should contribute to the general development of the pupil.
2. It should widen his experiences with industrial processes and materials.
3. The work should be extensive - no two pupils should necessarily do the same tasks or take the same courses.
4. The work should be pursued until a sense of achievement is developed.
5. The work should be conducted on an amateur level.

THOMAS-TINDAL and MYERS[2]

1. To provide sufficient try-out courses to enable pupils to discover and decide the type of work they are fitted to do.
2. To provide vocational training for those who are adapted for it and for those who will leave early.
3. To acquaint pupils with the occupations that are open to them.

TOUTON and STRUTHERS[3]

1. To provide contact or exposure courses.
2. To give information relative to vocational pursuits.
3. To acquire shop habits.
4. To establish ideals, appreciations and judgments in vocational, industrial and economic relations.
5. To discover the pupils interests and aptitudes and to form habits that will contribute to worthy home membership.

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1 Snedden, David -Principles of Secondary Education, p.99-108. Houghton Mifflin Co., 1917

2 Thomas-Tindal, Emma V. and Myers, Jessie D.-Junior High School Life. The Macmillan Co., New York City, 1925, p.73-75

3 Touton, Frank A and Struthers, Alice B -Junior High School Procedure. Ginne and Co., 1926

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VAN DENBURG[1]

"The subjects of study selected for our junior high school work must be capable of furnishing such a variety of vocational experiences as will assist the pupil in his selection of work and study upon which he will sooner or later specialize."

SUMMARY

Among the most frequent claims and recommendations listed for the industrial arts by the authors of text-books in the field of secondary education are the following:-

CLAIMS

a. It is a cultural subject.

b. It enriches the curriculum.

c. It adds to social intelligence.

d. It gives an insight into social and economic values.

e. It trains in problem solving.

f. It contributes to physical development.

g. It provides skills that the average house-holder needs.

RECOMMENDATIONS

a. 'Try-out', 'broadening' and 'finding' courses should be provided, to permit pupils to discover their likes, aptitudes, interests, and needs.

b. The work should be extensive rather than intensive.

c. For the majority of pupils the work should be conducted upon an amateur level.

d. Provision should be made for pre-vocational and vocational training for those, who, for various reasons must leave school early.

e. Provision should be made for the study of occupations, and an educational and vocational guidance program should be established.

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1 Van Denburg, J.K. - The Junior High School Idea, p.62-63. Henry Holt Co., 1922

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STATEMENTS OF EDUCATIONAL AUTHORITIES

BENNETT, C.A. - (Editor Industrial Education Magazine)

Present Needs

1. "Methods of procedure that stimulate the form of right technical habits of action and at the same time stimulate the right kind of thinking and plenty of it."
2. "The best ways of testing results of instruction."
3. "Whether a general shop or merely a general shop ideal should prevail in a school system or whether neither are important."
4. "Standards of attainment in the manual arts."
5. "How to make art effective in the shopwork and drawing instruction in the schools, both elementary and secondary."

CHARTERS, W.W. - (Director of Educational Research, Ohio State University)

"The major defects of the Industrial Arts program are two in number.

"The first place, not enough attention is given to the cultural content and to the problems of citizenship in curricula which seek to train young men and young women for life.

"In the second place, the vocational material that is put in the curriculum is not always selected with a view to its practical use. There is frequently much irrelevant vocational material in the curriculum. In short, the curriculum from the cultural point of view should be more cultural and from the professional point of view more professional. The cultural element is necessary and the revamping of the vocational material is advisable."

COURTIS, S.A.-(Professor of Education, the University of Michigan)

"Specifically my criticism of industrial art programs is, that ordinarily they are made out without reference to children's purposes. They are administered in terms of adult standards and ideals. When a child takes such a program and is by nature suited to it,

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he gets very great benefit, but the industrial arts program is not well adjusted to say more than 10% of the children. Probably 60 or 70% more get considerable benefit while the remainder of the group may even be injured by their work. The program must be organized and administered in a spirit of service to the child before such conditions can be overcome. That is, the needs and interests of the child must determine not only the goal for which the child works, but the methods by which he works and the standards by which his product is judged. From this point of view teaching will be chiefly salesmanship. The child should not be required to do anything on which he cannot be sold."

ERICSON, E.E. - (Director of Industrial Education, Santa Barbara, Calif State Teachers College)

Defects

1. "The assumption that every junior high school boy may become a tradesman and the organization of the shop curriculum entirely on the pre-vocational or trade finding basis."
2. "Too little correlation in our larger junior high schools between the various shop subjects such as sheet-metal, electrical work, etc."
3. "Elimination particularly in our larger school systems of activities that do not fall purely under one of the five or six accepted shop subjects for junior high schools."
4. "Lack of connection between present, personal, and general home needs of the individual with the work that he has no opportunity to do in the school shop."
5. "Overstressing trade methods in the junior high school by teachers who have the vocational education view point and extensive industrial training as a background."
6. "Over-equipping for industrial arts work, forgetting that hand work activities and resourcefulness may be more useful in the future life of a student than skill in operating a few machines."

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7. "A lack of organized material for governing the teaching of industrial arts in such a way that a student will make logical progress from year to year."
8. "A lack of comprehensive records of actual processes that a boy has performed during all his experience in home, school, boy scout activities employment, etc., in order that his experience may consciously be guided in school to fulfill a certain desirable variety of opportunities that would presumably fit him for future membership in society."

LEAVITT, F.M. (Assoc. Supt. and Director of Vocational Education, Pittsburgh, Pa., Public Schools)

Some of the Common Defects

1. "There is frequently a lack of a definite objective or, if several objectives are claimed to dominate or determine the course of study, there is little or no attempt made to bring about the right relation between objectives and methods."

   "It is probable that at any point in a manual arts course two or three objectives may be set up and that each of these objectives requires the application of a proper method of instruction and technique of work. Too often there is no correspondence whatever between the objective set up and the method already provided in the course of study."
2. "In cases where several objectives have been set up, there is too often a lack of giving the greater emphasis to the more important or basis of these objectives. The fundamentals are sometimes overlooked and relatively unimportant and superficial factors are magnified out of all proportion to their importance."

   "There can be no question but what the development of accuracy is an important objective of the manual arts, but that it is the most important factor at all times and in all phases of the work cannot be maintained successfully. There are teachers, however,

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who apparently see little else than stressing accuracy in tool technique."

3. "At the opposite extreme is the equally bad or perhaps worse fault of habitually accepting work from pupils who have given far less than their best efforts in prosecuting the work."

4. "Too frequently the course of study fails to provide the teacher with suggestions as to how a real interest may be awakened and maintained at any given part of the course. Too often the teacher is interested in one phase of the problem under consideration and the pupil in another radically different phase. For example, the teacher may be working to secure the completion of a nicely considered and well planned project as a part of his routine duties, desiring to have the work brought up to a high standard which he has consistently sought to establish in the work under his direction, while, because of the close proximity of Christmas, the boy is interested mainly in finishing his project today in order that he may have it to take home as a present for his mother or sister.

"Teachers often fail to understand the paramount value of pupil interest and substitute therefore their own professional pedagogical interest, which is quite foreign to the personal interest of the pupil."

5. "Since the earliest days of manual training in the public schools of this country we have insisted that the important thing to develop was power in the pupils, - - power to think and to do, - - power, which might be applied in other fields than merely the field of the manual training project. Even today, however, it is too often the case that there is no real correlation between the manual arts course and courses or activities in art, science, civics and dramatization. It might be possible to conceive a

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course where no manual training projects as such were made, yet where the most important principles of manual arts instruction were embodied constantly in every piece of work carried out. Such courses, have been talked about and written about, but have seen only infrequently. While there must be apparently, a nucleus in the more or less set projects of a manual arts course, correlations as indicated above, are seen too infrequently."

HORN, ERNEST (Professor of Education, at the State University of Iowa)

"To many Industrial Arts "projects" have little educational worth because of one or more of the following defects: (1) They are not concerned with some important industrial process; (2) They do not use the procedures which characterize the industrial processes in life outside the school; (3) They do not use the materials used in the processes in life outside the school; (4) The project does not result in the product which duplicates, even in a crude way, the usable characteristics of the production in life outside the school."

"An example of complete worthlessness, from my point of view, as an Industrial Arts project is the making of a polar bear, by cutting out an outline in paper and pasting cotton on the outside. This fails completely to satisfy any of the requirements laid down above. An example of a good project and one which satisfies the above requirements is the making of butter."

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SUMMARY

During the past decade a great many fields of education have received considerable thought and attention from research and experimental students. The field of industrial arts is conspicuous for its lack of attention until quite recently. Since it is generally conceded, today, that the industrial arts form an integral part of general education, one of the most pressing needs in this field is research and experimentation. Among the more commonly felt needs and frequently listed criticisms are the following:-

a. Better methods of procedure are needed.
b. Methods for testing the results of instruction are necessary.
c. More stress should be given to the cultural value of the work.
d. A lack of proper records is noticeable.
e. Much of the work is too vocational.
f. In planning courses of study pupils interests and needs are given little attention.
g. There is little correlation between the various shops and other subject fields.
h. There is often a lack of definite objectives.
i. Teachers lack the ability to arouse students interests.
j. Much of the work as now conducted is obsolete, formal and impractical.

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Chapter VIII

THE REACTIONS OF HIGH SCHOOL AND COLLEGE SENIORS, EMPLOYEES, AND EMPLOYERS TO THE INDUSTRIAL ARTS.

In order to determine the effects of the industrial arts upon those who have taken the work and those who employ individuals who have taken it, questionnaires were submitted to the following: the layman, the high school senior, the university senior, and the manufacturer.

(1) Permission was granted by three of the five Cincinnati Senior High Schools to submit questionnaires to their senior boys. Two hundred forty-five questionnaires were distributed, with one hundred fifty-nine returns.

(2) Permission was granted by the deans of the engineering college, law college, liberal arts college, and medical college of the University of Cincinnati, to submit questionnaires to the senior students. Three hundred fifteen questionnaires were distributed with ninety-five returns.

(3) Approximately one thousand questionnaires were submitted to mature workers who were likely to have taken industrial arts work while attending the elementary or the high schools. Four hundred twelve questionnaires were filled out and returned.

(4) A list of the sixty-five most prominent industrial concerns of Cincinnati was furnished by the Research Department of the Cincinnati Chamber of Commerce. To these firms questionnaires were submitted, of which thirty-six were returned.

The results of these four questionnaires appear below.

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The Results of the Questionnaires submitted to the Senior High School Boys in the Western Hills, Withrow, and Woodward High Schools, of Cincinnati, appear in Tables VIII and IX, and in items A to K inclusive.

Table VIII

Distribution of Pupils by Grades in Industrial Arts Courses.

GRADE	NUMBER OF BOYS
4th	24
5th	52
6th	99
7th	125
8th	135
9th	86
10th	41
11th	49
12th	36
	Total 647

Table IX

Distribution of Pupils by Courses and Course Selection in the Senior High School

NAME OF COURSE	NO. OF BOYS TAKING COURSE	NO. BOYS TAKING COURSE IN SENIOR H.S. ONLY
1. Mechanical Drawing	127	91
2. Bench woodwork	102	14
3. Architectural Drawing	39	35
4. Cabinet Making	39	29
5. Wood Patternmaking	36	32
6. Wood turning	36	27
7. Machine shop	32	12
8. Foundry	26	26
9. Sheetmetal	25	21
10. Freehand Drawing	24	14
11. Forge Shop	23	19
12. Print Shop	16	8
13. Electrical Shop	15	14
14. Sketching	8	6
15. Art Metal	5	5
Total	553	Total 353

The items A to K inclusive are the answers to the questions three to thirteen inclusive in the questionnaire(see appendix D)

Item A - Reasons for electing shop and drawing course in the senior high school.

REASONS	FREQUENCY
1. I like mechanical work	42
2. I intend to take an engineering course	31
3. To try and discover whether I had mechanical ability	20
4. I hope to find employment in a mechanical occupation	10
5. My parents wanted me to take the work	10
6. I believe I have mechanical ability	9
7. To earn easy credits	9
8. To permit me to make things I wanted	7
9. I liked the teacher	5
10. I like the freedom of the shop	4

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Item A (continued)

REASONS	FREQUENCY
11. My chums recommended it	4
12. To make things for the home	3
13. It was required	2

Item B - Reasons for not electing shop and drawing courses in the Senior High School.

REASONS	FREQUENCY
1. I believe it is of little or no value for the occupation I hope to enter	36
2. I dislike the work	11
3. Colleges give insufficient credit for it	9
4. I did poorly in shopwork in the grades	8
5. My family opposed it	3
6. I dislike to soil my face and hands	3
7.My chum did not select it	3
8. Other reasons:	
a. It conflicted with other subjects	2
b. I did not realize its value at the time	1

Item C - Occupational choice

	NO.OF BOYS
1. Have made an occupational choice	109
2. Have not made an occupational choice	40
3. Not replying	10
Total	159

Item D - Influence of the Industrial Arts upon occupational choice.

	NO. OF BOYS
1. Influenced by the industrial arts	35
2. Not influenced by the industrial arts	77
3. Not replying	47
Total	159

Item E - Senior boys in high school who expect to enter college.

	NO.OF BOYS
1. Planning to attend college	111
2. Not planning to attend college	37
3. Undecided	11
Total	159

Item F - Amount of industrial arts work seniors in high school would choose if school work could be repeated

	NO.OF BOYS
1. Would choose the same amount	76
2. Would choose a greater amount	44
3. Would choose a less amount	30
4. Not replying	9
Total	159

Item G - Effect of the industrial arts upon intelligent buying or consumption of manufactured products

	NO.OF BOYS
1. Beneficial effect	68
2. No effect	54
3. Not replying	37
Total	159

Item H - The extent to which pupils make minor repairs about the home and its equipment.

	NO.OF BOYS
1. Pupils who perform these tasks	119
2. Pupils who do not perform these tasks	23
3. Pupils not replying	17
Total	159

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Item I - Articles made by the pupils in the school shop which they felt gave them the broadest experiences and the most satisfaction.

The articles listed under Item I were so fragmentary and scattered that they were of little value, hence they were omitted.

Item J -Things pupils disliked about shop and drawing courses (Random comments)

A. Shop Courses

1. Articles constructed had no appeal.
2. Disliked operating circular saw.
3. Disliked operating planer.
4. Don't like machinery.
5. Don't like to clean the machinery and equipment.
6. Not enough machinery in shop
7. Not enough work to keep everyone busy.
8. Not enough discipline.
9. Periods are too long.
10. Periods are too short.
11. A pupil must work out too much for himself
12. Teacher lacked interest in us.

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13. The work is too dirty.
14. Too many pupils in a class.
15. Too much mechanical drawing connected with the work.
16. Too much noise connected with shopwork.
17. Uninteresting and dull.
18. Uncouth companions.
19. Waste too much time.
20. No facilities for washing and "cleaning up".

B. Drawing courses
1. Classes are too large.
2. I have no ability in drawing.
3. I dont like mechanical drawing.
4. It is dry.
5. It is monotonous
6. It is impractical
7. It is too confining
8. It is too tedious
9. It is uninteresting
10. More explanation is needed
11. The instruction is insufficient.
12. The instruments are poor.
13. The room is poor
14. The teacher is poor.
15. The teacher is too strict.
16. The teacher should be stricter.
17. The teacher talks too much.
18. The teacher talks too much about other things.
19. The time is too short.
20. There is not enough variety of work.
21. There is no text used.

Item K - Suggestions for the improvement of industrial arts work.

1. Connect it with other school work.
2. Construct more practical things.
3. Give more time to the work.
4. Give more credit for college entrance.
5. Give more detailed instruction.
6. Have contests to make the work interesting.
7. Have longer periods.
8. Have more drawing periods per week.
9. Have industrial arts students take some freehand drawing.
10. Have more field trips.
11. Have more up-to-date equipment.
12. Have more and better materials.
13. Make mechanical drawing compulsory.
14. Make the work optional.
15. Provide continuity between consecutive grades and uniformity in schools of the same grade.
16. Provide shower rooms for foundry workers.
17. Select only those pupils who are willing to work.

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The Results of Industrial Arts Questionnaires submitted to Cincinnati University Seniors in the Departments of Engineering, Law, Liberal Arts and Medicine, appear in Tables X and XI and in items A to J inclusive.

Table X

Distribution of Pupils by Grade in which Industrial Arts Work was taken.

GRADE	NO. OF PUPILS
4th	6
5th	18
6th	43
7th	75
8th	72
9th	39
10th	33
11th	26
12th	14
Total	326

Table XI

Distribution of Pupils by Courses and in Terms of Estimated Values of Courses Chosen.

NAME OF COURSE	NO. OF PUPILS TAKING COURSE	NO. OF PUPILS LISTING COURSE AS MOST BENEFICIAL
1. Bench woodwork	75	16
2. Mechanical drawing	64	21
3. Wood turning	27	2
4. Cabinet-making	26	7
5. Freehand drawing	16	4
6. Woodpatternmaking	16	6
7. Machine shop	12	5
8. Forge shop	10	3
9. Foundry	10	4
10. Architectural drawing	7	2
11. Printing	6	1
12. Sketching	6	2
13. Art metal	3	3
14. Electrical shop	3	0
15. Sheet metal	3	0
Total	284	76

The items A to J inclusive are the answers to the questions three to twelve inclusive in the questionnaire (see appendix E)

Item A - Industrial Arts Requirements.	NO OF PUPILS
1. Pupils taking only the minimum requirements	68
2. Pupils taking more than minimum requirements	23
3. Not replying	4
Total	95

Item B - Industrial arts courses selected by those who took more than the minimum requirement:

NAME OF COURSE	FREQUENCY
1. Mechanical drawing	9
2. Cabinet making	6
3. Full industrial arts course	5
4. Architectural drawing	1
5. Art-metal	1
6. Auto mechanics	1
7. Freehand drawing	1
8. Printing	1
Total	25

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Item C - Reasons for not taking more industrial arts work than the minimum requirements.

a. Not interested
b. Felt I had no aptitude for mechanical work.
c. There was no more offered
d. Lack of time
e. Had to take required subjects
f. Expected to enter a profession
g. Took general academic course

Item D - The influence of the Industrial Arts upon occupational choice.

	NO. OF INDIVIDUALS
a. Occupational choice influenced by the industrial arts	17
b. Occupational choice not influenced by the industrial arts	65
c. Not replying	13
Total	95

Item E - Effect of the industrial arts upon intelligent buying and consumption.

	NO. OF INDIVIDUALS
a. Beneficial effect upon intelligent buying and consumption	38
b. No effect upon buying and consumption	47
c. Not replying	10
Total	95

Item F - The extent to which the industrial arts experience enable these students to make minor repairs about the home and its equipment and thereby effect a saving of money.

	NO. OF INDIVIDUALS
a. Those who perform those tasks	57
b. Those who do not perform those tasks	30
c. Not replying	8
Total	95

Item G - The amount of industrial arts work that would be selected if the school career could be repeated.

	NO. OF INDIVIDUALS
a. Would choose a greater amount	45
b. Would choose the same amount	37
c. Would choose a less amount	8
d. Not replying	5
Total	95

Item H - Articles constructed by these students that offered them broad experience and satisfaction.

The articles listed under Item H were so fragmentary and scattered that they were of little value, hence they were omitted.

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21. Lamp
22. Library table
23. Magazine
24. Mechanical toys
25. Model house
26. Pedestal
27. Piano bench
28. Radio equipment
29. Screw driver
30. Serving cabinet
31. Smoking stand
32. Taboret
33. Table
34. Telephone stand
35. Tie rack
36. Tool chest
37. Vise
38. Waste Basket
39. Wood clamps
40. Work bench

Item I - Reasons listed for disliking the Industrial Arts work.

A. Shop courses
1. Women teachers
2. Lack of equipment
3. Lack of organization
4. Not enough choice in articles made
5. Too many useless articles made
6. Disinterested teachers
7. Inexperienced teachers
8. Poor supervision
9. Wasted too much time getting materials
10. Classes were too large
11. Not enough time
12. Too many details
13. Lack of adequate instruction
14. Not enough individual help
15. Arbitrariness of teacher
16. Teacher lacked patience
17. Teacher ridiculed those who lacked skill
18. Nothing was put to practical use
19. Tools were always dull
20. Not enough material

B. Drawing courses
1. The teacher was uncouth and rough
2. It was not practical
3. Everyone worked the same problem
4. The time was too short.
5. Materials were poor
6. The teachers were uninspiring
7. The classroom was on the third floor; too far to walk
8. Too much time spent on lettering
9. Mistakes were not corrected
10. Insufficient explanation
11. Too much emphasis on uninteresting things.
12. The text was poor
13. Too much inaccuracy permitted
14. Fundamentals were not stressed
15. Problems were too easy
16. Too many drawings of the same variety

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Item J - Suggestions listed for improving the industrial arts work.

1. Eliminate those who do not like it.
2. Provide more machine work.
3. Provide better instruction.
4. Provide more time
5. Foster the pupil's imagination instead of stifling it.
6. Give more sketching.
7. Give each pupil a different problem
8. Give quizzes.
9. Provide guidance in the eighth grade for the high school course.
10. Make the drawings more practical.
11. Include work in design.
12. Give more and better explanations and demonstrations.
13. Provide more opportunity for creative ability
14. Make more useful articles.
15. Provide tactful supervision.
16. Provide a reference library.
17. Secure teacherswho are good craftsmen.
18. Have inspiring talks by good mechanics.
19. Make the work optional rather than compulsory.
20. Treat beginners sympathetically.
21. Permit those without aptitude for this work to select some other subject.
22. Prescribe the work for medical students.
23. Provide for more practical application.
24. Discontinue the formal, lock-step methods and provide for individual differences and tastes.
25. Make provision for individual initiative.

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The results of Industrial Arts Questionnaires submitted to Mature Wage Earners, who as students took shop and drawing courses, appear in Tables XII, XIII, XIV, and in items A to G inclusive.

Table XII

Distribution of the Occupations of 412 Wage Earners who as Grade and High School Pupils took Industrial Arts Work.

NAME OF OCCUPATIONS	FREQUENCY
1. Teacher	41
2. Machinist	21
3. Salesman	21
4. Carpenter	18
5. Draftsman	18
6. Clerk	16
7. Auto mechanic	15
8. Patternmaker	12
9. Truck-driver	10
10. Accountant	8
11. Laborer	6
12. Lawyer	6
13. Lumber salesman	6
14. Electrician	5
15. Machine operator	5
16. Manager	5
17. Occupation not listed	5
18. Printer	5
19. Painter	4
20. Pharmacist	4
21. Foreman	4
22. Bank clerk	3
23. Chauffeur	3
24. Clothing cutter	3
25. Contractor	3
26. Engineer	3
27. Grocer	3
28. Meat cutter	3
29. Merchant	3
30. Minister	3
31. Plumber	3
32. Sheetmetal worker	3
33. Stock clerk	3
34. Student	3
35. Student (co-op)	3
36. Bell hop	2
37. Bookkeeper	2
38. Concrete Construction foreman	2
39. Contractor (building)	2
40. Engineer	2
41. Estimator	2
42. Fireman (locomotive)	2
43. Florist	2
44. Garage owner	2
45. Insurance salesman	2
46. Jeweler	2

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47. Manager (insurance)	2
48. Mechanic	2
49. Millwright	2
50. Packer	2
51. Plasterer	2
52. Purchasing agent	2
53. Stenographer	2
54. Tailor	2
55. Unemployed	2
56. Architect	1
57. Artist	1
58. Art glass worker	1
59. Ast. Treasurer	1
60. Baker	1
61. Barber	1
62. Batteryman	1
63. Boilermaker	1
64. Bookbinder	1
65. Blacksmith	1
66. Broker	1
67. Bus driver	1
68. Candy maker	1
69. Cement finisher	1
70. Clerk (shipping)	1
71. Clerk (police)	1
72. Dental mechanic	1
73. Dental surgeon	1
74. Detective	1
75. Diamond setter	1
76. Electrical dealer	1
77. Engineer (application)	1
78. Engineer (civil)	1
79. Engineer (inspection)	1
80. Engineer (mechanical)	1
81. Engineer (sales)	1
82. Factory worker	1
83. Farmer	1
84. Fireman (city)	1
85. Forester	1
86. Foreman (asst.)	1
87. Foreman (building construction	1
88. Foreman (Foundry)	1
89. Foreman (Patternshop)	1
90. Foundry worker	1
91. Freight agent	1
92. Fruit dealer	1
93. Iron worker	1
94. Janitor	1
95. Laboratory research assistant	1
96. Lather	1
97. Machine designer	1
98. Manager (advertising)	1
99. Manager (assistant)	1
100. Manager (Auto agency)	1
101. Manager (finance)	1
102 Manager (hotel)	1
103 Manager (traffic)	1

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104.	Manufacturer	1
105.	Meat dealer	1
106.	Messenger	1
107.	Metallurgist	1
108.	Meter reader	1
109.	Motor truck builder	1
110.	Newspaper carrier	1
111.	Optical fuser	1
112.	Optometrist	1
113.	Paymaster	1
114.	Physician	1
115.	Piano builder	1
116.	Piano dealer	1
117.	Plasterer contractor	1
118.	Politician	1
119.	Presser	1
120.	Press feeder	1
121.	Publisher	1
122.	Pump tester	1
123.	Radiator repairman	1
124.	Radio expert	1
125.	Real estate dealer	1
126.	Tile worker	1
127.	Time checker	1
128.	Time study man	1
129.	Toolmaker	1
130.	Tracer	1
131.	Truck assembler	1
132.	Sales manager	1
133.	Shoemaker	1
134.	Shoe designer	1
135.	Statistician	1
136.	Steam fitter	1
137.	Steeple jack	1
138.	Street car conductor	1
139.	Stockman	1
140.	Superintendent	1
141.	Superintendent (car plant)	1
142.	Superintendent (cemetry)	1
143.	Superintendent (maintenance)	1
144.	Supervisor (deliveries)	1
145.	Undertaker	1
146.	Watchcase maker	1
147.	Welder	1
148.	Woodworker	1
149.	Wrapper	1
150.	Yardmaster	1
	Total	412

Table XIII

Distribution of Individuals by Length of Years that Industrial Arts Work was taken.

YEARS	NUMBER OF INDIVIDUALS
1	66
2	114
3	92
4	55

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YEARS (continued)	NUMBER OF INDIVIDUALS
5	23
6	17
7	7
8	20
Total	394

Table XIV

Distribution of Pupils by Courses and in Terms of Estimated Values of Courses Taken.

NAME OF COURSE	NO. OF PUPILS TAKING COURSE	NO. OF PEOPLE LISTING COURSE AS MOST USEFUL SINCE LEAVING SCHOOL
1. Woodwork (bench)	278	67
2. Mechanical drawing	185	77
3. Cabinet making	131	38
4. Wood-turning	129	8
5. Freehand drawing	107	26
6. Machine shop	99	35
7. Forge shop	78	17
8. Pattern shop	75	20
9. Architectural drawing	68	26
10. Electrical shop	60	14
11. Sheetmetal shop	56	8
12. Sketching	51	13
13. Foundry	49	17
14. Printing	43	8
15. Art metal	17	3
Total	1416	Total 377

The items A to G inclusive are the answers to the questions four to ten inclusive in the questionnaire (see appendix F)

Item A - Influence of the Industrial Arts upon occupational choice.

	No. of Individuals
a. Occupational choice influenced by the industrial arts	170
b. Occupational choice not influenced by the industrial arts	228
c. Not replying	14
Total	412

Item B - Effect of the Industrial Arts upon intelligent consumption and buying.

	No. of Individuals
a. A beneficial effect upon intelligent buying and consumption	299
b. No effect upon buying and consumption	90
c. Not replying	23
Total	412

Item C - The extent to which people make minor repairs about the home and thereby effect a saving of money

	No. of Individuals
a. Those who perform these tasks	335
b. Those who do not perform these tasks	57
c. Not replying	20
Total	412

Item D - The amount of industrial arts work that would be selected if the school career could be repeated.

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Item D (continued)

	No. of Individuals
a. Would choose a greater amount	335
b. Would choose the same amount	38
c. Would choose a less amount	16
d. Not replying	23
Total	412

Item E - Reasons listed for liking the industrial arts work.

1. It was practical.
2. We made useful things.
3. It gave me a better grasp of practical work.
4. It was a diversion.
5. Because I am handy with tools.
6. Because I am mechanically inclined.
7. There was no outside preparation.
8. It helped me to find myself occupationally.
9. The spirit of the shop was democratic.
10. It afforded practical experience and gave an opportunity to observe concrete results.
11. The work induced me to think for myself and aided me in analyzing my own problems.
12. I gained practical experiences in everyday problems.
13. It gave me a knowledge of reading blueprints.
14. It afforded an outlet for excess energy.
15. It helped to make geometry easy.
16. It helped to give meaning to my academic work.
17. The experiences gained in the school shop aided me in working my way through college.
18. It was a pleasant change from regular school work.
19. It increased my appreciation of industrial products.
20. It gave me a foundation for an engineering course.
21. It assisted me in choosing a trade.
22. It gave opportunity for self-expression.
23. I felt I was accomplishing something.
24. I learned part of my trade.

Item F - A list of items showing some of the things, that former industrial arts pupils did not like.

1. The time was too short.
2. There were no provisions for individual differences.
3. The teacher lacked practical experience.
4. There was too much routine.
5. Too many useless articles were made.
6. I did not like to do repair work about the school.
7. I did not like production work.
8. There was too great a variety of work offered.
9. I disliked examinations and tests.
10. It was not real shopwork.
11. There was too much intricate work.
12. I did not like drawing.
13. There was too much repetition of courses.
14. Drawings were made and then never used in the shop.
15. The work was not correlated with other school work.
16. The work was poorly organized.
17. There was not enough modern machinery.
18. There were few privileges granted.
19. There were too many changes in the methods of teaching.

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20. The discipline was poor.
21. The teacher was poor.
22. The tools were dull.
23. The shop was too small.
24. The equipment was insufficient.
25. There were too many long lectures.
26. To many things were made for the school.
27. The selection of materials was limited.
28. The teacher was partial.

Item G - Suggestions listed by former industrial arts pupils for the improvement of the work.

1. Visit commercial shops where real work is conducted.
2. Organize smaller classes.
3. Give more individual attention.
4. Have less routine and more provision for original ideas.
5. Extend the class periods.
6. Add cartooning and advertising to the industrial arts program.
7. Make the courses more intensive and practical.
8. Give work in the field of guidance.
9. Give more work in drawing.
10. Do not require boys to do janitor work.
11. Hire more practical teachers.
12. Provide more of this work for the lower grades.
13. Secure better equipment.
14. Provide more work for a "mass production" nature.
15. Teach boys to do more repair work.
16. Require a two year period in industry for all the teachers.
17. Advertise the work among the parents.
18. Offer short unit courses in more varied fields.
19. Use instruction and job sheets to secure better instruction.
20. Arrange fewer but longer periods.
21. Have larger shops.
22. Have more material on hand.
23. Standardize all courses.
24. Have better ventilated and better lighted shops.
25. Teach students to use tools correctly.
26. Grade pupils work accurately.
27. Secure practical men instead of college men.
28. Give talks showing the dignity of labor.
29. Make industrial arts compulsory for everyone.
30. Permit girls to take some of this work.
31. Permit and encourage initiative and ingenuity on part of pupils.
32. Give more and better explanation of principles.
33. Eliminate production work.
34. Add a course in design.
35. Give more training in the reading of drawings.
36. Develop a better understanding and appreciation of industry.

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The Results of Questionnaires submitted to Local Manufacturing and Industrial Concerns appear in items A to H inclusive, Tables XV, XVI, XVII, and items I to O inclusive.

The items A to H inclusive and I to O inclusive are the answers to the questions, one to eight inclusive, and twelve to eighteen inclusive, in the questionaire.(see appendix G)

Item A - Apprentices	NO.OF FIRMS
1. Firms employing apprentices	23
2. Firms not employing apprentices	13

Item B - Educational requirements	
1. Firms having educational prerequisites for employment	17
2. Firms not having educational prerequisites for employment.	16
3. Firms not replying	3

Item C - Employment preference to High school graduates	
1. Firms giving employment preference to high school graduates over eighth grade graduates and others	26
2. Firms that do not consider high school graduation in selecting employees	7
3. Firms not replying	3

Item D - Prefer 'exploratory' shop experiences	
1. Firms preferring employees who have had exploratory 'shop experiences'	27
2. Firms who have no preference relative to shop experiences	3
3. Firms not replying	6

Item E - Approval of shopwork in our public schools for general educational purposes.	
1. Firms approving shop work in our public schools for general educational purposes	34
2. Firms not approving shop work in our public schools for general educational purposes	1
3. Firms not replying	1

Item F - General industrial training	
1. Firms who believe that the schools can give valuable experiences of a general industrial nature.	34
2. Firms opposed to giving general industrial training in our public schools.	0
3. Firms not replying	2

Item G - Employing boys who have had industrial arts work.	
1. Firms who prefer to employ boys who have had industrial arts work.	32

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	NO. OF FIRMS
2. Firms who do not prefer to employ boys who have had industrial arts work	2
3. Firms not replying	2

Item H - Difference between industrial arts and non-industrial arts students.

1. Firms who believe that the boy who has had industrial arts work has a better grasp of things industrial	26
2. Firms who do not believe that the boys who have had industrial arts work have a better grasp of things industrial.	2
3. Firms not replying	8

Table XV

Distribution of Industrial and Non-Industrial Arts Pupils as to Certain Quality Traits.

	NO. REPLIES YES		NO. REPLIES NO
1. Are they (industrial arts pupils) more industrially inclined	15		8
2. Do they use better judgment	24		3
3. Are they more accurate	22		2
4. Are they more dependable	19		3
5. Do they display greater initiative	21		2
6. Average number not replying - - 11	111	Total	18

Table XVI

Distribution of Industrial Arts Courses Considered Valuable for Entering upon Industrial Employment

NAME OF COURSE	CONSIDERED MOST VALUABLE FOR ENTERING INDUSTRY FREQUENCY	CONSIDERED MOST VALUABLE FOR ENTERING SPECIFIC INDUSTRIES FREQUENCY
1. Mechanical Drawing	26	18
2. Machine shop	25	12
3. Electrical shop	20	6
4. Foundry	16	3
5. Wood patternmaking	12	6
6. Bench woodwork	11	1
7. Forge Shop	10	1
8. Sheetmetal	10	5
9. Sketching	10	5
10. Architectural drawing	18	5
11. Printing	8	3
12. Wood turning	7	1
13. Cabinet-making	6	1
Total	179	Total 65

Table XVII

Distribution of Factors Considered Essential for Successful Employment with Various Local Industrial Concerns.

NAME	FREQUENCY
1. Accuracy	27
2. Initiative	26
3. Effort	25
4. Honesty	25
5. Health	22

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Table XVII (Cont'd)

NAME	FREQUENCY
6. Personal Habits	19
7. Speed	15
8. Neatness	14
9. Originality	14
Total	187

Item I - Type of training, firms prefer boys to have before entering their employment.

	NO. OF FIRMS
1. General academic with manual experiences	19
2. General academic without manual experiences	1
3. General academic with specific occupational training	12
4. Firms not replying	4

Item J - Furnishing industrial training for new employees.

1. Firms desiring to furnish entire training for employees	5
2. Firms not desiring to furnish entire training for employees	19
3. Firms not replying	12

Item K - Amount of annual labor turnover

1. Firms having a small annual labor turnover	18
2. Firms having a medium annual labor turnover	12
3. Firms having a large annual labor turnover	3
4. Firms not replying	3

Item L - Causes listed for labor turnover;

Seasonal type of work; floaters; lack of work; business depression; failure to meet production standards; wages; not satisfied with entering wage; incompetence; will not work hard enough to earn premium; desire change, etc.

Item M - Qualities and traits found lacking in employees:

Intelligence; initiative; character; effort; originality; accuracy; concentration; responsibility; neatness; ambition; promptness; etc.

Item N - Qualities and traits found lacking in those who seek employment:

Personality; ambition; health; intelligence; neatness; unwilling to begin at the bottom; no plans for future; etc.

Item O - Suggestions for better adaptation of school work to the needs of pupils.

1. Impress upon pupils the difference between school and industry.
2. Have pupils decide what they wish to do and concentrate upon it.
3. Provide a better understanding of things industrial.
4. Don't try to train a boy for industry because he cannot do academic work.
5. Impress upon the pupils that when they first enter employment they are a liability.
6. Ground pupils in the fundamentals.
7. Instill the idea of alertness and cleanliness.
8. Give boy's the kind of work theylike to do and are best suited
9. Instill ideas of success in boy's mind. to do.
10. Teach boys to give one more minute than the regular hours called
11. Teach loyalty to the firm that employes them. for.

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SUMMARY AND CONCLUSIONS

While these data do not presume to be conclusive or to set forth authoritative claims for the Industrial Arts, they do, however, show certain tendencies. Among which are the following:

1. Most industrial arts work is taken in the seventh and eighth grades.
2. Bench woodwork and mechanical drawing are the course most frequently taken.
3. The fact that people have or believe that they have mechanical aptitude is the most frequently listed reason for taking the work.
4. A lack of interest or inability are the most frequently listed reasons for not liking or selecting the work.
5. In the majority of cases, the industrial arts has had little or no influence upon the pupil's occupational choice. With the present system of guidance, as now established in the Cincinnati Public Schools, this deficiency should be overcome.
6. A majority of people would select a greater amount of industrial arts work, if they could repeat their school course.
7. A majority of people have gained valuable mechanical experiences in the industrial arts classes which have been a means of saving money by enabling them to do numerous home repairs.
8. A majority of people are more intelligent buyers and consumers of manufactured and industrial products, due to the experiences afforded by the industrial arts.
9. Mature individuals, who are at present employed in mechanical occupations recommend a more extensive and intensive industrial arts program.
10. Students who enter college and prepare for the professions see little or no need for industrial arts work.

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11. The majority of manufacturers believe that valuable manual experience can be furnished by our public schools.
12. The majority of manufacturers advocate a curriculum that provides general academic training with manual experiences.
13. The suggestions of those who filled out the questionnaires indicate, many problems of mutual interest to both teacher and pupil. In addition, there are apparently many misunderstandings existing, which, if at all feasible should be corrected.
14. Many of the criticisms of the industrial arts work, as herein listed are highly significant and should constitute a list of questions for frequent self-examination on the part of the teacher.

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Chapter IX

SUGGESTIVE CONTENT MATERIAL FOR AN INDUSTRIAL ARTS COURSE OF STUDY

To provide content materials for the course of study that will take into consideration the pupils needs, interests, the shop equipment, the teacher opinions, and other considerations, the following data were secured:

1. The suggestions of 4345 local, elementary, junior, and senior high school industrial arts pupils relative to the articles that they desired to make.
2. A suggestive list of articles, by the local industrial arts teachers, that could readily be made with the present shop equipment.
3. A list of tools that the average householder needs.
4. A list of frequent home repairs and odd jobs.
5. A list of questions asked frequently by industrial arts pupils.

The data contained in the following: Table XVIII, Lists A, B and C are a summarization of suggestions by pupils and teachers of the Industrial Arts.

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In order to discover pupils' interests, relative to the Industrial Arts, sixty five Industrial Arts teachers requested their pupils to list several articles that they wished to make. The following, Table XVIII, shows a distribution of pupils suggestions which include, bench woodwork, cabinetmaking, wood patternmaking, electricity, printing and metalwork.

Table XVIII

Distribution of Articles that 4345 Elementary, Junior and Senior High School Pupils Desire to Construct in the Industrial Arts Shops.

WOODWORK

5th Grade

NAME OF ARTICLE	FREQUENCY	NAME OF ARTICLE	FREQUENCY
1. Airplane	333	43. Skatemobile	6
2. Boat	196	44. Clothes line winder	5
3. Toys	112	45. Ironing board	5
4. Bird house	94	46. Kite winder	5
5. Toys, animals	86	47. Boat, serf	4
6. Book ends	67	48. Book stand	4
7. Toy clowns	65	49. Box, shoe shine	4
8. Bell boy, smoking stand	50	50. Broom holder, whisk	4
9. Smoking stand	43	51. Case rack	4
10. Book rack	39	52. Cow boy	4
11. Auto	38	53. Garden markers	4
12. Checker board	38	54. Hat rack	4
13. Sword	30	55. House numbers	4
14. Tie rack	30	56. Love heart	4
15. Doll furniture	27	57. Shelf	4
16. Ship	26	58. Spool holdar	4
17. Bread board	23	59. Stilts	4
18. Dagger	23	60. Toy indian	4
19. Flower stand	22	61. Wheel barrow	4
20. Stool	20	62. Bats	3
21. Magazine rack	18	63. Cabinet, sewing	3
22. Lamp	17	64. Desk set	3
23. Ash tray	16	65. Horse, hobble	3
24. Foot stool	16	66. House model	3
25. Tool chest	16	67. Kite winder	3
26. Shack furniture	14	68. Letter holder	3
27. Bench	13	69. Radio set	3
28. Log cabin	13	70. Sewing set	3
29. Sled	11	71. Taboret	3
30. Gun drill	10	72. Towel rack	3
31. Mail box	10	73. Trellis	3
32. Puzzle	10	74. Base ball game	2
33. Sleeve board	10	75. Bow and arrow	2
34. Hall Tree	9	76. Box, match	2
35. Dump cart and horse	8	77. Bridge	2
36. Table	8	78. Doll house	2
37. Chariot	7	79. Door stop	2
38. Felix cat	7	80. Foot ball goals	2
39. Shack	7	81. House, dog	2
40. Wagon	7	82. Jumping jack	2
41. Chairs	6	83. Knife and fork box	2
42. Guns, rubber	6	84. Paddle	2

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85. Push cart 2
86. Rabbit pen 2
87. Shelf Bracket 2
88. Shield 2
89. Telephone stand 2
90. Auto creeper 1
91. Balloon 1
92. Bed warmer 1
93. Bench, wash 1
95. Drawing board 1
96. Boat, motor 1
97. Box, shoe shine 1
98. Canoe 1
99. Cigar holder 1
100. Clamps 1
101. Coat hanger 1
102. Concrete models 1
103. Dog cart 1
104. Fishing rod 1
105. Flower box 1
106. Frame, picture 1
107. Garden rake 1
108. Hat plate 1
109. Match striker 1
110. Merry-go-round 1
111. Paperholder 1
112. Pin cushion 1
113. Sewing companion 1
114. Sewing table 1
115. Stage coach 1
116. Table, library 1
117. Tennis racket 1
118. Trailer 1
119. Train 1
120. Weather vane 1
121. Wooden bucket 1

6th Grade

1. Airplane 442
2. Boat 301
3. Letter holder 147
4. Bird house 128
5. ✗ Toys 105
6. Foot stool 93
7. End table, fibre 89
8. Book rack 87
9. Smoking stand 78
10. Auto 71
11. Ship 68
12. Taboret 67
13. Flower stand 57
14. Hat rack 56
15. Tool chest 55
16. Bell boy, smoking stand 47
17. Magazine rack 47
18. Coat hanger 46
19. Bread board 42
20. Tie rack 42
21. Book ends 39
22. Board, game 35
23. Box, match 35
24. Bank 30
25. Box, shoe shine 30
26. Ring and peg game 30
27. Clown 27
28. Book shelf 24
29. Sword 24
30. Table 23
31. Weather vane 23
32. Desk set 22
33. Gun drill 22
34. Soap carving 20
35. Step ladder 20
36. Wagon 20
37. Waste basker 19
38. Stool 18
39. Trellis 18
40. Book stand 17
41. Board, checker 16
42. Serving tray 16
43. Box, match, Uncle Sam 15
44. Frame, picture 15
45. Scooter 14
46. Board, ironing 13
47. Dagger 13
48. Fernery 13
49. Radio set 13
50. Hall tree 12
51. Telephone stand 12
52. Towel rack 12
53. Spool holder 12
54. Baseball game 11
55. Sand wheel 11
56. Sewing set 11
57. Wagon, toy 11
58. Bench 10
59. Board, meat 10
60. Candle stick 10
61. Frame, clock 10
62. Kite winder 10
63. Stool, fibre 10
64. Tooth brush rack 10
65. Bow and arrow 9
66. Flower box 9
67. Cabinet, medicine 9
68. Ash stand (tray) 8
69. Broom holder 8
70. Chair 8
71. Stilts 8
72. Tea pot stand 8
73. Match striker 8
74. Knife 7
75. Lamp 7
76. Lamp table 7
77. Spoon 7

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78.	Wheelbarrow	7	
79.	Ash tray	6	
80.	Doll furniture	6	
81.	Doll house	6	
82.	Trestle	6	
83.	Bench, wash	5	
84.	Chest	5	
85.	Toys, clown	5	
86.	Skate mobile	5	
87.	Board, marble	4	
88.	Book case	4	
89.	Chimes	4	
90.	Dump cart and horse	4	
91.	Horse	4	
92.	Knife and fork	4	
93.	Target	4	
94.	Toy, animal	4	
95.	Paper knife	4	
96.	Puzzle	4	
97.	Shelf	4	
98.	Umbrella rack	4	
99.	Box	3	
100.	Box, mail	3	
101.	Bake Cutter	3	
102.	Cannon	3	
103.	Castle	3	
104.	Clothes rack	3	
105.	Flower stand fibre	3	
106.	House, dog	3	
107.	Lamp stand	3	
108.	Log cabin	3	
109.	Swing, child's	3	
110.	Board, cutting	2	
111.	Cabinet, filing	2	
112.	Door stop	2	
113.	House, chicken	2	
114.	Lamp, desk	2	
115.	Steam engine	2	
116.	Submarine	2	
117.	Telephone chair	2	
118.	Trap, rabbit	2	
119.	Motor boat	2	
120.	Skiis	2	
121.	Truck	2	
122.	Bed	1	
123.	Board, bulletin	1	
124.	Boat, serf	1	
125.	Box, coal	1	
126.	Box, wood	1	
127.	Calendar back	1	
128.	Chariot	1	
129.	Chifferobe	1	
130.	Cigar holder	1	
131.	Cigar stand	1	
132.	Circus	1	
133.	Dog, rex electric	1	
134.	Doll cradle	1	
135.	Dump cart and horse	1	
136.	Glider	1	
137.	Hurdle, low	1	
138.	Kite	1	
139.	Lamp, floor	1	
140.	Locomotive and cars	1	
141.	Loom	1	
142.	Sppoligator	1	
143.	Springing shoes	1	
144.	Stand, tea pot	1	
145.	Stand, victrola	1	
146.	Table, end	1	
147.	Telephone	1	
148.	Motor, water	1	
149.	Music rack	1	
150.	Music stand	1	
151.	Paddle	1	
152.	Pedestal	1	
153.	Pencil sharpener	1	
154.	Plow	1	
155.	Post card rack	1	
156	Radio cabinet	1	
157.	Radio stand	1	
158.	Ring toss	1	
159.	Sewing maid	1	
160.	Shelf	1	
161.	Shield	1	
162.	Sled	1	
163.	Trunk	1	
164.	Wagon bed	1	

7th Grade

1.	Airplane	171
2.	Boats	148
3.	Smoking stand	111
4.	Stool	104
5.	End Table	87
6.	Flower stand	71
7.	Book rack	69
8.	Taboret	65
9.	Toys	61
10.	Book ends	59
11.	Dirigible	50
12.	Magazine rack	50
13.	Table lamp	47
14.	Bird house	46
15.	Fernery	39
16.	Lamp	37

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17. Hall tree 34
18. Medicine cabinet 34
19. Serving tray 27
20. Table 26
21. Telephone stand 25
22. Tool chest 23
23. Bell boy, smoking stand 21
24. Chair 20
85. Tie rack 20
26. Book case 19
27. Radio cabinet 19
28. Book shelf 18
29. Coat hanger 18
30. Picture frame 18
31. Desk set 16
32. Radio set 16
33. Chicken house 15
34. Ink stand 15
35. Kite winder 15
36. Kite 14
37. Book trough 13
38. Snow shovel 13
39. Ash tray 12
40. Checker board 12
41. Towel rack 12
42. Victrola record case 12
43. Bats 11
44. Cabinet sewing 11
45. Cake stand 11
46. Dog house 11
47. Trellis 10
48. Pedestal 10
49. Slides 10
50. Bookstand 9
51. Bread board 9
52. Broom holder, whisk 9
53. Spoon 9
54. Box, mail 8
55. Hammer 8
56. Tooth brush, rack 8
57. Scooter 8
58. Screw driver 8
59. Auto 7
60. Board, drawing 7
61. Friction fire maker 7
62. Hat rack 7
63 Lamp, floor 7
64. Waste basket 7
65. Weather vane 7
66. Bank 6
67. Box, flower 6
68. Desk 6
69. Log cabin 6
70. Steam engine 6
71. Swords 6
72. Rolling pin 6
73. Bow and arrow 5
74. Chest 5
75. Clock case 5
76. Telephone shelf 5
77. Bench 4
78. Piano bench 4
79. Box 4
80. Puzzle 4
81. Skatemobile 4
82. Board, cutting 3
83. Box, bread 3
84. Garden rake 3
85. Match striker 3
86. Pelican bank 3
87. Punch, centre 3
88. Radio cabinet 3
89. Book stand, fibre 2
90. Bow gun 2
91. Box, match 2
92. Coat of arms 2
93. Coat hanger 2
94. Doll house 2
95. Ice boat with sails 2
96. Kiddy car 2
97. Stationery holder 2
98. Step ladder 2
99. Mallet 2
100. Match striker 2
101. Wall ornament 2
102. Airplane hanger 1
103. Alligator cage 1
104. Auto creeper 1
105. Bench, work 1
106. Biscuit cutter 1
107. Board ironing 1
108. Bridge 1
109. Canoe 1
110. Canoe paddle 1
111. Chair, folding 1
112. Chimes 1
113. Clamps 1
114. Comb case 1
115. Concrete bench 1
116. Duck 1
117. Fishing rod 1
118. Flower box 1
119. Hockey stick 1
120 House, model 1
121. Paddle 1
122. Pen and ink stand 1
123. Power house 1
124. Sewing table 1
125. Signed flag sticks 1
126. Sled 1
127. Street car model 1
128. Tack tray 1

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129. Ten pins	1
130. Tie ring	1
131. Trap, rabbit	1
132. Wagon tongue	1
133. Yacht	1

8th Grade

1. Boat	126
2. Airplane	119
3. Smoking stand	87
4. Lamp	81
5. End Table	60
6. Fernery	59
7. Book ends	59
8. Footstool	58
9. Taboret	56
10. Dirigible	43
11. Magazine rack	43
12. Bird house	39
13. Hall tree	38
14. Shoeshine box	35
15. Flower stand	34
16. Telephone stand	33
17. Medicine cabinet	32
18. Bookstand	31
19. Radio set	30
20. Stool	30
21. Picture frame	24
22. Tool chest	24
23. Trellis	24
24. Table lamp	22
25. Clock case	21
26. Wagon	21
27. Workbench	20
28. Candle stick	18
29. Toys	18
30. Chair	17
31. Motor boat	17
32. Pedestal	16
33. Book rack	15
34. Serving tray	15
35. Horse, hobby	14
36. Inkstand	14
37. Knife and fork box	14
38. Book case	13
39. Hammers	12
40. Scout accessories	12
41. Wash bench	11
42. Waste basket	11
43. Sewing table	10
44. Bookstand, fibre	9
45. Ironing board	9
46. Sewing cabinet	9
47. Tie rack	9
48. Book trough	8
49. Library table	8
50. Book shelf	7
51. Fibre cord work	7
52. Concrete models	7
53. Metal lamp	7
54. Chest	6
55. Drawing board	6
56. Flower box	6
57. Floor lamp	6
58. Telephone shelf	6
59. Board, checker	5
60. Cake stand	5
61. Copper tray	5
62. Radio stand	5
63. Shack furniture	5
64. Snow shovel	5
65. Trap, rabbit	5
66. Vegetable rack	5
67. Waste basket	5
68. Cigar holder	4
69. Collection case	4
70. Concrete bench	4
71. Cow boy	4
72. Hat rack	4
73. Table, card	4
74. Baseball game	3
75. Board and bread	3
76. Boat, sail	3
77. Box, window	3
78. Cabinet, filing	3
79. Canoe	3
80. Dagger	3
81. Hammer handles	3
82. Refinishing furniture	3
83. Sewing basket	3
84. Sewing tray	3
85. Skiis	3
86. Stationery holders	3
87. Tee squares	3
88. Ash tray stand	2
89, Box, match	2
90. Cabinet, curio	2
91. Clothes line winder	2
92. Collection case	2
93. Garden markers	2
94. Hat rack and mirror	2
95. House, chicken	2
96. Music stand	2
97. Paddle	2
98. Pedestal	2
99. Porch swing	2
100. Puzzle	2
101. Radio cabinet	2
102. Smoking cabinet	2
103. Step ladder	2
104. Stilts	2

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105.	Street car model	2
106.	Table	2
107.	Towel rack	2
108.	Battery case	1
109.	Blotter pad	1
110.	Bow and arrow	1
111.	Box, mail	1
112.	Box, music	1
113.	Broom, holder	1
114.	Butcher knife	1
115.	Cabinet, curio	1
116.	Cabinet, medicine	1
117.	Cabinet, Music	1
118.	Case rack	1
119.	Cement tools	1
120.	Chair, folding	1
121.	Chess, stand	1
122.	Clothes rack	1
123.	Desk set	1
124.	Dog, rex electric	1
125.	Doll furniture	1
126.	Electric motor	1
127.	Fire by friction	1
128.	First aid kit	1
129.	Flower box	1
130.	Fruit, dish	1
131.	Game, marble	1
132.	Gun, rack	1
133.	Hatchet	1
134.	Lathe	1
135.	Log cabin	1
136.	Moving picture machine	1
137.	Paper knife	1
138.	Picture projector	1
139.	Potatoe masher	1
140.	Sewing lap board	1
141.	Stool, bath room	1
142.	Stool, Fibre	1
143.	Stool, Fireside	1
144.	Swords	1
145.	Table, bedside	1
146.	Telephone booth	1
147.	Television	1
148.	Time cane	1
149.	Towel rack	1
150.	Trestle	1
151.	Wagon bed	1
152.	Wagon jack	1
153.	Wheel barrow	1

CABINET MAKING

1.	Table lamp	52
2.	Floor lamp	51
3.	End table	47
4.	Smoking stand	40
5.	Radio cabinet	18
6.	Library table	18
7.	Telephone table and bench	17
8.	Flower stand	16
9.	Candle sticks	15
10.	Writing desk	11
11.	Magazine stand	11
12.	Book case	10
13.	Dirigible	10
14.	Footstool	10
15	Porch swing	9
16.	Airplane	8
17.	Boat	8
18.	Stool	8
19.	Cedar chest	7
20.	Medicine cabinet	7
21.	Book ends	6
22.	Clock case	6
23.	Fernery	6
24.	Table, inlaid	6
25.	Checker board	5
26.	Drawing board	5
27.	Book trough	4
28.	Folding chair	4
29.	Sewing cabinet	4
30.	Sewing table	4
31.	Wastepaper basket	4
32.	Baby crib	3
33.	Canoe	3
34.	Chair	3
35.	Fern box	3
36.	Fibre stool	3
37.	Hall tree	3
38.	Magazine rack	3
39.	Skiis	3
40.	Table	3
41.	Telephone shelf	3
42.	Flat top table	2
43.	Tool chest	2
44.	Arm chair	2
45.	Baseball bat	2
46.	Chest	2
47.	Console table	2
48.	Dresser	2
49.	Drop leaf table	2
50.	Flower box	2
51.	Kitchen cabinet	2
52.	Kitchen table	2
53.	Picture frame	2
54.	Ship	2
55.	Smoking cabinet	2
56.	Work bench	2
57.	Art desk	1
58.	Bob sled	1
59.	Book rack	1
60.	Bread box	1
61.	Cabinet (small)	1
62.	Card table	1

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63. Cat boat	1
64. Checker table (inlaid)	1
65. Croquet set	1
66. Drawing desk	1
67. Drum	1
68. Easel	1
69. Filing cabinet	1
70. Flute	1
71. Flower basket	1
72. Gavel	1
73. Hose reel	1
74. Ice box	1
75. Lawn mower handle and roller	1
76. Model house	1
77. Motor boat	1
78. Piano bench	1
79. Record cabinet	1
80. Piano stool	1
81. Small table	1
82. Stand	1
83. Swing, (camp)	1
84. Tee square	1
85. Taboret	1
86. Tea wagon	1
87. Telephone desk	1
88. Tie rack	1
89. Trellis	1
90. Truck body	1
91. Typewriter table	1
92. Umbrella stand	1
93. Vegetable bin	1
94. Wagon	1
95. Wardrobe	1
96. Wheelchair	1

PATTERNMAKING

1. Book ends	19
2. Airplane models	14
3. Belt buckle	6
4. Boat	6
5. Door stop	3
6. Yacht model	3
7. Anvil (small)	2
8. Concrete tamper	2
9. Locomotive (small)	2
10 Vise	2
11 Zeppelin	2
12 Bending jig	1
13 Grinder	1
14 Electric motor patterns	1
15 Exhaust pipe	1
16 Flag holder	1
17 Jack	1
18 Jig saw treadle	1
19 Lamp cover	1
20. Lathe	1
21. Motor - 4 cylinder gas	1
22. " 5 " compressed air	1
23. " electric	1
24. Soldering furnace	1
25. Steam engine	1
26. Wheels - 8" (wagon)	1
27. Woodworking vise	1

ELECTRICITY

1. Motor	181
2. Toaster	170
3. Transformer	130
4. Shocking coil	116
5. Heater	96
6. Table lamp	68
7. Drop or extension cord	61
8. Ark lamp	58
9. Electro plating	45
10. Telegraph set	39
11. Electric bell set	36
12. Night lamp	33
13. Fuse tester	31
14. Sign flasher	30
15. Test lamp	29
16. Electric lantern	28
17. Radio Crystal	28
18. Induction coil	27
19. Electro magnet	26
20. Dry cell	23
21. Lift magnet	23
22. Dry cell, Wet	21
23. Flash light	18
24. Buzzer	17
25. Current reverser	17
26. Soldering iron	13
27. Radio set	12
28. Fuse puller	11
29. Storage battery	5
30. Television set	4
31. Electric train	3
32. Electric fan	2
33. Floor lamp	2
34. Push button	2
35. Christmas lights	2
36. Amplifier	1
37. Electric iron	1
38. House wiring	1
39. Reversing switch	1
40. Spark coil	1
41. Switch board	1
42. Telephone set	1
43. Switch board	1
44. Test point	1
45. Wind armature	1

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PRINTING

1.	Calling cards	151
2.	Stationery	39
3.	School paper	21
4.	Business cards	17
5.	Christmas cards	17
6.	Letter heads	11
7.	Envelopes	8
8.	Letter heads	8
9.	Album for photos	5
10.	Book plates	5
11.	Block cards	3
12.	Mailbox cards	3
13.	Poems (original)	3
14.	Scout rules	3
15.	Scout laws	2

METAL WORK

1.	Screwdriver	90
2.	Hammer	73
3.	Dustpan	58
4.	Waste basket	52
5.	Cake cutter	43
6.	Boat	42
7.	Mailbox	42
8.	Bucket	41
9.	Ice tongs	40
10.	Centre punch	33
11.	Airplane	32
12.	Ice pick	30
13.	Scratch awl	30
14.	Woodworking vise	30
15.	Floor lamp	28
16.	Cold chisel	27
17.	Funnel	26
18.	Hand grinder	25
19.	Bird house	23
20.	Knife	22
21.	Animal cutter	20
22.	Can opener	20
23.	Motor boat	20
24.	Nail set	20
25.	Bread and Cake pans	18
26.	Drill press	18
27.	Square hammer	18
28.	Tin cup	18
29.	Ballpean hammer	15
30.	Fernery box	15
31.	Flower stand	15
32.	Screw jack	15
33.	Coal bucket	12
34.	Drip pan	12
35.	Pipe bench	12
36.	Calipers	10
37.	Chisel	10
38.	Machine grinder	10
39.	Match box	10
40.	Window box	10
41.	Smoking stand	9
42.	Loud speaker	7
43.	Tool chest	7
44.	Book ends	6
45.	Cabinet	6
46.	Claw bar	6
47.	Electric grinder	6
48.	Model ship	6
49.	Tap wrench	6
50.	Television receiver	5
51.	Toaster	5
52.	Dipper	3
53.	Loving cup	3
54.	Safe deposit box	3
55.	Smoking stand	3
56.	Ash stand	2
57.	Basket	2
58.	Bird stand	2
59.	Compass bar	2
60.	Cooking pan	2
61.	Flower box	2
62.	Gas engine	2
63.	Sea sled	2
64.	Square waste basket	2
65.	Table	2
66.	Table lamp	2
67.	Ash tray	1
68.	Bench Shaper	1
69.	Compressed air pump	1
70.	Drain catch pan	1
71.	Fly wheel	1
72.	Hatchet	1
73.	Lathe (small)	1
74.	Biscuit cutter	1
75.	Small sander	1
76.	Speedster body	1
77.	Stool	1
78.	Telegraph relay set	1
79.	Tub (galvanized)	1
80.	Waste can	1
81	Zeppelin model	1

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In many instances Industrial Arts pupils desire to construct articles that are almost impossible to make, due to the lack of shop equipment and other necessary materials. For these reasons, the local Industrial Arts teachers were asked to list the projects that could be made easily, with their present equipment.

The following, list A, shows the suggestions of sixty five Industrial Arts teachers.

List A

Teachers' Suggestions Relative to Articles that Pupils can make with Present Equipment.

WOODWORK

5th Grade

1. Airplane
2. Auto
3. Ax
4. Bird house
5. Boat
6. Book stall
7. Bow and arrow
8. Broom holder
9. Brush holder
10. Crock cover
11. Cutting board
12. Doll furniture
13. Flower stand
14. Garden marker
15. Glider
16. Gun (toy)
17. Ironing board
18. Kite
19. Match box
20. Nail box
21. Plant stand
22. Sewing companion
23. Skatemobile
24. Sled
25. Stilts
26. Sword
27. Tie rack
28. Towel rack
29. Toys (animal)
30. Trellis
31. Wagon (toy)
32. Whistle
33. Zeppelin

6th grade

1. Airplane
2. Auto
3. Ball bat
4. Barrel cover
5. Baseball bases
6. Bill file
7. Bird house
8. Blotter pad
9. Boat (toy)
10. Book ends
11. Book shelf
12. Book trough
13. Bow and arrow
14. Box - feed
15. Box - Flower
16. Box - knife and fork
17. Box - nail
18. Box - Mail
19. Box - Tackle
20. Box - Window
21. Breadboard
22. Broom holder
23. Bulletin board
24. Calendar back
25. Camp stool
26. Candle holder
27. Can holder
28. Catty and stick
29. Checkerboard
30. Toaster
31. Comb box
32. Cutting board
33. Dog house
34. Fernery
35. Fishing rod
36. Foot stove
37. Friction fire maker
38. Goal posts
39. Hat rack
40. Ironing board
41. Jumping standards
42. Key board
43. Kitty car
44. Kite
45. Kite winder
46. Lamp stand
47. Loom
48. Magazine basket
49. Magazine rack
50. Marble board
51. Match striker
52. Medicine cabinet
53. Mixing board
54. Paper rack
55. Plant stand
56. Pointer
57. Puzzle peg
58. Radio
59. Reed work
60. Ring toss
61. Salt box
62. Sand wheel
63. Scooter
64. Score board
65. Serving tray
66. Ship (model)
67. Shoeshine stand
68. Skatemobile
69. Sled
70. Smoking stand
71. Snow shovel
72. Soap carving
73. Soldering
74. Spool holder
75. Stage scenery
76. Step ladder
77. Stilts
78. Submarine
79. Swing board
80. Taboret
81. Target
82. Telephone stand
83. Thermometer back
84. Tie rack
85. Tool box
86. Toothbrush holder
87. Wagon
88. Waste paper basket
89. Water wheel
90. Windmill

7th Grade

1. Airplane
2. Art fibre work
3. Auto creeper
4. Ball bat

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5. Bench hook
6. Bird house
7. Boat
8. Book ends
9. Bracket shelf
10. Broom holder
11. Camp stool
12. Candle holder
13. Canoe paddle
14. Cement
15. a. Base plates
    b. Benches
    c. Jardiniers
    d. Posts
    e. Pots
16. Checkerboard
17. Chest
18. Child's swing
19. Clothes rack
20. Comb and brush box
21. Costumer
22. Cutting board
23. Desk set
24. Dish drainer
25. Dog house
26. Drawing board
27. End table
28. Fern stand
29. Flower trellis
30. Fly trap
31. Foot stool
32. Garden seat
33. Glass holder
34. Hall tree
35. Handkerchief box
36. Ice wagon
37. Ironing board
38. Jardinier stand
39. Kiddy car
40. Kite
41. Kite winder
42. Lamp base
43. Letter rack
44. Mallet
45. Magazine rack
46. Medicine cabinet
47. Piano bench
48. Picture frame
49. Pipe rack
50. Plant trellis
51. Porch swing
52. Radio
53. Radio cabinet
54. Racer
55. Rolling pin
56. Sanding Block
57. Screen
58. Sewing table
59. Shelf
60. Sled
61. Sleeve board
62. Shaving cabinet
63. Soap container
64. Stationery rack
65. Stool
66. Swing board
67. Table
68. Taboret
69. Tea table
70. Telephone chair
71. Telephone stand
72. Tie rack
73. Toys
74. T-square
75. Tray
76. Towel rack
77. Umbrella stand

8th Grade

1. Airplane
2. Auto creeper
3. Baseball bat
4. Boat
5. Bookcase
6. Book shelves
7. Book stand
8. Camp furniture
9. Cement flower box
10. Chair
11. Chair caning
12. Checkerboard
13. Chess board
14. Chests
15. Costumer
16. Desk
17. Dog house
18. Drawing board
19. End Table
20. Feed trough
21. Fern stand
22. Floor lamp
23. Flower box
24. Hall tree
25. Hammer handle
26. Ice wagon
27. Ironing board
28. Kite
29. Lamp
30. Library table
31. Magazine rack
32. Mallet
33. Medicine cabinet
34. Mitre-box
35. Music stand
36. Pedestal
37. Picture frame
38. Plant trellis
39. Porchswing
40. Rake
41. Radio
42. Sewing stand
43. Shoe box
44. Smoking stand
45. Soap carving
46. Stool
47. Table
48. Taboret
49. Tea wagon
50. Telephone stand
51. Tool box
52. Toys
53. Traps
54. Tray
55. Trophy case
56. Umbrella stand
57. Wall shelf
58. Wash bench
59. Waste basket
60. Work bench

9th grade

1. Armchair
2. Auto creeper
3. Baseball bat
4. Bedside Stand
5. Bench
6. Bookcase
7. Book shelf
8. Book stand
9. Candle stick
10. Cedar chest
11. Chair
12. Chair ladder
13. Chest
14. Clock case
15. Costumer
16. Desk
17. Dictionary stand
18. End table
19. Fernery
20. Floor lamp
21. Flower stand
22. Library table
23. Mallet
24. Medicine cabinet
25. Music cabinet
26. Music stand
27. Pedestal
28. Picture frame
29. Plate rack
30. Porch swing
31. Radio cabinet
32. Serving tray
33. Rolling pin
34. Sewing cabinet
35. Sewing stand

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36. Smoking stand
37. Step ladder
38. Table
39. Table lamp
40. Telephone stand
41. Telephone stool
42. Tool handles
43. Umbrella stand
44. Wall shelf
45. Work bench

CABINETMAKING

Senior High School

1. Airplane
2. Bird feeding station
3. Bird house
4. Boat
5. Bookcase
6. Book ends
7. Book shelf
8. Cabinet
8. Canoe paddle
10. Cedar chest
11. Chair
12. Checkerboard
13. Chicken brooder
14. Chicken feed box
15. Clock case
16. Costumer
17. Dog house
18. Doll furniture
19. Drawing board
20. Easle
21. Fernery
22. Filing case
23. Foot stool
24. Garden furniture
25. Magazine rack
26. Medicine cabinet
27. Ornamental gate
28. Pedestal
29. Picture frame
30. Playground apparatus
31. Porch swing
32. Radio cabinet
33. Rustic furniture
34. Sail boat
35. Skooter
36. Screen (folding)
37. Sewing cabinet
38. Sled
39. Stage scenery
40. Standards -Jumping
-Hurdling
41. Stool and ladder (combination)
42. Tray (serving)
43. Table - console
44. " - drawing
45. " - end
46. " - kitchen
47. " - sewing
48. " - telephone
49. " - tilt
50. Taboret
51. Tea chart
52. Tool chest
53. Trellis
54. T-square
55. Trophy case
56. Turned
a. Candle stick
b. Floor lamp
c. Smoking stand
d. Table lamp
57. wagon
58. Wall shelves
59. Wardrobe
60. Waste basket
61. Weather vane
62. Work bench
63. Writing desk

WOOD PATTERNMAKING

Senior High School

1. Anvil
2. Arbor press
3. Band wheel
4. Belt buckle
5. Bench grinder
6. Bench sander
7. Bench vise
8. Book ends
9. Brackets
10. Casters
11. Concrete tamper
12. Couplings
13. Door knobs
14. Door step
15. Engine (small)
16. Face plate
17. Gears (blanks)
18. Gear case
19. Grate bars
20. Handwheel
21. Jacks
22. Lamp bracket
23. Lamp base
24. Lathe (small)
25. Levers
26. Mandrel
27. Motor bracket
27. Motor head
28. Pipe fitting
29. Proof press
30. Proprellor
31. Pulley
32. Radiator bracket
33. Router plane
34. Seals (club & school)
36. Shaft hanger
37. Surface plate
38. Table lamp
39. Wrenches

ELECTRICITY

7th Grade

1. Annunciator
2. Bedside light
3. Buzzer
4. Common wire splices
5. Current reverser
6. Electric Cord
7. Electric extension cord
8. Electric lantern
9. Electro Magnet
10. Magnet compass
11. Motor (small)
12. Push button
13. Small Transformer
14. Switch (knife)
15. Telegraph set
16. Test set
17. Water rheostat

8th Grade

1. Arc.light
2. Battery
3. Buzzer
4. Electric bell
5. Electroplatingcell
6. Electric top
7. Floor lamp
8. Fuse tester

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9. Heater
10. Leyden jar
11. Microphone
12. Motor
13. Radio set
14. Reflectoscope
15. Relay
16. Rheostat
17. Shocking cell
18. Sign flasher
19. Soldering
20. Table lamp
21. Taping
22. Telegraph
23. Test eight
24. Toaster
25. Underwriters knot

9th Grade

1. Annunciator
2. Battery charger
3. Bell transformer
4. Conduit wiring
5. Electric engine
6. Electric grill
7. Electric Heater
8. Electric soldering iron
9. Fuse testing and replacing
10. Galvanometer
11. Motor
12. Radio set
13. Radiovision apparatus
14. Shocking coil(medical)
15. Simple motor wiring
16. Spark coil
17. Telegraph set
18. Toaster
19. Transformer

Senior High School

1. Battery charger
2. Electric motor
3. Soldering iron
4. Toaster
5. Transformer

METALWORK

SHEET METAL

Junior High School

1. Aquarium
2. Bake pan
3. Biscuit cutter
4. Boxes
5. Bucket
6. Cabinet
7. Canteen
8. Cookie cutters
9. Cookie tray
10. cup
11. Dipper
12. Dust pan(hemmed edge)
13. Dust pan(wired edge)
14. Elbows and pipe for heating & ventilating
15. Fern pans
16. Funnel
17. Fruit bins
18. Fruit jar filler
19. Garbage can
20. Ice pans
21. Light shades
22. Measures
23. Mail box
24. Scoop(flour & sugar)
25. Soap dish
26. Tee joints
27. Tool box
28. Tray
29. Waste basket
30. Window refrigerator

Senior High School

1. Ash can
2. Ash sifter
3. Ash tray
4. Auto heater
5. Bird house
6. Book ends
7. Bowls
8. Bucket
9. Cake box
10. Camp stool
11. Canteen
12. Chicken feeder
13. Coffee pot
14. Cookie cutter
15. cookie tray
16. Drip pan(auto
17. " " (ice)
18. Dust pan (hemmed ed
19. Elbows
20. Elec. toaster
21. Fernery
22. Fishing tackle box
23. Flaring pan
24. Flood lighter
25. Funnel
26. Lamp
27. Mail box
28. Match box
29. Name plate
30. Off-set funnel
31. Oil can
32. Reflector
33. Register box
34. Scale scoop
35. Smoking stand
36. Snow shovel
37. Store canopy
38. Straight side pail
39. T-joint
40. Tool box
41. Tube testing pan
42. Vase (cemetary)
43. Vase(table)
44. Waste basket
45. Waste can
46. Weather vane
47. Window refrigerator
48. Winter front (auto)

MACHINE SHOP

Senior High School

1. Angle plate
2. Arbor
3. Bolts
4. Broachers
5. Bushings
6. Calipers-inside -outside
7. Capscrew

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8. Centre Punch
9. Chucks
10. Chuck wrench
11. Collars
12. Depth gauge
13. Dies
14. Drift pin
15. Doweling jig
16. Face plate
17. Gears
18. Hammers
19. Lathe Centers
20. Mandrels
21. Plumb bob
22. Punch
23. Pulley
24. Reamer
25. Screw driver
26. Screw driver handle
27. Screw jack
28. Shafts
29. Studs
30. Surface plates
31. Tap wrench
32. Taper pins
33. Vise

Junior High School

1. Auto stool
2. Basketball goals
3. Bicycle carrier
4. Blocks (V)
5. Book ends
6. Calipers - inside
   - outside
7. Can opener
8. Centers (lathe)
9. Centre punches
10. Chisel (cold)
11. Countersinks
12. Cutters
13. Drill gauge
14. Drill press (small)
15. Flat punches
16. Garden towel
17. Grinder (power)
18. Hacksaw frame
19. Hammer (ballpean)
20. Hand grinder
21. Hollow punches
22. Ice tongs
23. Jar opener
24. Lathe (small)
25. Luggage carrier
26. Marking gauge
27. Nail set
28. Nut cracker
29. Plumb bob
30. Pot scraper
31. Prick punch
32. Reamers
33. Rivet set
34. Scratch awl
35. Screw driver
36. Scriber
37. Square hammer
38. S-Wrench
39. Tap wrench
40. Tinner's hammer
41. Vise (machinist)
42 Vise (woodworking)
43 Wrenches

FORGING

Senior High School

1. Andirons
2. Aquariams
3. Curtain hangers and poles
4. Drapery brackets
5. Ferneries
6. Fire screen
7. Fire sets
8. Fireside bench
9. Fire tools
10. Foot scrapers
11. Lamps
12. Log holders
13. Smoking stands
14. Swinging flower pots
15. Tools (small)
    a. Center punch
    b. Chisel
    c. Hammer heads
    d. Scratch awl
    e. Tongs
16. Wall brackets
17. Wall pockets

PRINTING

1. Absence blanks
2. Announcements
3. Ballots
4. Billheads
5. Business cards
6. Diplomas
7. Dodgers
8. Envelopes(addressed)
9. Envelopes(return)
10. Examination questions
11. Folders
12. Form letters
13. Greeting cards
14. Invitations
15. Letterheads
16. Magazines
17. Order blanks
18. Pamphlets
19. Permits
20. Personal cards
21. Photo albums
22. Postal cards
23. Posters
24. Programs
25. Reports
26. Score cards
27. Stamp albums
28. Tabular rule forms
29. Tickets
30. Work certificates

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The Industrial Arts do not attempt to develop a high degree of skill. But do, however, attempt to develop certain maniuplative abilities that will be beneficial to everyone, regardless of future occupation. Especially, are these abilities significant for the average householder.

The following, List B, is a suggestive list of repairs and jobs that occur frequently in the home. This list was compiled by sixty five local Industrial Arts teachers.

List B
Frequent Repairs and Odd Jobs that are essential for the upkeep of the Home.

AUTO

1. Change oil
2. " tires
3. " water in radiator
4. Check oil
5. Clean carbon
6. Clean spark plugs
7. Grease car
8. Grind valves
9. Inflate tires
10. Paint car
11. Polish car
12. Repair punctures
13. Replace fan belt
14. Replace auto top
15. Test battery
16. Tighten bolts.
17. Wash car
18.

CEMENT, BRICK, STONE AND PLASTERING

1. Lay cement, brick and stone walks
2. Repair " " " "
3. Repair and replace broken steps
4. Repair plastering
5. Replace broken caps and coping
6. Point up chimney and brick work

CARPENTRY AND CABINETMAKING

1. Build a coal bin
2. " a cupboard
3. " a trellis
4. Cane a chair bottom
5. Hang awnings, shades, screens and screen doors
6. Hang pictures
7. Hang storm doors and storm windows
8. Install weather stripping
9. Renew sash cords
10. Repair board-walks
11. Repair fences
12. " furniture
13. " Floors, screens & windows
14. Replace floor boards
15. " joist or sill
16. " shelving
17. " shingles
18 " steps
19. " weatherboards
20. " window catches
21. Upholstering a chair

ELECTRICITY

1. Install an aerial and ground wire
2. " doorbells
3. " light extension
4. " floor plugs
5. " new lighting fixtures
6. Repair electric coffee percolator
7 " " curling iron
8 " " iron
9 " " sweeper
10 " " waffle iron
11 " " toaster
12 " " radio
13 Replace fuse plugs
14 Test and refill auto and radio batteries
15. Wire Christmas tree
16. Wire lamps

PAINTING, VARNISHING, DECORATING AND GLAZING

1. Clean wall paper
2. Cut glass to size
3. Lay carpet
4. " linoleum
5. " oilcloth
6. Paint furnace
7. " inside woodwork

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8. Paint outside woodwork
9. " roof, spouting and gutters
10. " Store pipes
11. Polish floors
12. Refinish floors
13. " Furniture
14. Repair wall paper
15. Replace broken window pane
16.

PLUMBING AND PIPE FITTING

1. Clean out drains and traps
2. Connect gas stoves
3. Cover pipes
4. Repair gas fixtures
5. " hot water heater
6. " heating system (minor)
7. Repack valves
8. Replace ball in flush tank
9. " broken pipes
10. " washers in faucet

METAL AND SHEETMETAL WORK

1. Adjust, repair and sharpen lawn mower
2. Make keys
3. Repair furnace
4. " Hinges
5. " locks
6. " radio
7. " spouting, gutters, etc.
8. " Tin roof
9. " victrolas
10. Soldering kitchen utensils

MISCELLANEOUS

1. Clean out flue
2. Frame pictures
3. Put up a clothesline
4. Repair laundry equipment
5. " leaky hose
6. " shoes
7. " toys
8. Sharpen edge tools
9. Thaw out frozen pipes

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Formerly Industrial Arts work was concerned chiefly with tool manipulation. Today, the informational side is considered more essential.

In order to determine some of the frequent problems that attract pupils' attention, sixty five local Industrial Arts teachers compiled a list of questions that were asked by their pupils during a semester.

The following, List C, contains questions asked frequently by Industrial Arts pupils.

List C

Questions Asked Frequently by Industrial Arts Pupils

BUILDING CONSTRUCTION

1. How is cement made?
2. What causes cemem t to stick together?
3. Wha t causes cement to crack?
4. Why should cement and gravel be mixed together before adding gravel
5. What is the difference between cement and lime? and rock?
6. How is red mortar made?
7. Why is limestone burned to produce lime?
8. What materials are used in manufacturing brick, concrete and clay products?
9. What causes pressure in a water pipe?
10. What is a hot wire?
11. Why are nails used in assembling some construction parts and screws in others?
12. Why should the chimney be higher than the ridge of the roof?
13. Why are studs placed sixteen inches on centre?
14. Whyis bridging placed between floor joists?
15. Why is sheathing placed nn the sides of a building before the roof is completely framed?
16. What is a two by four?

MECHANICAL D RAWING

1. What is the size of the sheet?
2. How large is a border?
3. How far from the object shall the dimensions be placed?
4. What size lettering shall be used?
5. How many views are required?
6. What grade pencils shall be used for lettering?
7. " " " " " " for drawing object lines?
8. Do centre lines extend beyond the object?
9. Which is the 30° - 60° triangle?
10. Which is the 45° triangle?
11. How can I draw lines at various angles?
12. How is an equilateral triangle drawn?
13. How is a hexagon drawn?
14. How is a octagon "
15. What caused my ruling pen to blot?
16. How is a blueprint made?
17. What is meant by a theoretical element line?
18. " " " " natural element line?
19. How are circles divided into six, twelve or twenty-four parts with the triangle?
20. How many drawings must be made?

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21. What causes tracing paper to wrinkle?
22. What is the chemical solution used to wash blueprints?
23. How can I make my pen draw a fine line?
24. What kind of a line is a border line?
25. What scale shall I use?
26. Is the ruling pen used for making letters?
27. How much space should be left between views?
28. What is the size of the title?
29. Is there a demand for draftsmen?
30. What salary do draftsmen receive?

MACHINE SHOP

1. Why do some lathes cut smoother than others?
2. It is correct to cut from the right to the left side, if the cutter is ground off in the left side?
3. How is taper calculated?
4. Does it harm a lathe to stall it?
5. Does a shaper vise have a feed on it?
6. Why is there more than one feedon a lathe?
7. When are chucks used?
8. Why do lathes have back gears?
9. Why are there two sets of figures on lathe boxes?
10. Why are spindles hollow?
11. Are the lathes made at present better than those made during the war?
12. Could you run any of the machine tools with a gasoline or steam engine?
13. What is the life of a lathe in years?
14. Where is the weakest part of a lathe?
15. Can our school lathe take a $\frac{1}{4}$" cut?
16. Which is the best metal, cast iron or steel?
17. What causes the hard shall on cast iron?
18. What kind of metal is best for machine bearings?
19. What causes electricity in the belts?
20. How many kinds of screw threads are there?
21. What is the purpose of a follower?
22. Can you use the cross feed to turn a taper?
23. Should the chasing dial always be used?
24. How many horsepower are required to drive a 16" lathe?
25. Do worn bearings cause lathes to chatter?
26. What is the largest number of multiple threads in use?
27. Can a round ball be turned on a lathe?
28. Can too much oil be put on a machine?
29. Do all power saw cut on both the forward and backward stroke?
30. Can an oval be cut on a lathe?
31. Can tapers be cut without moving the tail stock of a lathe?
32. Can a school boy make a set of dies?
33. Can knurling be done at high speed?
34. What is an engine lathe?
35. How do you run a l athe backwards?
36. Are bevel gears used on lathes?
37. Should oil be used when polishing wi th emery cloth?
38. What causes the shaper tool to cut deeper and deeper?
39. Are multiple threads difficult to cut?
40. How can the scale on cast iron be cut?
41. How small can stock be cut down and be threaded on a lathe?
42. What determines how fast the shaper or planer should be operated?
43. Are there different designs of knurling?

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44. How large is a No.60 drill?
45. Can dovetailing be done on a milling machine?
46. Are milling cutters made out of special steel?
47. Is it difficult to grind drills accurately?
48. Is oil always used in drilling iron?
49. Is the machinist's trade difficult to learn?
50. What wages do machinists earn?

PRINTING

1. How is this line set?
2. What size type is this?
3. How are lines evenly spaced?
4. How are blank spaces made in printing?
5. How are words divided?
6. Is this the correct type to use?
7. Is this line too tight?
8. How wide shall I set my stick?
9. How much indention shall I use?
10. What letter is this?
11. Is this a "p" or a "d"?
12. Is this an "n" or a "u"?
13. What type shall I use?
14. How is type set for big newspapers?
15. How does a linotype work?
16. Is this line set correctly?
17. Are all cases the same?
18. Is this word spelled correctly?
19. Does a 3-em space follow a comma?
20. Is this line properly centered?
21. Is this line properly spaced?
22. Is this copy correct?
23. Should the heading be set in caps?
24. What shall I use to make quotation marks?
25. What do you use to make a dash between words?
26. How many oil-holes has the press?
27. What kind of ink shall I use?
28. How can I make these letters print heavier?
29. Is the ink heavy enough?
30. How shall I determine the amount of margin?
31. Is the form right side up?
32. Why does this form fail to lift?
33. Can several colors be printed at the same time?
34. Why is type planed?
35. How are pictures made in printing?
36. Would you smash your hand if it became caught in the press?
37. How are the rollers made?
38. How are the guides set on a press?
39. How is colored work done in printing?
40. Is this bond or book paper?

ELECTRICAL WORK

1. How is a single stroke bell made out of a vibrating type?
2. What is alternating current?
3. What is direct current?
4. What is a breaker point?
5. What does a breaker point hit?
6. When is a pigtail splice used?

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7. Why is moisture necessary in a dry cell?
8. Why are electric bulbs in a vacuum?
9. How does an electric meter work?
10. Why is paste used in soldering a joint?
11. How does an electric motor work?
12. " " " generator work?
13. How do you find the positive and negative poles in a battery?
14. On what principle does the voltmeter and ammeter work?
15. What happens if a dry cell is connected with two live wires?
16. What is the advantage of a keyless socket?
17. What is electricity?
18. What is an ampere?
19. What is a volt?
20. What is static electricity?
21. How are radio stations tuned out?
22. Can direct current be changed to alternating current?
23. What causes a dry cell to burn out?
24. What is a dynamo?
25. What is a conductor?
26. What is a phase?
27. What is a magnate?
28. Does electricity travel through the wires or around it?
29. What is a short circuit?
30. What is the difference between an A and B battery?
31. What is a gravity cell used for?
32. How fast does electricity travel?
33. How does a circuit breaker work?
34. What is the purpose of a transformer?
35. Why is zinc used in a wet battery?
36. What caused corrosion on the terminals of a battery?
37. How are magnets made?
38. What is an insulator?
39. Why does current flow from the positive to the negative?
40. Which "Hook-up" gives the most current?
41. What are fuses made of?
42. Are fuses refillable?
43. Why do fuses burn out?
44. What kind of current do street cars use?
45. What are magnetic poles?

FOUNDRY

1. How are hollow castings made that have no exterior openings?
2. Why doesn't moulten metal in a cupola flow into the tuyeres?
3. Why does steel melt at a higher temperature than gray iron?
4. Why is it more difficult to get a satisfactory steel casting than a gray iron casting?
5. Where is fire clay found?
6. Why is sharp sand used as a flux for skimming?
7. How does one determine when metal is fluid enough for pouring?
8. Is parting sand injurious to moulding sand for continuous use?
9. What happens to a core if it is left in the oven for a long time?

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10. How long should cores be baked?
11. Can brass be melted in an iron crucible?
12. How are gates cut for aluminum castings?
13. Do moulders estimate the size of weights to be placed on the moulds to keep them from rising?
14. By what process can cast iron be made less brittle?
15. How long does it take to melt gray iron?
16. Does brass melt more quickly than gray iron?
17. Why does metal shrink when it cools?
18. Is it necessary for a foundry to have a dirt floor?
19. How are fire bricks made?
20. Why are gaggers dipped in clay wash?
21. Can cores be used more than once?
22. How far will metal run in a mould before cooling?
23. Are risers necessary on all moulders?
24. How hard should a pattern be rammed?
25. Why are moulds vented?

SHEETMETAL

1. How is the gauge of wire determined?
2. What metal is used in the manufacture of metal airplanes?
3. What kind of rivets should be used for different jobs?
4. What is the difference between galvanized iron and tin plate?
5. How are spirals made?
6. How hot should a furnace become to do good work?
7. How is solder made?
8. What is a wire gauge?
9. How is sheet iron manufactured?

PATTERNMAKING

1. Why is shellac rather than varnish used for finishing patterns?
2. Since patternmaking is so difficult to learn w hy are the wages so low?
3. Does excessive rapping on small patterns make the castings too large?
4. Should thin patterns have more draft per foot than thick ones?
5. Where do patternmakers learn the theory of moulding?
6. Where should rapping plates be placed on patterns?
7. Should glue or shellac be used in fastening fillets?
8. How are good cutting edges kept on tools?
9. When are half and when are whole core boxes required?
10. How long should prints be made to support the cores?
11. Whenshould a pattern be "coped"?
12. " " " " "cored"?
13. How should patterns be placed on a "match board"?
14. When should patterns be constructed "solid"?
15. " " " "parted"?
16. How many dowel pins should be used in holding patterns and core boxes together?
17. Where should dowel pins be placed in patterns and core boxes?
18. How are "loose pieces" attached to patterns?

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WOODWORK

1. What kind of wood is this?
2. Why are chisels sharpened only on one side?
3. Why do some woods need filler?
4. Will the backsaw cut iron?
5. What are planer marks?
6. Why is it so difficult to square a board?
7. Why do shavings curl up?
8. Why is it necessary to bore holes for screws?
9. Why do coping saw blades break when they get hot?
10. What kind of wood is used in building airplanes?
11. How are propellor blades made?
12. How long does it take paint to dry?
13. How is woodfiller made?
14. How is shellac made?
15. How is varnish made?
16. Why are some woods heavier than others?
17. Can a back-saw be used for ripping small pieces?
18. What brand of saws are considered the best?
19. Why can't a ruler be used for drawing lines on wood?
20. What is the difference between nails and brads?
21. How can nails be driven without splitting the wood?
22. What is glue made of?
23. When and where are flat-headed and rouhd headed screws used?
24. How can one tell the size of nails, brads and screws?
25. How can one tell the size of a bit?
26. How may end grain be planed so that it will not split?
27. How are duplicate parts laid out?
28. Does wood finish preserve wood?
29. How can warp be taken out of a board?
30. Why does lacquer dry up so quickly?
31. How are plane bits set?
32. When should a spoke-shave be used?
33. Which way does the grain run in a board?
34. What is the difference between a rip and cross-cut saw?
35. How can boards be planed thatare too wide to fasten in the vise?

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Chapter X

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY OF FACTS RELATIVE TO THE INDUSTRIAL ARTS:

1. Manual instruction, either informal or formal, is found in all stages of civilization as it is essential for the preservation of life.
2. Race progress has been slowest when little attention was paid to manual activities.
3. During the Greek and Roman periods, and throughout most of the Middle Ages, little attention was paid to formal instruction in the manual activities. These activities were advocated by social reformers during the 16th and 17th centuries; incorporated into the curriculum during the 18th and 19th centuries, and established during the 20th century.
4. Much confusion exists today relative to the terminology employed in designating manual instruction in our schools.
5. There is no list of objectives for the industrial arts that will meet with universal acceptance. The generally accepted objectives, however, are, that they provide for the constructive tendencies of youth, provide basic mechanical skills and information useful to everyone, provide opportunities for occupational guidance purposes, and assist in vitalizing other school subjects.
6. Cincinnati is one of the country's outstanding industrial centers, containing many industries into which hundreds of boys find their way annually.
7. Library and other reports show an increased interest in things industrial and mechanical in the city of Cincinnati.
8. There are relatively few state and city courses of study in the field of industrial arts. Of these available the majority are indefinite as to objectives, time allotment, grade placement, informational materials, references, etc.

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9. School surveys have discovered little in the field of industrial arts to commend. The majority of commendations are for good workmanship and good equipment. The chief criticisms are the lack of provision for pupil initiative, that it is narrowly technical, that the courses are too formal or obsolete, that educational and vocational guidance provisions are lacking, that greater breadth of instruction and integration between the elementary school junior and senior high school is needed.

10. Textbooks in the field of education, primarily those in secondary education, advocate industrial arts work that is extensive rather than intensive.

11. Redognized educational leaders criticize the industrial arts upon grounds that they lack proper objectives, proper methods of teaching procedures, ability to arouse and sustain pupils' interest, correlation between the various shops and other school subjects, adequate records, methods for testing the results of teaching, stress upon the cultural rather than upon the vocational side of education.

12. The Majority of the industrial arts work is taken by pupils in the seventh and eighth grades and consists of woodwork and mechanical drawing.

13. The lack of interest and ability are the chief reasons given for not liking or selecting industrial arts work.

14. The industrial arts have had little influence upon pupils occupational choice.

15. The industrial arts have had a beneficial effect upon intelligent buying and consumption.

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16. Those who have had industrial arts work have effected a saving of money by being able to do much of the repair work about the home and its equipment.

17. College and high school seniors see little need for industrial arts work, while those engaged in skilled and semi-skilled crafts recommend an extensive as well as an intensive program.

18. If former students could repeat their school courses a majority would select a larger amount of industrial arts work.

19. Much confusion exists between the school administrator, teacher, pupil, layman, and manufacturer relative to the industrial arts.

20. Teachers' suggestions, relative to projects, show that many articles are obsolete or have become hobbies with the teachers.

21. Pupils' suggestions, on the project side, show an outstanding interest in airplanes, boats, mechanical toys, etc. While on the informational side there are many significant problems that appear to perplex them.

CONCLUSIONS AND RECOMMENDATIONS

1. Race history shows that manual experience possess a deep social significance, since they are closely allied with man's chief concern - the preservation of life. While pupils work with concrete and material things and seek to accomplish practical ends, the obtained results are no less intellectual and cultural than some other subjects, since many of the most significant achievements of mankind grew out of useful occupations. It is recommended that school administrators acquaint themselves more fully with the possibilities of industrial arts work for the motivation

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of all school work. The status of the industrial arts, in any school, usually depends upon the attitude of the head of the school toward it.

2. A great confusion exists in the terminology applied to manual activities. A term applied in one part of the country may have an entirely different meaning in another section. This confusion is obvious, when, for example, a group of three hundred fifty-eight industrial arts teachers in the state of Ohio, in 1927, used twenty-eight different terms to designate the work that they were conducting. The term that has been employed in the Cincinnati, Ohio, Public Schools, for a period of approximately twenty-five years and which is used throughout this study is "Industrial Arts". This term denotes manual activities as an integral part of general education and differentiates between general education and specific occupational training. It is recommendated that the various educational agencies and associations come to some agreement relative to terminology and thereby obviate much of the present confusion.
3. It is held that educational theory precedes educational practice from ten to twenty-five years. Hence a logical aid in the solution of our curriculum problems would be an examination of the theories advocated by our recognized educational leaders. This plan was followed in working our the "Guiding Principles" of this study in which the policies of the theorist and practical expert were brought together and harmonized for practical purposes. It is recommended when constructing a curriculum that both theory and practice be carefully considered and that out of the harmonization of the two will develop a more worthwhile program of studies.
4. Investigation shows that Cincinnati is not only a large commercial and industrial center but has large and diversified industries. In view of the

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fact that modern industry is changing so rapidly and becoming more mechanized, it becomes evident that less skilled craftsmen will be required. On the other hand, it is obvious that the schools should train pupils who will be more versatile and adaptable to the present and future industrial civilization in which we live and work. It is recommended that the Cincinnati Public Schools furnish sufficient contacts with material things to guarantee sufficient training and understanding of things industrial, for those who will eventually enter industry and for those who will reside in an industrial environment. It is believed that the general shop plan and the general "Unit shop" such as the "general metal shop" at the new Western Hills High School are excellently suited for carrying out this idea.

5. A study of industrial arts courses from the various sections of the country reveals the fact that the industrial arts curriculum is one that is grossly neglected and needs much study, research, and experimentation. A glaring defect is the relative indefiniteness regarding objectives, time allotments, grade placement, suggestive problems, materials for testing instructions, references, etc. While some attempts are being made by various industrial arts associations, there is, however, a lack of concentrated effort. It is recommended that more attention be given to this type of work by way of research and experimentation, in as much as the equipment for industrial work is expensive and the cost per pupil relatively higher than that of any other subject. It is further recommended, that locally, those industrial arts teachers who have already obtained their bachelor's degree and are pursuing graduate work turn their attention toward some of the many perplexing problems that confront the industrial arts today. This may readily be done, due to the unique relationship that

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exists between the Cincinnati Public Schools and the College of Education of the University of Cincinnati.

6. In formulating a course of study it is essential to examine all the available materials and to secure data from as many reliable sources as possible, In consequence one of the means employed in this study was an examination of textbooks, school surveys, and expressions from recognized educational authorities in the field of Industrial Arts education. These three sources are recommended as being useful for the building of any Industrial Arts program as they bring together three significant factors, viz: - the viewpoint of the theorist, the viewpoint of the specialist, and an evaluation of the operations of the subject in actual practice.

7. An analysis of questionnaires submitted to the layman, high school senior, college senior, and manufacturer, reveals the fact that the layman and manufacturer see a distinct need for the schools to furnish manual experiences. While the prospective high school and college graduates see little or no value in them, with the exception of those who are taking or expect to take engineering courses. Since we live under a democratic form of government where the majority of people have, to some extent, equal educational opportunities, it is almost impossible to predict how much of a certain subject is sufficient, how long it should be pursued, or for what groups it is highly desirable. While it is generally agreed that a certain amount of industrial arts work is worth while for everyone, regardless of future occupation, it is recommended that the amount of industrial arts work a pupil pursues, shall depend primarily upon the pupil himself, taking into consideration his likes and dislikes, aptitudes, abilities, capacity, etc., and in addition it is recommended that pupils shall make an occupational choice as soon as feasible, thereby, permitting

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the planning of an intelligent school program that will function when the individual leaves school.

8. Another outstanding factor revealed by the questionnaires is the gross misunderstanding of aims, purposes, methods, etc., of the Industrial Arts. The criticisms and suggestions of pupils, graduates, and laymen are very significant. It is recommended that ways and means be devised for bringing together the school administrator, the teacher, the pupil, patron, and manufacturer, in order that many misunderstandings may be corrected and closer cooperation effected.

9. It is noticeable that little or nothing has been mentioned in this study regarding educational or vocational guidance. This apparent neglect is due to the fact, that the Cincinnati Public Schools maintain a Vocational Bureau whose employees are specialists and care for these needs. Likewise, the matter of excursions or field trips, which are significant from the standpoint of first hand information, are provided through a special service, furnished by the Cincinnati Civic and Vocational League. It is recommended that while separate organizations provide for guidance, the study of occupations, etc., that the industrial arts teacher, due to his unique position relative to industry and occupational life, not only avail himself of the established service but keep abreast of the times through readings, study and analysis of occupations, trips, excursions and occasional summer employment in industry.

10. Of the suggestive materials furnished by the pupils and teachers for this study, the significant suggestions are those provided by the industrial arts pupils, relative to projects and the questions that they frequently ask. Not only do these materials furnish valuable content for a course of study but they likewise show the pupils interests and the trend of the times. As previously pointed out, boys show a marked attachment for

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airplanes, boats, mechanical toys, etc. This shows an underlying interest in projects that pertain to speed and power, an undeniable tendency of the day. Hence it is recommended that pupil needs and interests be carefully analyzed in planning a proposed activity, in order to insure mental growth rather than a high degree of manipulative skill. Furthermore, teachers should realize that the day of the coat-hanger, roller-towel, boot-jack, etc., is past and in their place have come other projects which have a greater fascination and appeal - projects in which pupils are already interested and in which teacher stimulation is reduced to a minimum. The recent enthusiasm for radio is a notable example.

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PART II

A COURSE OF STUDY IN INDUSTRIAL ARTS

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CHAPTER XI

INTRODUCTION:

This course of study is not a standardized plan to be followed ridigly, but rather a suggestive outline of materials for the industrial arts teacher. It has been planned with the view of being a handy reference for the experienced teacher and a guide for the new or immature teacher.

The course provides materials for the elementary, junior and senior high school pupil. For the elementary level, the work is designed largely to clarify and vitalize other school subjects. For the junior high school grades and the seventh and eighth grades found in the traditional elementary school, the work is planned to give contact and experience with as many tools, materials, and process as time and pupil inclination will permit. In the senior high school, the work is designed to elaborate more fully the experiences previously acquired and to provide a more elaborate subject matter content.

In formulating this course of study, the plan took into consideration the present school organization in the Cincinnati Public Schools, viz: the 8 - 4 plan, the 6 - 6 plan, and the 6 - 3 - 3 plan, as well as the difference in the time allotment and the equipment found under these various plans of organization. In addition, pupils' needs and interests, and the teachers' experience and viewpoints were given consideration throughout.

The general method of procedure employed is as follows:

1. General objectives of the specific subject.
2. Specific objectives of subject and grade.
3. Manipulative and informational abilities to be acquired

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relative to operations, processes, constructions, materials and tools.

4. A suggestive list of projects to be constructed.

5. Suggestions for correlation with such academic subjects as English, mathematics, science, etc.

6. Suggestive tests for pre-testing and testing.

Due to the three plans of school organization (8-4, 6-6-3, 6-6) found in many sections of the country, the time allotted to the industrial arts varies considerably. The present time allotment in the various grades of the Cincinnati Public Schools is as follows:

GRADES	TIME
8 - 4 plan of organization	
5 and 6	1 hr. per week
7 and 8	1½ hrs. per week
6 - 3 - 3 plan of organization	
7	Six 45 minute periods per week for all pupils
8	Four 45 minute periods per week for all pupils and opportunity for 3 extra periods.
9	Commercial course - two 45 minute periods per week. General course - four 45 minute periods per week. Industrial Arts course - eight 45 minute periods per week.
6 - 6 plan of organization	
7 and 8	One 60 minute period per diem
9	Three 60 minute periods per week, and opportunity for 6 additional periods.
Senior High School	
9 to 12 or 10 to 12	Ten 45 minute periods per week Industrial Arts course

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One year of either mechanical drawing or free hand drawing is a requirement for all senior high school pupils. The time allotment is 90 minutes pwe week.

The general plan of the course as outlined above is of such a nature, that it permits flexibility without destroying the basic structure. It is suggested that additions and eliminations be made whenever necessary, thereby, keeping the course abreast of modern educational, occupational, and industrial tendencies.

It should be noted that the Industrial Arts are concerned primarily with general education. There are, however, occasions when the work may become intensive and specific rather than extensive. This condition is brought about by several factors, (a) Those who remain in school due to the compulsory education laws (b) Those who wish to leave school early and do not care to serve an apprenticeship (c) Those who desire to take as much work in a particular subject as possible and (d) Those who for social reasons find it difficult to receive training in a vocational school or in an industrial or commercial organization.

Examples of a more specific training are furnished by the accompanying courses in Building Construction and Mechanical Drawing in the eleventh and twelfth grades. The students in the latter group have received training in the basic operations and process, of which there are not a great number, and hence may do some rather intensive work if they desire to continue the subject.

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ELEMENTARY HANDWORK

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GENERAL OBJECTIVES OF THE INDUSTRIAL ARTS

1. To provide a well balanced general or liberal education.
2. To provide for the innate constructive tendencies of pupils.
3. To provide the necessary training and experiences with concrete things that are no longer furnished by the home.
4. To give an insight into the many social, economic, and industrial problems in our present industrial civilization.
5. To develop a reasonable amount of manipulative skill and technical information, in order that individuals may care for the up-keep of the home, buy and consume industrial products more intelligently.
6. To provide opportunities for exploring and discovering one's abilities, capacities, and aptitudes through the contacts with various basic mechanical and industrial processes.
7. To provide occupational and educational guidance opportunities through practical occupational experiences and a study of occupational life.
8. To provide opportunities for the development of avocational or recreational abilities.
9. To correlate and vitalize other school subjects.
10. To provide subject matter that contains a high socializing value.

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CHAPTER XII

ELEMENTARY HANDWORK FOR GRADES FOUR AND FIVE

General Objectives

1. To give an opportunity to live through some of the handicraft experiences of civilization.

2. To develop a feeling of responsibility in all that the child undertakes.

3. To give an appreciation of economic life.

4. To develop the ideal of worthy home membership.

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Fourth Grade

Note: This work is to be done in the Industrial Arts room with the help of the home room teacher.

1. The Specific Objective:

To vitalize the work of geography.

2. Abilities

(a) Manipulative abilities to be acquired.

1. To do simple clay work.
2. To do simple wood work.
3. To do simple weaving.
4. To do simple soap carving.

(b) Informational Abilities to be Acquired.

1. To suggest and devise ways and means for developing the suggestive topics and projects for the year.
2. To develop simple and original designs.
3. To know names and uses of coping saw, ruler, back saw, and claw hammer.

Work beginning in September:

Mesopotamia:

1. Sun dried brick houses with flat roof, two small windows, and mud fences.
2. Dolls dressed in turbans and robes.
3. Frames for weaving rugs.
4. Minaret.

Arabia:

1. Tents of nomads.
2. A loaded caravan - water jars.
3. Round flat baskets carried by women on their heads.

Palestine:

1. Walls and gates of Jerusalem.
2. Threshing wheat between two stones.

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Egypt:

1. Pyramids, Sphinx, and Obelisk of clay.
2. Egyptian boats.
3. Houses of stone or brick with balcony and bay latticed windows.
4. Irrigation projects.

Reference:
Barrows, H.H. and Parker E. P. "Journeys in Distant lands," Silver, Burdette & Co.-1924
pp. 37-Fig. 54
" 41- " 56
" 43- " 61 Mosques and minarets.

Congo Region:

1. Houses made of woven branches and thatched roofs.
2. Tropical animals.
3. Tropical vegetation.

Spain:

1. Rock of Gibraltar.
2. Dolls dressed in native costume.
3. Cork forest, malaga grape vineyard.

Italy:

1. Dolls dressed in native costome.
2. Italian cart and donkey.
3. Mt. Vesuvius.
4. Italian boats.

Greece:

1. Temples.
2. Ruins of the Acropolis.
3. Dolls dressed in native costume.

Switzerland:

1. Chatlets.
2. Dolls in native costume.
3. Chamois.
4. Mountains with tunnels and glaciers.

Holland:

1. Dutch houses.
2. Wind Mills.
3. Dikes.
4. Dolls in native custume.
5. Canal barges.
6. Milk canals and dogs.

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Norway:

1. Norwegian houses.
2. Dolls in native costumes.
3. Gay racks.
4. Viking boats.

North Pole:

1. Igloo.
2. Summer Tents.
3. Sledges.
4. Eskimo dogs.
5. Dolls in native costumes.

India:

1. Elephants.
2. Native huts.
3. Dolls in native costumes.

China:

1. Chinese houses.
2. Pagodas.
3. Dolls in native costumes.
4. Junka house boats.
5. Chop sticks.
6. Rice fields.

Japan:

1. Japanese house with sliding walls.
2. Dolls in native costumes.
3. Japanese gardens -- bridges -- tea houses.
4. Japanese lacquered ware.
5. Japanese cherry trees in bloom.

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References:

Carpenter, F. Around the World with the Children. American Book Co., 1921.

Sears, Minnie E. Childrens Catalogue (3rd Edition). H. W. Wilson Co., New York 1925.

School Arts Magazine - p. 490-491 April 1929. Davis Press, Inc., Worcester, Mass.

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Fifth Grade

Note: The work for the fifth grade will be correlated with the regular course of study. The material for it comes from the history, geography and language lessons. The work is to be done in the Industrial Arts room with the help of the home room teacher.

1. Specific Objectives:

   (a) To vitalize for the children regular subject matter. (History, Geography, Language).
   (b) To train for self expression through activity.
   (c) To train for group activity.
   (d) To provide an interest and appreciation of the life and activities of former times as compared with the life and activity of today.

2. Abilities:

   (a) Manipulative abilities to be acquired:

      1. To saw with a coping and back saw.
      2. To measure with a rule.
      3. To do "free" planing.
      4. To do simple assembly and fastening.
      5. To construct simple pottery.
      6. To weave simple reed baskets and vases.
      7. To do simple soap carving.

   (b) Informational Abilities to be Acquired:

      1. To know the names and uses of the coping saw, back saw, claw hammer, plane, and rule.
      2. To know the name and use of basswood and poplar.
      3. To develop simple and original designs.
      4. To suggest and devise ways and means for developing suggested topics and projects for the year.

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3. SUGGESTIVE PROJECTS FOR THE YEAR.

1. World Workers.
2. Columbus Day.
3. Indian Life.
4. Pilgrims for Thanksgiving.
5. From Thanksgiving to Christmas coping saw work or other wood-work; making toys and gifts.
6. Life in the City.
7. Lincoln or Washington.
8. Preparing for Spring.
9. Arbor Day.
10. Jefferson's Birthday by a portrayal of the Lewis and Clark Expedition.
11. Flag Day.

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Project for September
World Workers
(To be worked out in Connection with language topic)

(a) Build a modern garage showing the work shop where the repairs are done on the different cars. Also show the machinery used, such as cranes, etc.

(b) Make a study of a blacksmith shop. (show anvil, bellows, tools).

(c) Build a spinning wheel and a loom in miniature size to show how the thread is made and the cloth woven. (Secure some raw wool and raw cotton.)

(d) Set up a frontier store showing how the people of the frontier days traded cattle, wheat, and nails for the necessities of every day life. In connection with this set up a modern store where money is used as a means of trade.

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Project for Early Part of October

Columbus Day

(a) Make a sand table problem of Columbus landing in Cuba.

(b) Show the ships on the water.

(c) Show the tropical landscape.

(d) Show the astonished Indians.

(e) Show the group of men with Columbus.

(f) Show Columbus with the flag of Spain.

(g) Show Columbus at his home.

(h) Build an old Spanish home and have Columbus seated in front of it engaged in combing wool.

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Reference

School Arts Magazine; Pictures of Ships, p.540-551, May 1929, Davis Press, Inc., Worcester, Mass.

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Project for the Study of Indian Life.

Indians of the East -- Movable type houses.

1. Wigwams (poles, canvass)
2. Totem pole.
3. Pine trees, oak trees.
4. Water (Glass or mirror.)
5. Canoes.
6. Dolls (Indian costumes)
    1. Mocassins.
    2. Beads.
    3. Blankets
    4. Feathers.
    5. Quiver.
    6. Wampum.
7. Boys and arrows.
8. Birds (robin, blue bird)
9. Animals (rabbits, squirrels, deer).
10. Linden cradle (twigs)
11. Moss and rushes (shavings).
12. Linoleum block printing of Indian designs.
13. Indian arrow heads from slate.
14. Needles from bone.
15. Kettles and jars, clay bowls.
16. Weaving (bead weaving and blanket weaving).
17. Baskets.
18. Bone and stone tools, tomahawks.

In connection with this work cut an Indian village of the South-West Pueblo type or fixed house type.

Many of the things for this will be the same as for the Indians of the East. More weaving, more pottery, different houses.

Soon after this study of Indian life is started, make an excursion to the Museum to study the Indian collection. Compare the two studies of Indian life with Indians of today.

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References:

Curtis, Edward S.	Indian Days of Long Ago. 1914.	World Book Co.
Driggs, H. R.	Life Language Lessons. Book (pp. 24-26,35,20,20-21).	II University Publishing Co. N.Y.City,1921
Hall, Jennie	Indian Stories Retold from St. Nicholas.	The Century Co.

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Project for the Study of Indian Life (cont.)

References: (cont.)

Moon, Grace	Chi-wee. Doubleday, Page & Co. 1925. Chi-wee and Loki of the Desert. Doubleday, Page and Co. 1926.
Pugh, Beatrice B.	Little Indian Maidens at Work and Play. E. P. Dutton Co.
Pumphrey, Margaret,	Pilgrim Stories, Fand, McNally & Co. 1910.

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Project for November

The Pilgrims

Pilgrim Settlement of 1620

1. Large log house.
2. Hospital (made of logs)
3. Meeting House (logs)
4. Seven dwellings (logs)
5. Mayflower (sail boat)
6. Dolls (Pilgrim costume - Indian costume)
7. Animals (wolves, deer)
8. Birds (wild turkeys, pigeons, wild geese, pheasants)
9. Tools (for making clapboards, ax).
10. Household furnishings.
    1. Fireplace with kettle.
    2. Table (board placed on logs)
    3. Chairs (logs, short lengths of tree trunks).
    4. Bed (logs with rope lacings)
    5. Dishes (wooden trenches, bowl gourds, pewter spoons, bowl and cups made of pumpkins and gourds, dippers and bottles).
    6. Brushes - turkey wings.
    7. Candles from bayberry brush.
    8. Pine knots.
    9. Tubs, barrels and buckets.
    10. Weapons (swords, guns, bow and arrow)

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Project for November (cont.)

References:

Coe, E.P.	Founders of Our Country, pp.153-166 American Book Co. 1912.
Gordy, W.F.	Leaders in Making America, Chas. Scribners Sons, 1923.
Pumphrey, Margaret,	Pilgrim Stories, Rand,McNally & Co.1910.
School Arts Magazine,	pp.114-115, Oct. 1928, Davis Press, Inc., Worcester, Mass.

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Projects For December

Toys and Gifts

Children make toys for themselves, or gifts for others.

1. Book rack.
2. Book ends.
3. Bread board.
4. Auto.
5. Canoe.
6. Doll furniture.
7. Doll house.
8. Door stop.
9. Game board.
10. Letter holder.
11. Puzzle.
12. Ship.
13. Tie rack.
14. Toys(animals).

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Project for January

Life in the City

A Reproduction of early Cincinnati

1. Fort Washington (log).
2. Rude log homes.
3. Flat boat and canoes on Ohio river.
4. Crude streets from Broadway to Central and North to Liberty.
5. Show settlement at Columbia.
6. Show settlement at North Bend.
7. Indians and white people (soldiers)
8. Leading characters.
    1. General St. Clair
    2. John Symmes.

Reference: The Citizens Book.

At the same time or in connection with this construct a modern Cincinnati.

1. Business district and surrounding hills.

2. Reproduction of prominent places.

    1. Eden Park Tower
    2. Rookwood Pottery
    3. Fountain Square
    4. Union Central Building,
    5. East End Pumping Station
    6. Post Office
    7. Union Central Depot
    8. Sixth Street Market
    9. Municipal Airport

3. Sidewalks
4. Lamp posts
5. Signal Lights
6. People on Streets
7. Street cars, autos.

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Lincoln's andWashington's Birthdays

Lincoln:

The Lincolns moving to Little Pigeon Creek.

1. Show Abe and his father cutting a road through dense forest from the Ohio river to their new home on Little Pigeon Creek.

2. Wild animals; deer, wild cat, wolf, bear (clay modeled, soap-cut or wood-cut) also birds, snakes, wild turkeys, cranes wading in creek.

3. Their first houses - half-faced (4th side open), poles covered with dead leaves and brush. Bonfires in front of open side. Later replaced with log houses as the Lincolns did the next Spring.

4. Children construct some furniture similar to that used in the Lincoln cabin.

Moore, Chas. W. Abraham Lincoln for Boys and Girls. Houghton Mifflin Co. 1909.

Washington:

Make a representation of Mount Vernon, the home of George Washington.

1. The large estate.

2. The large colonial home.

    1. Entrance leading to kitchen.
    2. Spinning house and weaving house.
    3. Butler's house.
    4. Servents' quarters.

3. Fields of corn and pasture

4. Fruit orchards (peach and apple)

5. Vegetable garden

6. Seed house

7. Flower Garden

Baldwin, J. Four Great Americans, American Book Co. 1897.

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Project for the study of Spring.

1. Sand table farm -- a typical farm.
   (a) Farm house.
   (b) Barn.
   (c) Fences.
   (d) Garden.
   (e) Fields of hay, corn, wheat.
   (f) Soap, clay, or wood cut animals.
2. Miniature greenhouse or hot-bed. Greenhouse may be checked off with black paint on glass. Glass - cut the shape of a real greenhouse and put together with hard clay. From clay or soap construct vegetables and flowers and paint.

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Project for the Study of Arbor Day

(a) Model a scene of a lumbering industry.

(b) Have one part covered with trees representing a forest.

(c) Have small road leading from the woods down a hill to a saw mill near a river.

(d) Have the saw mill run by water power.

(e) Contrast with this the saw mill run by steam.

(f) Have small stacks of lumber.

(g) Build bird house by the class.

(h) If possible plant a tree.

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Reference:

The School Arts Magazine, pp.583-620, June, 1928.

Davis Press, Inc., Worcester, Mass.

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To celebrate anniversary of Jefferson's birthday by a project illustrating the journey of Lewis and Clark.

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1. Dolls.
   - (a) Soldiers.
   - (b) Servants -- carpenters -- cooks.
   - (c) Hunters.
   - (d) Indians.
   - (c) Negroes.
2. Horses.
3. Boats (Flat-bottomed hollowed out from logs, small real boats, five altogether.)
4. Rude houses and forts (logs)
5. Forests. (trees of Rockies)
6. Wagons or carts.
7. Model figures of chief characters.
   1. Lewis.
   2. Clark.
   3. Sacajawea - the Bird Woman.
   4. Carbonneau - the French Interpreter.
8. Supplies.
   1. Salmon.
9. Weapons.
   1. Guns.
   2. Swords.

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LEWIS AND CLARK

I. Geography Text.

Smith J.R. Human Geography. Book I. Part I.
J. C. Winston Co. Philadelphia, 1925

(a) North Central States, pp. 55-75

(b) Plateau States, pp. 81-96

(c) Pacific Section, pp. 96-103.

(d) Map showing how U. S. has grown, pp. 46.

II. History.

1. Kingsley, N. Four American Explorers.
American Book Co. 1902.

2. McMurry, C.A. Pioneers of the Rocky
Mountains and West,
MacMillan Co. 1904.

3. McMurry, C. A. Pioneers of the Rocky
Mountains and West, p. 1-39
Third Book, MacMillan Co. 1928.

c. Tappan, Eva. American Hero Stories, pp. 207-217
Houghton, Mifflin Co. 1906.

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Flag Day Topic

1. A project showing a section of Philadelphia -- with a store numbered 239 Arch Street where first flag was made. Show Betsy Ross making the first flag.
2. Make flags of many lands.

School Arts Magazine	pp. 382 Feb. 1929, Davis Press, Inc. Worcester, Mass.
Our Holiday Retold from St. Nicholas	Century Co.

References:

1. Bonser F. and Mossman L.	Industrial Arts for Elementary Schools. MacMillan Co. 1923
2. Lincoln School Staff	Curriculum Making in Elementary School. Ginn& Co. 1927
3. Wiecking, A.M.	Education through Manual Activity Ginn & Co. 1928

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BENCH WOODWORK

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CHAPTER XIII

BENCH WOODWORK FOR GRADES SIX, SEVEN, AND EIGHT.

GENERAL OBJECTIVES

1. To offer opportunities for self-expression
2. To give an insight into a number of basic industrial occupations
3. To give a practical knowledge of simple mechanical devices
4. To develop the ability to perform simple mechanical operations
5. To develop ideas of good workmanship
6. To stimulate interest that may lead to a vocational choice
7. To vitalize other school subjects

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Sixth Grade Woodwork

1. Specific Objectives

   (a) To give a practical acquaintance and experience with the common bench woodworking tools.
   (b) To do simple construction, assembly and finishing.
   (c) To make simple home repairs and adjustments.

2. Abilities

   (a) Manipulative abilities to be acquired:

   1. To square stock.
   2. To plane stock.
   3. To measure stock.
   4. To get out stock.
   5. To sketch a project.
   6. To lay out a project.
   7. To saw to a line.
   8. To gauge to width and thickness.
   9. To cut and chisel to depth.
   10. To bore and drill holes.
   11. To read a rule.
   12. To construct a butt and cross-lap joint.
   13. To lay out duplicate parts.
   14. To assemble and fasten parts.
   15. To sandpaper and prepare stock for finish.
   16. To apply paint, stain, shellac and wax finish.
   17. To do simple mathematical problems including fractions.

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B. Informational Abilities to be Acquired.

1. To know the names, uses, and common characteristics of the following tools and materials:-

a. Lumber
   1. Bass
   2. Chestnut
   3. Gum
   4. Poplar

b. Tools.
   1. Coping saw
   2. Coping saw clamp
   3. Cross-cut saw
   4. Rip saw
   5. Back saw
   6. Key-hole saw
   7. Turning saw
   8. Handy-handle saw
   9. Rule
   10. Knife (sloyd)
   11. Plane
   12. Chisel
   13. Brace
   14. Bits
   15. Screwdriver
   16. Vise
   17. "C" clamp
   18. Claw hammer
   19. Nail set
   20. Mallet
   21. Pinchers
   22. Try-square
   23. Spoke shave
   24. Tool grinder

c. Fastenings
   1. Glue
   2. Nails
   3. Brads
   4. Screws

d. Finishes
   1. Paint
   2. Stain
   3. Wax
   4. Shellac
   5. Sandpaper

2. To know how lumber is measured.
3. To know how a bill of material is estimated.
4. To know how to read a simple working drawing.
5. To know how to read a common rule.
6. To know how the grain of lumber runs.
7. To know how holes may be bored without splitting the wood.
8. To know how to lay out parts, in order to secure maximum strength and economy of materials.
9. To know how to fasten materials properly with brads, nails, screws and glue.
10. To know how to prepare projects for the application of finishes.
11. To know how to apply finishes properly.
12. To know how to lay out butt and cross-lap joints.
13. To know how to dispose of scraps, oily waste, rags, etc;

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3. Suggestive Projects

1. Airplane
2. Ash tray
3. Auto
4. Bank
5. Baseball bat
6. Bell-boy smoking stand
7. Bench
8. Bench, wash
9. Bird houses
10. Board, bread
11. " checker
12. " drawing
13. " game
14. " ironing
15. " marble
16. " meat
17. Boat, sail
18. Book, case
19. " ends
20. " rack
21. " shelf
22. " stand
23. Bow and arrow
24. Box, flower
25. " match
26. " shoeshine
27. Broom holder
28. Cabinet, medicine
29. Cake, cutter
30. Candle stick
31. Chair
32. Chest
33. Clown
34. Coat hanger
35. Dagger
36. Desk
37. " set
38. Doll furniture
39. Dump cart & horse
40. Dinner chimes
41. Fernery
42. Flower stand
43. Footstool
44. Frame, clock
45. " picture
46. Gun, drill
47. Hall-tree
48. Hat-rack
49. Kite
50. Kite winder
51. Lamp, floor
52. " table
53. Log cabin
54. Magazine rack
55. Match striker
56. Paper knife
57. Puzzle
58. Radio set
59. Ring and peg game
60. Sand wheel
61. Sewing tray
62. " set
63. Shelf
64. Ship
65. Skatemobile
66. Smoking cabinet
67. Soap carving
68. Spool holder
69. Spoon
70. Stand, teapot
71. Step-ladder
72. Stilts
73. Submarine
74. Sword
75. Table
76. " end
77. Taboret
78. Target
79. Telephone stand
80. Tie rack
81. Tool-box
82. Toys
83. Trellis
84. Trestle
85. Umbrella rack
86. Wagon
87. Wallaby
88. Wastebasket
89. Weather vane
90. Wheelbarrow

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4. Suggestions for Correlation

a. English

1. The correct pronounciation and spelling of tools, materials, and processes.

b. Mathematics

1. A knowledge of the four fundamentals of arithmetic and common fractions.
2. A knowledge of linear measure.
3. Ability to figure cost of materials.
4. Ability to solve the mathematical problems that arise out of the projects constructed.

c. History - Geography

1. The development of woodworking occupations.
2. A knowledge of the source, manufacture and use of tools and materials.

d. Science

1. The elimination of rust from tools.
2. The necessity for using oil in sharpening and grinding tools.
3. Spontaneous combustion caused by oily waste and rags.

e. Art

1. The application of art and design to form color, decoration and finish.

f. Drawing

1. A sufficient knowledge of drawing should be developed to make rough sketches and to read simple working drawings.

g. Hygiene

1. Importance of proper ventilation.
2. Importance of proper lighting.
3. Importance of proper position to do effective work.
4. Importance of cleanliness and sanitation.

h. Safety

1. The importance of safety precautions.
2. The proper handling of tools and materials.
3. The immediate attention and report of any injury, however slight.

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5. Suggestions for Pre-Testing and Testing

True - False

T F 1. A coping saw is used only for cutting straight lines

T F 2. A rip saw is used for cutting with the grain

T F 3. A cross-cut saw is used for cutting across the grain

T F 4. A back saw is used for cutting logs

T F 5. All woods are approximately the same weight

T F 6. Poplar is heavier than chestnut

T F 7. Woods are divided into two classes---hard and soft

T F 8. The grain of lumber runs smoothly and evenly in all woods

T F 9. Mallets are usually made of iron

T F 10. It is unnecessary to countersink flat-headed screws

T F 11. A board foot is 12" x 12" x 1"

T F 12. Auger bits are used to bore holes

T F 13. A hammer should always be used in driving a wood chisel

T F 14. Wood should be sandpapered with the grain

T F 15. Curved edges should be smoothed with a plane

T F 16. On narrow parts the grain of wood should run cross-wise

T F 17. Glue will hold metal or wood together equally well

T F 18. The commonest joint used is the butt

T F 19. A lap joint gives more strength than a butt joint

T F 20. Paint is easier to apply than shellac

T F 21. Shellac is thinned with alcohol

T F 22. Paint is thinned with turpentine

T F 23. Hammer marks can be removed easily with sand-paper

T F 24. More accurate work results by working to a knife line than to a pencil line

T F 25. A sketch or drawing is necessary to work intelligently

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MULTIPLE CHOICE

1. The hardest wood used in the shop is Gum; Bass; Chestnut; Poplar.
2. The heaviest wood used in the shop is Gum; Gass; Chestnut; Poplar.
3. The best wood to use in making a bird-house is Gum; Bass; Chestnut; Poplar.
4. The best finish to put on bird houses is Shellac; Wax; Paint; Varnish.
5. Paint; Varnish; Shellac; Wax; dries the quickest.
6. Sandpaper is used to Square stock; Smooth the Wood after Planing; Remove Hammer Marks; Sharpen Tools.
7. Twist Drills; Gimlet Bits; Countersink Bits; Auger Bits, have screw points on the end.
8. Auger bit sizes are determined by Numbers on the Shank; Length of the Bit; Weight; Color.
9. The sizes of bits are given in 1/8; 1/4; 1/32; 1/16 inches.
10. When fastening with F.H.B. Screws; R.H.B. Screws; Glue; Nails; a Countersink is Used.
11. To rip a 7/8" piece of Gum-wood it is best to use a, Coping Saw; Rip Saw; Cross-cut Saw; Back-Saw.
12. The set in the saw determines the, Use; Kind; Size; Ease of Sawing.
13. The Number stamped on the heel of a saw denotes; Kind; Length; Number of Teeth to the Inch; Weight.
14. The cutting part of a plane is called, the Lever Cap; the Cap Iron; the Plane Bit; the Adjusting Screw.
15. A Hammer; Mallet; Try-Square; Hatchet, should be used in driving a Wood Chisel.

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MULTIPLE CHOICE

16. To drive small brads it is best to use a Try-Square; Hammer; Mallet; Marking Gauge.
17. 12/16; 16/24; 20/32; 1/4; equals 5/8.
18. 1/2 of 2-1/4 equals 1-1/4; 1-1/8; 1-1/16; 1.
19. 3/8" is less than 1/4"; 1/8"; 25/64"; 11/32".
20. A bird-house should be fastened together with Nails; Glue; Screws; Bolts.
21. In laying off a straight line it is best to use a; Pencil and Rule; a Try-square and Knife; a Tape-Measure and Chalk; a Yard Stick and Awl.
22. A turning saw is a kind of Cross-cut Saw; Back-saw; Coping Saw; Rip Saw.
23. Finish is placed on wood to Preserve it; to Change the Color; to Cover Defects; to Hide the Grain.
24. The finest grade of sandpaper is Number 2; 1; 1/2; 0.
25. The tip of a screw-driver should be Ground Sharp; Square; Round; Pointed.

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COMPLETION TEST

1. A _____ is used for driving nails.
2. Mallets are used for driving _____.
3. The _____ saw is used for ripping lumber.
4. A cross-cut saw is used to cut _____.
5. Curved lines are cut with a _____ saw.
6. Wood warps due to _____.
7. A No._____ bit is used to bore a 1" hole.
8. A No. 8 bit will bore a _____ hole.
9. A _____ is used for drawing circles.
10. To set the head of a F.H.B. screw below the surface of the wood a _____ is used.
11. Before starting a project it is well to first make a _____.
12. Wood may be fastened together with _____ or _____ or _____.
13. The _____ is used to test for squareness.
14. Curved surfaces should be smoothed with a _____.
15. Woods are classified as _____ and _____.
16. Two kinds of screws are _____ and _____.
17. Brads are used on _____ work.
18. Glue is made of _____.
19. The material glued on sandpaper consists of crushed _____.
20. _____ is used to thin shellac.
21. Turpentine is used to thin _____.
22. _____ is used to smooth wood after all the tool processes are completed.
23. A _____ is used to set a nail or brad.

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24. Nail holes are filled up with _____.

25. _____ is used to secure a good polish on wood.

---***---

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SEVENTH GRADE WOODWORK

1. Specific Objectives

   a. To develop a reasonable amount of tool technique and skill in woodwork.
   b. To study the tools and the materials used in their relations to industry.
   c. To do some simple designing in order to stimulate and encourage original thought and initiative.
   c. To do simple joinery, involving a lap, dado, and mitre joint.

2. Abilities

   A. Manipulative abilities to be acquired.

      1. To square a board to dimensions.
      2. To plane a bevel.
      3. To plane a chamfer.
      4. To smooth a concave and convex surface.
      5. To construct a dado and mitre joint.
      6. To use a jig.
      7. To work from centre lines.
      8. To fasten pieces of wood together with brads; nails, screws, glue, and dowels.
      9. To dissemble, assemble, and adjust a plane.
      10. To sharpen plane bits and chisels.
      11. To make a rather detailed layout.
      12. To calculate the cost of materials.

   B. Informational abilities to be acquired.

      1. Materials.

         A. Lumber - names, uses, and characteristics of base, chestnut, oak, pine, poplar.
         B. Fastenings - names, sizes, and uses of brads, dowels, glue, nails, screws.

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C. Finishes - names, uses, and characteristics of:
   1. Filler
   2. Paint
   3. Shellac
   4. Stain
   5. Varnish
   6. Wax
   7. Sandpaper

2. Operations and Processes:
   a. Selecting the stock in regard to:
      1. The requirements of the working drawing.
      2. The suitability to use of project.
      3. The desirability as to appearance.
      4. The adaptability as to working qualities.

   b. Getting out stock:
      1. Roughing out.
      2. Smoothing.
      3. Cutting to size.
      4. Making joints.

   c. Measuring and laying out:
      1. Duplicate parts.
      2. For strength and economy.

   d. Assembling with:
      1. Nails
      2. Screws
      3. Glue
      4. Dowels

   e. Finishing:
      1. Preparing surfaces by scraping and sanding.
      2. Coloring surface with stain and paint.
      3. Filling surfaces with paste filler and liquid filler.
      4. Completing surface with shellac, wax, varnish, and lacquar.

3. Tools
   Cutting Tools
   Saws
      1. Crosscut
      2. Rip
      3. Back
      4. Coping
      5. Turning
      6. Handy-handle
   Planes
      Block
      Jack
      Spoke Shave

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Tools (cont.)

- Chisels
  - Firmer
  - Socket Firmer
  - Gouge
- Knives
  - Sloyd
  - Pocket

Laying out tools
- Rule
- Try Square
- Framing Square
- Marking Gouge
- Dividers
- Yardstick

Driving Tools
- Hammer
- Mallet
- Screw Driver
- Nail Set
- Wrench

Boring tools
- Holders
  - Brace
  - Hand Drill
- Bits
  - Gimlet
  - Auger
  - Twist Drill
  - Expansive
  - Forstner
  - Countersink

Holding tools
- Saw Horse
- Vise
- Bench Hook
- Bench Stop
- Hand Screw
- Carriage Clamp
- Cabinet Clamp
- Mitre Box

Scraping tools
- Scraper
- File

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3. Suggestive projects

1. Airplane Model
2. Ash Tray
3. Auto-Toy
4. Auto Creeper
5. Bank
6. Bats
7. Bell Boy Smoking Stand
8. Bench
9. " piano
10. " work
11. Board-bread
12. Board-cutting
13. Board-checker
14. Board-drawing
15. Boats
16. Boats-sail
17. Book-case
18. Book-ends
19. Book-rack
20. Book shelf
21. Book stand
22. Book trough
23. Bow & arrow
24. Box
25. Box-bread
26. Boxflower
27. Box-mail
28. Box-match
29. Box-shoe shining
30. Broom holder
31. Broom holder-whisk
32. Cabinet-medicine
33. Cabinet-sewing
34. Cake stand
35. Chairs
36. Chest
37. Clock case
38. Coasters
39. Coat of arms
40. Coat hanger
41. Desk
42. " set
43. Fernery
44. Fire by friction sets
45. Flower stands
46. Frame-pictures
47. Hall tree
48. Hat rack
49. House-chicken
50. House-dog
51. Ink stand
52. Kiddie Car
53. Kite
54. Kite winder
55. Lamp
56. Lamp-floor
57. Lamp-table
58. Letter holder
59. Log cabin
60. Magazine rack
61. Match striker
62. Paddle
63. Pedestal
64. Pen & ink stand
65. Potato macher
66. Puzzles
67. Racer
68. Radio cabinet
69. " set
70. Scooter
71. Serving tray
72. Serving table
73. Ship models
74. Signal flag sticks
75. Skiis
76. Slides
77. Smoking stand
78. Snow shovel
79. Stationery holders
80. Steam engine
81. Step ladder
82. Stool
83. Swing-child's
84. Swords
85. Table
86. Table-end
87. Taboret
88. Telephone stand
90. Tire rack
91. Tool chest
92. Tooth brush rack
93. Towel racks
94. Toys
95. Trellis
96. Traps
97. Wagons
98. Waste baskets
99. Weather vanes

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4. Suggestions for Correlation.

(a) English

1. The correct pronunciation and spelling of tools, materials, operations, and processes.
2. Topical assignments for investigation.
3. Oral and written reports.
4. Class discussions.

(b) Mathematics.

1. Shop problems involving the fundamental processes of arithmetic, fractions and mensuration.
2. To estimate accurately the cost of a project.

(c) History -- Geography

1. The development of industries related to woodwork.
2. Study of the source, supply, manufacture, and use of materials.

(d) Science

1. The seasoning of lumber.
2. The preservation of wood.
3. Assembling of materials to guarantee strength and durability.
4. Sharpening of tools.

(e) Art

1. The application of the fundamentals of good design to the projects constructed.
2. An appreciation of the basic principle of color, decoration, and finish.

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(f) Drawing

1. Ability to make an intelligible working drawing.
2. Ability to read simple working drawings, sketches, and blue-prints.

(g) Hygiene

1. Importance of proper ventilation.
2. Importance of proper lighting.
3. Importance of proper position to do effective work.
4. Importance of cleanliness and sanitation.

(h) Safety

1. The importance of safety precautions.
2. The proper handling of tools and materials.
3. Immediate attention and report of any injury, however slight.

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5. Suggestions for Pre-testing and Testing

True-False

T F 1. A cross-cut saw is used to cut with the grain

T F 2. A spoke shave is used on curved edges

T F 3. A hammer is used to drive a chisel

T F 4. A buck-saw is used for accurate work

T F 5. A try-square may be used as a hammer

T F 6. A T-Bevel may be used to copy angles

T F 7. Planes should be set upright on bench when not in use

T F 8. A rip saw has small teeth

T F 9. A coping saw is used for cutting thick wood

T F 10. An auger bit is held in a hand drill

T F 11. Always use a rip saw in sawing with the grain

T F 12. The piece to be sawed should be fastened in a horizontal position

T F 13. When planing end grain always carry the stroke of the plane clear across the piece

T F 14. When squaring stick never begin on the end grain

T F 15. Never use a marking gauge in laying out the stock

T F 16. Always adjust the plane to secure a deep cut on the end again

T F 17. When nailing grasp thehammer near the end of the handle

T F 18. Never allow bent over nails to remain in a piece of stock

T F 19. Always sandpaper across the grain of the wood

T F 20. Always sandpaper lightly between each coat of finish

T F 21. Shellac is thinned with alcohol

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5. Suggestions for Testing and Pre-testing (cont.)

T F 22. To eliminate waste it is best to tear sandpaper into four equal parts

T F 23. Brads are nails with small heads

T F 24. Paint brushes should be thoroughly cleaned after using

T F 25. Covers should be kept on glue and paint cans when not in use.

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Multiple Choice

1. A gimlet bit is used for Nails; Dowels; Screws; Bolts.
2. A screw driver may be used to drive Screws; Nails; as a Pry; as a Chisel.
3. A hammer may be used to drive Dowels; Bolts; Nails; Screws.
4. A try-square is used as a Wedge; a Rule; a Hammer; to Square Lines.
5. Firmer or socket firmer chisels are used to Cut Wood; Iron; Nails; Tin.
6. A counter sink is used for drilling a Screw Hole; to Take out a Screw; to Set the Head of a Screw Below the Surface of the Wood; to Insert a Round Headed Screw.
7. A coping saw is used, to Cut Logs; to Cut Planks; to Cut Iron; to Cut Irregular Lines.
8. Spokeshaves are used, to Plane Boards; to Rip Boards; to Smooth Curved Surfaces; to Cut End Grain.
9. A T-bevel is used to Copy and Lay out Angles; to Gauge a Line; to Lay Out Arcs; As a Try-Square.
10. Glue is used to Fill Cracks; to Plug Holes; to Fasten Wood together; as Paint.
11. Brads have Large Heads; Small Heads; No Heads; Pointed Heads.
12. Fine sandpaper is used; Before Using a Heavy Grade; After Using a Heavy Grade; Before Planing; After Planing.
13. Stain is applied: Before Shellac; After Shellac; After Wax; Before Sandpapering.
14. Dowel rods are used for making Mallet Heads; Joints; Hammer Handles; Chisel Handles.
15. Painting should be done in a Warm Room; Cold Room; Damp Room; Dark Room.

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16. Wood should be kept in a Dark Room; Damp Room; Dry Room; Cold Room.
17. Gimlet bits are designated in Eights; Sixteenths; Quarters; ~~halves~~.
18. A scraper should be used with One Finger; Two Fingers, One Hand; Two Hands.
19. Sanding should be done With the Grain; Across the Grain; At right Angles to the Grain; With a Circular Motion.
20. Nails should be driven with a Mallet; a Claw Hammer; a Ball-pean Hammer; a Hatchet.
21. A mallet is used to drive Nails; Spikes; Brace, Chisels.
22. Bits are held by Clamps; Braces; Hiers; Pinchers.
23. Nails are pulled with the Fingers; Clamps, Pinchers; Shears.
24. Screws are inserted with a Mallet; Screw-driver; Hammer; Chisel.
25. The size of a screw is designated by its Length; its Thickness; the Number of Screw Threads; the Width of the Head.

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(c) Completion

1. A _____ is used to determine the squareness of stock.
2. To lay off a Chamfer a _____ is used.
3. Two small pieces of wood may be fastened together with _____.
4. To whet or sharpen a cutting tool a _____ is used.
5. A _____ bit is used to bore a 3/32" hole.
6. A _____ is used to sharpen saws.
7. In ripping a long board, the board should be placed on a _____.
8. In drawing a nail a block should be placed under the head of the _____.
9. A _____ is used to set nails below the surface of the wood.
10. A _____ is used in drilling a hole for a screw.
11. To cut out curves and circles the _____ saw is used.
12. _____ are tools used to hold wood in a firm position.
13. A handy-handle saw has two types of blades; _____ and _____.
14. A screw-driver bit should fit the _____ of the screw.
15. (a) _____(b)_____(c)_____ woods have been used in our shop.
16. Paint brushes are cleaned with _____.
17. _____ is used to clean shellac brushes.
18. The purpose of wood finishes is to _____ and_____.
19. When the head of a screw is to be shown a _____ screw is used.

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20. Flat headed screws are used when _____.

21. Sandpaper is used to _____.

22. _____ should be done in a room free from dust and dirt.

23. Two methods of seasoning or drying lumber are _____ and _____.

24. _____ is the most expensive wood that we have used to date.

25. For safety, oily rags and waste should be kept in a _____.

---***---

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EIGHTH GRADE WOODWORK

I. SPECIFIC OBJECTIONS

(1) To develop an appreciation of art through good design of the objects constructed.

(2) To contribute to the economic upkeep of the home, through minor repairs and constructions.

(3) To give experiences with as many tools and materials as possible.

(4) To develop a reasonable amount of skill with hand tools.

(5) To lay out and construct the common woodworking joints.

(6) To plan, lay out, and carry through to successful completion, a project.

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Eighth Grade
Woodwork

(2) Abilities

(a) Manipulative Abilities to be Acquired.

1. To make a free-hand sketch of a project showing the method of construction.
2. To make out a stock bill showing material required to construct a project.
3. To get out stock economically.
4. To lay out accurately and systemmatically joints, holes, and other construction work.
5. To make a mortise and tenon joint.
6. To work accurately to construction lines.
7. To lay out and cut out curves, chamfers, tapers and other modifications.
8. To remove millmarks and other imperfections.
9. To scrape a surface.
10. To sand a surface.
11. To assemble or glue sections.
12. To apply finishes including varnish.
13. To rub down and polish varnish finishes.
14. To cane a chair seat.
15. To cut metal.
16. To drill metal.
17. To smooth metal edges and surfaces.
18. To do simple electric wiring.
19. To do simple soldering.
20. To rivet.
21. to cut glass.
22. To glaze a window.
23. To reqire a window screen or screen-door.
24. To mix concrete.
25. To sharpen edge tools.
26. To test batteries.
27. To service a radio for minor repairs.
28. To read blueprints and working drawings.

(b) Informational Abilities to be Acquired

The amount of information that can be given will depend upon the length of time and the capacity of the boy. These are both variable factors, therefore, no definite amount is suggested. The following is suggested as a field for selection rather than a procedure to be followed:

A. Material:
   (a) Lumber:
      Hard wood
      Soft wood

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A. Material (cont.)
Wood structure
Character of different woods
Logging
Sawmilling
Seasoning
Measuring
Grading

(b) Hardware
Nails
Screws
Bolts
Hinges
Hooks
Catches
Angle Braces
Eyes
Dowels
Glue
Locks
Special devices

(c) Finishings
Sandpaper
Emery cloth
Steel wool
Pumice stone
Paints
Stains
Varnishes
Wax
Shellac
Lacquers
Brushes

(d) Common Metals
Iron
Steel
Tin
Lead
Copper
Zinc
Brass
Bronze
Aluminum

(e) Miscellaneous
Concrete
Glass
Leather
Electric appliances

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B - Tools

(a) Cutting tools

Saws
Cross cut
Rip
Turning
Coping
Back
Keyhole
Compass
Hack

Knives & Paring tools
Bench
Drawing
Spoke shave
Chisels
Gouges

Planes
Jack
Jointer
Smooth
Router
Combination

(b) Boring Tools
Auger
Brace
Auger bit
German twist bit
Gimlet bit
Drill bits
Reamer
Counter sink
Center bit
Expansive bit

(c) Holding Tools
Bench
Vise
Saw bench
C-clamp
Hand screw
Coping saw clamp
Bar clamp

(d) Measuring & Marking Tools
Rule
Yard stick
Steel square
try square
Miter "
Center"
Sliding T-bevel
Marking guage
Dividers
Pencil compass

(e) Driving Tools
Hammers
Claw
Riveting
Mallet
Ball Peen

(f) Scraping Tools
Cabinet scraper
Veneer scraper
Files
File card

(g) Sharpening Tools
Emery wheel
Oil stone
Slip stone
Files

(h) Miscellaneous
Wrenches
Screw drivers
Nail set
Pliers
Pincers
Cold chisels
Star drill
Glass cutter
Tap and die

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C - Operations

1. Making working drawing.
2. Reading working drawing or blue print.
3. Making bill of material.
4. Selecting and getting out stock
5. Measuring and marking
   - A - Rule
   - b - Squares
   - C - Dividers
   - D - Pencil compass
   - E - Marking gage
6. Sawing - using:-
   - a - Cross cut saw
   - B - Rip saw
   - c - Keyhole saw
   - d - Turning saw
   - e - Coping saw
   - f - Hack saw
   - g - Back saw
   - h - Handy-handle saw
7. Planing
   - a - Surface
   - b - Edge
   - C - end
   - d - Bevel
   - e - Chamfer
   - f - Circular plane
8. Cutting to a line
   - a - Chisel
   - b - Gouge
   - c - Spoke shave
   - d - Draw knife
   - e - Bench knife
9. Boring
   - a - Brace and bits
   - b - Awl
   - c - Counter sink
10. Fastening
    - a - Nails
    - b - Screws
    - c - Glue
    - d - Dowels
    - e - Corrugated fasteners
    - f - Clamp nails
    - g - Bolts
    - h - Inserting locks
    - i - Inserting hinges
    - j - Inserting catches
11. Joints
    - a - Dado
    - b - Rabbet
    - c - Miter
    - d - Lap
      1. End
      2. Cross
      3. T.
    - e - Splice
    - f - Mortice & tenon
12. Sanding
    - a - Hand
    - b - Disk
    - c - Drum
    - d - Fastening sand disk on plate

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13. Laying Out
    - a - Duplicate parts
    - b - Hexagon
    - c - Octagon
    - d - Modified edges and surfaces.

14. Assembling
    - a - Clamps
    - b - Braces
    - c - Wedges

15. Finishing
    - a - Sponging
    - b - Sanding
    - c - Staining
    - d - Shellacing
    - e - Varnishing
    - f - Painting
    - g - Rubbing
    - h - Decorating
    - i - Waxing

16. Sharpening tools
    - a - Grinding
    - b - Whetting
        - a - Chisel
        - b - Plane iron
        - c - Knife
        - d - Gouge
    - c - Sharpening a scraper
        - a - Filing
        - b - Burnishing
    - c - Sharpening auger bits

17. Metal work
    - Soldering
    - Cutting metal
        - a - Hack saw
        - b - Cold chisel

18. Cutting pipe with pipe cutter
    - Cutting threads
    - Glazing
        - a - Removing broken glass
        - b - Cutting glass
        - c - Inserting glazier points
        - d - Applying putty

19. Concrete work
    - a - Building forms
    - b - Mixing concrete
    - c - Finishing
    - d - Removing forms

20. Electrical work
    - a - Inserting fuse
    - b - Splicing wire
    - c - Wiring socket
    - d - " plug
    - e - Wiring bell circuit
    - f - Repairing small motor
    - g - Building radio
    - h - Servicing radio
    - i - Testing batteries

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3. Suggestive Projects

1. Airplane
2. Auto-creeper
3. Bird house
4. Boat
5. Book ends
6. Book rack
7. Book stand
8. Book trough
9. Book boxes
10. Bread board
11. Bulletin board
12. Candle sticks
13. Chair
14. Checker board
15. Chest
16. Clock case
17. Clothes line winder
18. Concrete bench
19. Concrete models
20. Copper tray
21. Crates
22. Cross bow
23. Desk
24. Dog house
25. Drawing board
26. End table
27. Fernery
28. Flower box
29. Footstool
30. Game board
31. Hall tree
32. Hammer handle
33. Hat rack
34. Hobble horse
35. Ice boat
36. Ironing board
37. Knife and fork box
38. Lamp
39. Magazine rack
40. Marble board
41. Meat cutting board
42. Medicine cabinet
43. Motor boat
44. Music stand
45. Pedestal
46. Porch swing
47. Radio set
48. Radio stand
49. Refinishing furniture
50. Serving tray
51. Sewing cabinet
52. Sewing table
53. Ship
54. Shoe shine box
55. Sleeve board
56. Smoking stand
57. Table
58. Taboret
59. T-square
60. Telephone stand
61. Tool chest
62. Wagon
63. Waste basket

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4. Suggestions for Correlatinns

(a) English
1. The correct pronunciation and spelling of tools materials, operations and processes.
2. Topical assignments for investigation.
3. Oral and written reports
4. Class discussions and demonstrations

(b) Mathematics
1. Shop problems involving the fundamentals of arithmetic, fractions and mensuration.

2. To estimate a bill of paterial.

(c) History-Georgraphy
1. The development of industries, industrial processes, tools and materials.
2. A study of materials and their relation to local industries.

(d) Science
1. Effect of heat upon grinding tools.
2. The effect of dull tools.
3. Testing batteries.
4. Principles of electricity.
5. Mixing of paints and stains.
6. Spontaneous combustion of materials.

(e) Art
1. The application of the fundamentals of good design to the projects constructed.
2. An appreciation of the basic principles of color, decoration, and finish.

(f) Drawing
1. To make a simple detailed working drawing.
2. To read blue prints, sketches and working drawings.

(g) Hygiene
1. Importance of proper ventilation.
2. " " " lighting.
3. " " " temperature.
4. " " " cleanliness.
5. " " " and suitable work bench.
6. Protection from dust and fumes.

(h) Safety
1. The importance of safety precautions.
2. The proper handling of tools and materials.
3. Immediate attention and report of any injury.
4. Proper precautions pertaining to fire hazards.
5. Danger from fumes.

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5. Suggestions for Pre-Testing and Testing

True - False

T F 1. A claw hammer is used for driving nails

T F 2. A claw hammer is used for drawing screws.

T F 3. A mitre box is a box in which tools are kept

T F 4. A hack saw is used for cutting metals

T F 5. An expansive bit drills various size holes

T F 6. A good workman has no need for a try-square

T F 7. Planer marks should be removed with a plane

T F 8. Oak is distinguished from chestnut by its color

T F 9. Oak is distinguished from chestnut by the end grain

T F 10. Screws increase in size as the number of the screw decreases.

T F 11. Nails increase in size as the number of the nail increases

T F 12. Sandpaper is usually used on iron

T F 13. Wood swells when it becomes wet

T F 14. Gum-wood is well adapted for outside use

T F 15. Lumber is measured by the board foot

T F 16. Filler is used to fill the pores of the wood

T F 17. Stain is used as a polish

T F 18. A block plane is used for surfacing a board

T F 19. Paint covers the grain and acts as a preservant

T F 20. Wax is applied with a heavy brush

T F 21. The simplest joint to construct is the mortise and tenon

T F 22. A high polish eliminates tool marks on any job

T F 23. Knots in woods are caused by woodpeckers

T F 24. Quarter sawed oak is more expensive than plain oak

T F 25. Working from centre lines insures accuracy

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(b) Multiple Choice

1. A firmer or socket firmer chisel is used to cut:Iron; Wood; Steel; Tin.
2. A cold Chisel is used to cut: Iron; Wood; Paper; Putty.
3. The best wood to use for furniture is: Elm; Ash; Pine; Walnut.
4. Poplar; Cedar; Pine; Cypress is a hard wood.
5. Auger bits are numbered in Fourths; Eighths; Sixteenths; Twelfths.
6. Shellac is thinned with Water; Oil; Alcohol; Turpentine.
7. Poplar; Walnut; Chestnut; Cypress is the best wood to use in building a boat.
8. Mortise and tenon is a type of Saw; Chisel; Joint; Square.
9. Pincers are used to: Cut Wire; Drive Nails; Pull Nails; to Tighten Bolts.
10. Paint contains: Alcohol; White Lead; Shellac; Varnish.
11. Saws are made of Tin; Steel; Iron; Aluminum.
12. Concrete is Lime; Clay mixed with water; Clay mixed with Gravel; Cement.
13. A Gauge is a tool for: Marking Lines; Checking Squareness; Measuring; Planing.
14. For planing end grain on short pieces of stock it is best to use a Jack Plane; Router Plane; Block Plane, Smoothing Plane.
15. The best lumber is that which has been seasoned: 1 year; 2 years; 4 years; 10 years.
16. Sap wood is wood taken from the: Top of the Tree; the Bottom of the Tree; the Centre of the Tree; the Outside of the Tree.
17. Millmarks should be removed from wood with a Hammer; Plane; Chisel; Gauge.

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Multiple Choice -(cont.)

18. Glue should be applied with a Chisel; a Screw-driver; a Try-square; a Brush.
19. Oily waste and rage should be kept in a: Drawer, Locker; Cupboard; Metal Can.
20. An awl is used to: Punch a Hole; Gauge a Line; Smnoth a Surface; Countersink a Hole.
21. Iron is usually cut with a: Rip Saw; Cross-cut Saw; Back Saw; Hack Saw.
22. Dado; Rabbet; Mitre; Lap; is a joint cut at a 45 degree angle.
23. A hexagon has Two; Four; Six; Eight sides.
24. Nails; Brads; Screws; Dowels are designated by the term 10 penny; 20 penny, etc.
25. A gouge is a type of Plane; Saw; Clamp; Chisel.

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COMPLETION TEST

1. Thin nails with small round heads are called _____.
2. The size of _____ are designated by the term penny.
3. The _____ is used to hold the bit in boring holes.
4. A carpenter uses a _____ square in framing a building.
5. The _____ saw is used to cut with the grain.
6. Curves and irregular shapes are cut out with a _____ saw.
7. The smallest division on a standard two foot rule is _____.
8. _____ is used to thin paint.
9. Lacquer is a kind of _____.
10. Shellac is thinned with _____.
11. A surface is tested for squareness with a _____.
12. A _____ is placed under a clamp to protect the surface of the wood.
13. A plane should be _____ when not in use.
14. A plane bit should be ground with a _____bevel.
15. Chisels should be ground at an angle of _____ degrees.
16. There are _____ degrees in a circle.
17. Solder is made of lead and _____.
18. Metal is cut with a _____ saw.
19. Lumber is measured by the _____.
20. A _____ is used to drive a chisel.
21. A _____ should not be made before beginning a project.
22. Angles are laid off with a _____.
23. A picture frame is usually made with a _____ joint.
24. A _____ is made with a mortise and tenon joint.
25. A rabbet joint is used in making a _____.

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THE GENERAL SHOP

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CHAPTER XIV

THE GENERAL SHOP FOR GRADES SEVEN, EIGHT AND NINE.

General Objectives:

1. To provide experiences with a variety of common materials and tools.
2. To provide extensive rather than intensive mechanical experiences.
3. To provide "unspecialized practical activities" needed by everyone.
4. To provide exploratory manipulative experiences with materials in a number of occupations, within a single shop.

Specific Objectives:

1. To give practical experiences in the following activities:--
   - A. Auto mechanics
   - B. Concrete
   - C. Electricity
   - D. Furniture Repair
   - E. Glazing, painting, plastering, papering, finishing.
   - F. Metal work (bench)
   - G. Metal work (sheet)
   - H. Plumbing and Pipe Fitting
   - I. Sharpening Tools
   - J. Woodwork

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Abilities

(A) Manipulative Abilities to be Acquired

1. Auto Mechanics
   a. to change an auto tire
   b. to change the oil
   c. to change the water
   d. to check the oil
   e. to clean the spark plugs
   f. to grease the car
   g. to repair punctures
   h. to replace a fan belt
   i. to replace light bulbs
   j. to test and fill battery
   k. to tighten nuts and bolts

2. Concrete
   a. to construct simple forms
   b. to mix concrete
   c. to pour concrete
   d. to repair minor breaks

3. Electricity
   a. to adjust points on bells
   b. to connect a door bell
   c. to install ground wires and aerial for radio
   d. to install a transformer
   e. to locate and replace a burned out fuse
   f. to make a branch tap
   g. to make minor repairs to electric appliances
   h. to make minor repairs to a radio
   i. to make a wire splice
   j. to make electric extensions
   k. to solder connections
   l. to test and refill radio batteries
   m. to wire lamp sockets
   n. to wire attachment plugs

4. Furniture Repair
   a. to glue broken parts
   b. to do minor upholstering
   c. to recane a seat bottom
   d. to refinish old and worn pieces
   e. to reenforce parts with braces
   f. to replace broken arms, rockers and rungs
   g. to replace seat bottoms

5. Glazing, painting, plastering, papering, and finishing
   a. to apply enamel
   b. to apply filler
   c. to apply paint
   d. to apply shellac
   e. to apply stain
   f. to apply varnish
   f. to apply wax

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5. Glazing, etc. (cont.)
   h. to glaze a sash
   i. to make minor repairs on wallpaper
   j. to make minor repairs on plastering
   k. to mix and apply white-wash
   l. to re-bronze pipes and radiators
   m. to sandpaper
   n. to set a window pane with wood strips

6. Metal Work (Bench)
   a. to cut iron with a cold chisel
   b. to cut iron with a hack saw
   c. to cut threads on rods with dies
   d. to drill holes in iron
   e. to construct metal braces
   f. to construct small metal tools

7. Metal Work (Sheet)
   a. to cut with snips
   b. to make a layout
   c. to punch holes
   d. to set rivets
   e. to shape and form materials
   f. to solder holes and joints
   g. to tin a soldering iron

8. Plumbing and Pipe Fitting
   a. to assemble common pipe fittings with a Stillson wrench
   b. to connect two pieces of pipe
   c. to clean water drains and traps
   d. to cut a piece of pipe with a hack saw
   e. to cut a piece of pipe with a pipe cutter
   f. to file a battered thread
   g. to thread pipe
   h. to ream pipe
   i. to replace washers in faucets
   j. to replace tank ball in closet tank
   k. to trace and shut off water, gas, and electric lines

9. Sharpening Tools
   a. to sharpen an auger bit
   b. to sharpen a chisel
   c. to sharpen a knife
   d. to sharpen a lawn mower
   e. to sharpen a pair of shears
   f. to sharpen a plane bit

10. Woodwork
   a. to bore holes
   b. to chisel
   c. to plane
   d. to saw
   e. to hang awnings, pictures, screen doors, etc.

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10. Woodwork (cont.)
    f. to fit screens
    g. to repair screens, fences, and board-walks
    h. to replace hinges, latches, and other hardware
    i. to set shelves, cupboards and fixtures

11. Miscellaneous
    1. to mend toys
    2. to repair bicycles, skates, scooters, etc.
    3. to rivet leather and straps
    4. to sew canvas
    5. to sole and repair shoes

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B. Information Abilities to be Acquired

I Materials. (Names, uses, sizes, and characteristics)

(a) Fastenings
bolts
cobblers nails
dowels
glue
nails
rivets
screws
tacks

(b) Finishes
bronze
enamel
lacquer
paint
plaster
putty
shellac
stain
varnish
wax

(c) Metals
iron
lead
solder
steel
tin

(d) Lumber
chestnut
hickory
maple
oak
poplar

(d) Miscellaneous
cane
electric fixtures
electric wires
flux
glazer points
leather
rubber
sandpaper
tire patches, etc.

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2. OPERATIONS AND PROCESSES

a. Amount of pressure in tires
b. Method of weaving wire.
c. Cutting and stretching wire cloth
d. Preparation of glass and sash for window pane
e. Soldering
f. Care of brushes
g. Slaking lime
h. Mixing concrete
i. Matching and applying wallpaper
j. Principles of electricity
k. Installing electric fixtures
l. Short circuits
m. Measuring electricity, gas, and water
n. Storage and care of lumber
o. Upholstering
p. Laying out shape of shoe soles
q. Preparation of wood for glueing
r. Construction of brick and frame walls
s. Location of studding
t. Laying floors
u. Use of washers
v. Heating, hardening, tempering, and annealing of steel
w. Cutting metals
x. Importance of starting taps and dies straight
y. Constructional joints used in wood and metal
z. Splicing wire

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3. Tools (names, uses, sizes, and characteristics)

(a) Boring and Drilling tools

1. (a) Bits (wood)

auger
centre
countersink
expansive
forstner
gimlet
screwdriver
twist

(b) Drills (Metal)
hollow punches
twist drills

2. Cutting Tools

(a) Metal
cold chisel
dies
files
hack saw
pinchers
pipe cutter
pipe reamer
pliers
taps
tinner's snips

(b) Wood
chisels
draw-knife
gouges
knife
plane
saws
spokeshave

3. Driving Tools

Hammers
mallet
nail set
punches
rivet set
screwdriver
wrenches

4. Finishing Tools

brushes
putty knife
trowel

5. Heating Tools

Blow torch
forge
soldering iron

6. Holding Tools

Brace
breast drill
clamps

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hand drill
pliers
tongs
vice

7. Laying out, Testing and Measuring Tools

centre punch
dividers
framing square
marking gauge
plumb bob
rule
scratch awl
straight edge
try square

8. Sharpening Tools

burnishers
file
file card
oil stone
tool grinder

9. Testing Tools

calipers
framing square
hydrometer
meter oil gauge
plumb gauge
tire gauge
try square

10. Miscellaneous

auto jack
caning needle
glass cutter
tire pump
tire tools

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6. SUGGESTIVE PROJECTS

(A) BELL WIRING
1. Bell, buttons, batteries, and transformers mounted on a large board and wired for different circuits.

(B) CONCRETE AND CEMENT
1. Benches
2. Bird Baths
3. Book Ends
4. Flower Boxes
5. Flower Pots
6. Paper Weights

(C) GLAZING
1. A small wooden frame about 8" x 10"

(D) METAL WORK (SHEET)
1. Braces
2. Cookie Cutters
3. Lamps
4. Match Box
5. Scoops
6. Smoking Stand
7. Squere and round containers
8. Tooth brush holder

(E) TOOLS
1. Anvil
2. Chisels
3. Ice Pick
4. Punches
5. Screw Drivers
6. Trowels

(F) WIRING
1. Assembling of short extension cords
2. Making splices and tops
3. Wiring electric lamps and fixtures
4. Wiring sockets and plugs

(G) WOODWORK
1. Boards - bread; cutting; ironing
2. Book-ends; rack; stand; trough
3. Boxes - flower; nail; shoe-shine
4. Cabinets-medicine; sewing
5. Candlesticks
6. Footstools-cane; upholstered; wood
7. Handle-hammer; hatchet
8. Lamps
9. Magazine-corner; holder; rack
10. Wallet
11. Pedestal

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12. Smoking stand
13. Stepladder
14. Tool chest
15. Toys-airplane; animals; boats; kites; sleds; wagons; etc.
16. Wheelbarrow

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4. Suggestions for Correlation.

(a) English
1. The correct pronunciation and spelling of tools, materials, operations, and processes.
2. Topical assignments for investigation.
3. Oral and written reports.
4. Class discussions and demonstrations.

(b) Mathematics
1. Shop problems involving the fundamentals of arithmetic, fractions, and mensuration.
2. To estimate a bill of material.

(c) History-Geography
1. The developments of industries, industrial processes, tools and materials
2. A study of materials and their relation to local industries.

(d) Science
1. The effect of heat upon metals
2. The effect of dull tools.
3. The principles of electricity.
4. The composition of finishes and other materials.
5. Spontaneous combustion or materials.

(e) Art
1. The application of the fundamentals of good design to the projects constructed.
2. An appreciation of the basic principles of color, decoration, and finish.

(f) Drawing
1. To make a simple working drawing
2. To read sketches and working drawings.

(g) 1. Importance of proper ventilation
2. " " " lighting
3. " " " temperature
4. " " cleanliness
5. " " suitable work bench
6. Protection from dust and fumes

(h) Safety
1. The importance of safety precautions
2. The proper handling of tools and materials
3. Immediate attention and report of any injury
4. Proper precautions pertaining to fire hazards
5. Danger from fumes

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5. Suggestions for Pre-Testing and Testing

(A) True - False

T F 1. Paint brings out the grain of the wood

T F 2. Filler should always be used on open grain wood

T F 3. Wood is painted only to beautify it

T F 4. Shellac gives a good waterproof finish

T F 5. Varnish is easier to apply than paint

T F 6. A cold chisel is used to cut iron

T F 7. A hack saw is used to cut wood

T F 8. A try-square is used to check the oil in an auto

T F 9. Holes are drilled rather than bored into iron

T F 10. Glue is best applied when hot

T F 11. Glazier points are used for locating holes in wood

T F 12. Rivets are used for fastening wood

T F 13. Lacquer is a kind of paint

T F 14. Cement is usually mixed with sand, water and gravel

T F 15. Short circuits are dangerous and may cause a fire

T F 16. Studs are usually placed 16" apart (center to center)

T F 17. Lime is usually slaked with oil

T F 18. A draw knife is used in making drawings

T F 19. A tap is a kind of hammer

T F 20. A file is a cutting tool

T F 21. A caliper is used for measuring stock

T F 22. A hydrometer is used for measuring electricity

T F 23. Batteries are usually filled with kerosene

T F 24. A Stillson wrench is used by a Plumber

T F 25. It is better to apply two or three thin coats of paint than one thick coat.

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MULTIPLE CHOICE

1. A hack saw should cut on: Both forward and back stroke; Back stroke only; Forward stroke only; Neither forward nor back stroke.
2. A hack saw is made to cut: Hard metals; Soft metals; Wood; Concrete.
3. A cold chisel is made of: Machine steel; Tool steel; Cast iron; Babbit.
4. A drill cuts when it is turned to the Right; Left; Either Way; Neither way.
5. Holes for rivets should be: Smaller than the Rivet; Larger than the Rivet; The same size as the Rivet; Twice as large as the Rivet.
6. Copper is used for soldering copper because it: Is not too heavy; Will not rust; Will not burn; Gives off heat readily.
7. Soldering flux is used to: Keep the surfaces clean; Clean the surfaces; For its adhesive qualities; As a preservant.
8. Rosin is used as a flux because it is: Non-corrosive; Cheap; Keeps the surface clean; Avoids hazards.
9. Tinner's snips are used to cut: Wire; Leather; Iron; Sheetmetal.
10. Taps are used to cut: Outside threads; Inside threads; Outside and Inside threads; Neither outside nor inside threads.
11. The process of treating a piece of tool steel so that it develops a certain degree of hardness is called: Heating; Hardening; Tempering; Annealing.
12. The best hammer for general metal work is the Riveting; Ball Pean; Claw; Upholsterer's.
13. Galvanized iron is used because it: Does not rust; Is cheap; Is Smooth; Is rough.

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14. Pipe threads differ from other threads because they: Are smaller; Are larger; Taper; A different Shape.
15. Studs are made of: Wood; Iron; Copper; Glass.
16. Glazier points are used to: Locate a hole; Hold a pane of glass in a sash; Solder a joint; Rivet leather.
17. The best saw to use in cutting out a hole is a: Hack saw; Back saw; Rip saw; Keyhole saw.
18. A hydrometer is used in connection with a: Forge; Blow torch; Auto; Vise.
19. A mortise and tenon is a kind of: Plane; Joint; Saw; Chisel.
20. Lumber is usually retailed by the: Carload; Ton; Pound; Board-foot.
21. Tenpenny refers to a: Nail; Screw; Brad; Glue
22. Alcohol is used to thin: Glue; Wax; Shellac; Paint.
23. The number stamped on the heel of a saw denotes: Weight; Length; Cost; Teeth per inch.
24. The number stamped on the shank of an auger denotes: 1/8"; 1/4"; 1/16"; 1/32".
25. Stillson refers to: Saws; Wrenches; Chisels; Squares.

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COMPLETION

1. Three kinds of wood used in our shop are a _____b_____ c_____.
2. _____ is the hardest wood we use.
3. _____ is the softest wood we use.
4. Wood splits _____ grain.
5. A hack saw is used to _____.
6. Rivets are used for _____.
7. A _____ is used to heat a soldering iron.
8. Sheet-metal is cut with _____.
9. _____ is used to cut iron.
10. A_____hammer is used on a cold chisel.
11. Wood chisels are driven with _____.
12. Pipe threads are cut with a _____.
13. _____ is used for cutting threads on bolts.
14. A framing square is used to _____.
15. Circles are laid off on wood with _____.
16. Studs are usually placed_____ apart.
17. The solution in an auto battery is tested with a _____.
18. Volt is a term used in _____.
19. A _____ wrench is used for connecting pipe.
20. To bore a 1" hole a _____ auger bit is required.
21. A No. 8 auger bit will bore a _____ hole.
22. Filler is used to _____.
23. _____ is used to polish steel.
24. Sandpaper is used to _____.

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WOODWORK FOR SPECIAL GROUPS (Sub-Normal)

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CHAPTER XV.

WOODWORK FOR SPECIAL GROUPS (Sub-Normal)

Children for these groups are selected by the use of the Stanford Revision of the Binet'Simon tests, and various educational and performance tests. Children having intelligent quotients of 70 or below are recommended to special classes; a few cases above 70 with special difficulties are included. So far as possible they are grouped according to their mental ages, but this grouping must be modified by the consideration of their chronological age and physical development.

To make a curriculum suitable for special classes would be almost impossible, as each child presents a different case or problem. In the past, we have given too much thought to our subject and not enough thought to our pupils.

With special groups it is necessary to keep in mind the limitations of these children, do all we can to promote their happiness, help them to acquire regular habits and order, and fit them for a better social life. Therefore, the following objectives, activities, and information are offered merely as a guide for those who may work with retarded groups.

1. GENERAL OBJECTIVE

To aid through observation and study the mental and physical growth of the child and through correlation of subject matter and experiences gained in the shop help the child to become self-supporting and a more socialized individual.

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2. SPECIFIC OBJECTIVES

A. To stimulate interest through motor training.

b. To develop a spirit of co-operation.

c. To give practical training for home service.

3. ABILITIES FOR LOWER GROUPS (Mental ages 5-7)

a. Manipulative

1. To use coping saw.

2. To trace around simple patterns.

3. To drive nails on dots or lines.

4. To make simple toys and crude boxes.

3[a] ABILITIES FOR OLDER GROUPS (Mental ages 7-11)

b. Manipulative.

1. To cut on line.

2. To do simple measuring.

3. To sandpaper work properly.

4. To lay pattern on board in order to save material.

5. To do common repair jobs.

6. To use common tools properly.

3[b] ABILITIES

Informational

1. To know names and uses of at least six common tools as:-

A. Hammer	d. Plane
b. Coping-saw	e. Brace
c. Handy saw	f. Try-square

2. To know two or more kinds of lumber, as (Gum, (Poplar

3. To know the direction the grain runs in a board

4. To know how to assemble an object by the use of (Nails, (Screws, (Glue

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Informational - cont'd.

5. To know how to care for tools when in use and when not in use.
6. To know how to paint or stain an article.
7. To recognize some common defects of lumber.
8. Ability to read or take some instructions.

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1. MATERIALS

Woods	a. Poplar 1/4", 3/8", 7/8"
	b. Gum 1/4", 3/8", 7/8"
	c. Oak, 1/4", 3/8", 7/8"
	d. Chestnut, 1/4", 3/8"
Fastenings	Nails, 3/4", 1", 1-1/2", 2-1/2"
	Nails, (finishing) 1-1/2", 2"
	Screws R.H.B. Nos. 8 & 10, 1", 1-1/2", 1-3/4", 2"
	Screws F.H.B. Nos. 8 & 10, 1", 1-1/2", 1-3/4", 2"
	Glue (liquid)
	Dowel Rods, 1/4", 3/8", 1/2"
Wood Finishing	Stains (Walnut, Mahogany, Oak)
	Paint (Various colors)
	Filler
	Oil (Raw linseed)
	Oil (Boiled linseed)
	Wax
	Shellac
	Varnish

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1. MATERIALS - Cont'd.

Tools for Finishing
- Brushes (sizes from 3/4" to 1-1/2"
- Turpentine
- Cotton Waste
- Sandpaper

2. OPERATIONS

a. Getting out stock

b. Squaring stock to approximate dimensions

c. Assembling

d. Finishing

2a TOOLS USED IN OPERATIONS

a. Saw
- Coping
- Cross cut
- Rip saw
- Saw-horse

b. Plane

Try-square

Rule

c. Hammer

Screw-driver

Brace and bit

3. TOOLS FOR WOODWORK

1. Cutting Tools

Sloyd Knife

Chisels
- framing
- turning

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3. TOOLS FOR WOODWORK - Con't.

Saws	Rip
	Cross-cut
	Back saw
	Coping saw
	Turning saw
	Compass saw
Planes	Jack Plane
	Block Plane
	Spokeshave
2. Boring Tools	Gimlet bit No. 4 & 5
	Auger bit 4/16" to 1"
	Countersink (Rose)
	Expansive bit (small 1/2" to 1-1/2")
3. Pounding Tools	a. Hammer (claw)
	b. Mallet
	c. Nail set
Measuring and Marking Tools	a. Rule (steel bench rule)
	b. Steel-square
	c. Try-square
	d. Sliding T-bevel
	e. Marking guage
	f. Compass

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5. Holding Tools
   - a. Benches
   - b. Vises
   - c. Handscrews
   - d. Clamps
   - e. Bench-hook
   - f. Brace

6. Sharpening Tools
   - a. Grindstone
   - b. Agacite grinder
   - c. Oilstone
   - d. Files
   - e. Slipstone

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4. SUGGESTIVE PROJECTS FOR LOWER GROUPS

Most of the work with these groups should be confined to coping saw, handy saw work, and the tracing of very simple patterns, preferably for animals and small toys.

1. Auto
2. Axes (toy)
3. Boy and arrows
4. Calendar backs
5. Cutting board
6. Doll furniture
7. Flower stand (block type)
8. Guns
9. Kites
10. Match box
11. Match strikers
12. Marble game
13. Nail box
14. Swords
15. Toys (animal)
16. Towel rack
17. Wagon (toy)
19. Plant markers
20. Picture backs

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4[a] SUGGESTIVE PROJECTS FOR GROUPS OF HIGHER MENTALITY AND OLDER CHRONOLOGICALLY

1. Airplane
2. Ash tray stand
3. Auto
4. Base ball game
5. Bed (toy)
6. Bell-boy smoking stand
7. Bench
8. Bird feeder
9. Bird house
10. Board, meat
11. Board, marble
12. Board, sleeve
13. Boat
14. Boat, sail
15. Book ends
16. Book rack
17. Book shelf
18. Book, trough
19. Box
20. Box, flower
21. Box, mail
22. Box, match
23. Box, nail
24. Box, shoe-shine

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4[a] SUGGESTIVE PROJECTS - Cont'd.

25. Box, window
26. Broom, holder
27. Calendar back
28. Coat hanger
29. Candle sticks
30. Comb case
31. Dagger
32. Doll furniture
33. Doll house
34. Door stop
35. Duck
36. Flower stand
37. Foot stool
38. Game, marble
39. Garden markers
40. Hall tree
41. Hammer handles
42. Jumping jack
43. Kiddie Kar
44. Kite
45. Kite winder
46. Knife and fork box
47. Lamp, table
48. Loom
49. Magazine rack
50. Pedestal

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4[a] SUGGESTIVE PROJECTS - Con't.

51. Radio cabinet
52. Refinishing furniture
53. Serving tray
54. Sewing companion
55. Shelf
56. Ship
57. Smoking stand
58. Soap carving
59. Spool holder
60. Table, end
61. Taboret
62. Telephone stand
63. Tie rack
64. Tool chest
65. Tooth brush rack
66. Towel rack
67. Trellis
68. Truck (toy)
69. Wagon (toy)
70. Weather vane

A few of the older boys are capable of making the following projects on the lathe:

1. Candle holders
2. Chisel handles
3. Table lamps
4. Legs for stools and end tables
5. Vise handles

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5. SUGGESTEDPROJECTS FOR CORRELATION OF ARITHMETIC AND INDUSTRIAL ARTS

(a) Simple construction problems that deal with measurement, as boxes for paper and money used in grocery.

(b) Shelves for grocery

(c) Measure materials used in handwork, wood, etc.

(d) The following games:

1. Target games
2. Dart boards
3. Ball game
4. Jumping standard
5. Checker board
6. Ringtoss
7. Marble game
8. Bird-counting game

5[a] PROJECTS FOR CORRELATION OF READING AND INDUSTRIAL ARTS

1. Make small wooden objects portrayal of character and animals as found in stories.
2. Projects of ancient castles and characters of other lands.
3. Projects to represent various industries gotten from vocational booklets.
4. For the older groups the following projects:
   a. Bookshelves
   b. Book ends
   c. book rack
   d. Book stand
   e. Book trough

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5[a] PROJECTS FOR READING - Cont.

f. End table

g. Library Table

5[b] SUGGESTED PROJECTS FOR CORRELATION OF INDUSTRIAL ARTS AND HISTORY, CIVICS AND GEOGRAPHY.

1. Ships of various kind in studying discoveries, also ships of commerce and travel as:

a. Ancient Phoenicians

b. Viking-time about 900 A.D.

c. Spanish-time about 1492 (Columbus).

d. English (Sir Francis Drake) 1572

e. English-Mayflower 1621

f. Indian canoes - 1621

g. Early New England fishing boats 1621-1700

h. Schooner 1700-1800

i. Clipper ship

j. Early Steamboat models 1832

k. Later Steamboat models 1879

l. Yachts, Mah of War

m. Sea Planes

n. Submarines

o. A project showing travel routes before the time of Columbus.

Sand table depicted a caravan crossing the desert to the seaport where ships were waiting to carry the freight it brought to Europe. Ship in harbor, ancient sailing vessels, one made in flat silhouetts of wood; some carved from soap.

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5[b] PROJECTS FOR HISTORY, GEOGRAPHY AND INDUSTRIAL ARTS - Con't.

Houses in ancient Hebrew style made of wood and soap, near edge of water to represent seaport town.

p. Project showing modern methods of travel in the continent.

Models of modern ships, trains, airplanes, automobiles and boats on display.

q. A pilgrim project showing Pilgrim houses, for or block houses and Indian tents. The fort was constructed from Lincoln logs.

r. Projects for South lands.

Cotton-field with railroad station made of tin or wood and painted, also house, barn, wagon or trucks.

An oil-field with derricks, storage tanks, autos, etc.

s. Projects for western settlements.

Corrals for cattle and horses.

Indian villages with displays of leather work, bead work, bow and arrows, ancient firearms and puzzle maps of states.

t. For local study of these subjects maps of early Cincinnati and later periods can be made by making bases of wood and covering with a mixture of flour, salt and water. Before it drys make indentations representing hills and valleys. Streets and parks can easily be made, small buildings, representing industries, traffic stops, oil stations, autos, trucks, etc., representing various modes of travel.

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HYGIENE

1. Secure good light and ventilation
2. Assume a good position while working at the bench
3. Apply antiseptic to cuts and bind with clean gauze
4. Do not put nails or pencils in the mouth
5. Change air in room often
6. Keep shop clean

SAFETY

1. Keep turpentine away from fire
2. Burn "rub" rags and oily paper
3. Do not bring matches into the shop
4. Have fire extinguisher on hand

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BUILDING CONSTRUCTION

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CHAPTER XVI

BUILDING CONSTRUCTION FOR SEVEN, EIGHT AND NINE

1. General Objectives:
   (1) To enable the pupil through participation in co-operative problems, to perform better his duty as a member of his home, his school, and his country.
   (2) To give an insight into the variety of occupations involved in the building industry which may aid in discovering interests, aptitudes, and skills.
   (3) To aid the consumer in the intelligent choice of materials, design, construction,and workmanship.
   (4) To contribute to the economy of the home and to participate intelligently in the original planning and selection of materials in one's home.
   (5) To understand the fundamentals in simple building construction and provide some rather intensive experiences for particular groups.
2. Specific Objectives:
   (1) To make repairs, adjustments, and additions to the home and its equipment.
   (2) To construct parts and profiles of buildings.
   (3) To construct simple buildings.
3. Abilities:
   (a) Manipulative Abilities to be Acquired
   (1) To intelligently select, care, and use builders' tools.
   (2) To sharpen tools properly.
   (3) To draft and read plans of small houses and garages.

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(4) To lay out and build foundations for small structures.

(5) To proportion and mix concrete.

(6) To lay a plain brick or concrete wall.

(7) to point up brick work.

(8) To mix mortar.

(9) To build concrete forms for foundations and steps.

(10) To lay out, cut, and raise a frame.

(11) To cut and frame openings for doors and windows.

(12) To apply sheathing.

(13) To build a scaffold.

(14) To shingle.

(15) To frame a hip and a gable roof.

(16) To build an open or a box cornice.

(17) To lay out and build a porch.

(18) To apply wall board.

(19) To put up interior and exterior finish.

(20) To cut a pair of stringers for steps.

(21) To install or replace fuse plugs.

(22) To make minor repairs on electric equipment.

(23) To clean out drains.

(24) To connect gas stoves.

(25) To replace washers in faucets.

(26) To replace broken water and gas pipes.

(27) To thaw out frozen water pipes.

B. Information abilities to be acquired:

(1) The manufacture, use, and characteristice of the following building materials:

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Cement

Sand and gravel; methods of washing and grading.

Cement blocks; plain and face (city strength requirements)

Cinder block for foundation and wall construction.

Brick; kinds and their manufacture.

Patent mortars.

Lime mortar, cement mortar, cement lime mortar.

Mortar coloring.

Stone; artificial and natural. Granite, marble, limestone, etc.

Lumber; framing and finish (kinds).

Plaster; types and finish.

Plaster board, wall board, etc.

Shingles, asbestos, wood, slate, asphalt, tile and coup.

Composition roofing, tar, etc.

Tin flashing and copper valleys.

Nails; common, box, casing, finish.

Screws and hardware.

Iron and brass pipe.

Copper wire, insulators, etc.

2. Selection of building site.
3. Loans and mortgages.
4. Terms of payment.
5. Building code.

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(B) Major operations: Information relative to the following:-

1. Construction:

Masonry: To lay out foundation and square by 6-8-10 method.

To establish the finished grade line.

To excavate for foundation.

To place concrete footing.

To make and place concrete forms.

To mix concrete and fill forms.

To protect concrete while setting.

To water-proof foundation (tar and drain tile).

To build chimney, with at least two flues.

2. Main frame: To build and place sills and girders.

To nail floor joist 16" on center.

To cut out and nail in place header and trimmers.

To nail bridging.

To lay rough floors.

To nail bottom plates in place.

To lay off bottom and top plates 16" on center.

To build corner post (three types).

To plumb, brace, and nail corner posts in place.

To cut studs.

To nail studs to the top plate.

To raise a section of wall and fasten to corner posts.

To nail studs to bottom plate.

To line up and brace frame.

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(Main frame - continued)

To cut openings in frame (windows, etc.)

To nail on sheathing.

To frame porch and steps.

(3) Roof frame: To lay out plate for rafter locations.

To lay out and cut common rafters.

To lay out and cut hip rafters.

To lay out and cut valley rafters.

To lay out and cut jack rafters.

To lay out and cut cripple jack rafters.

To lay out ridge board.

To back hip rafters.

To nail common rafters to plate and ridge.

To nail hip, valley, and jacks in place.

To frame look-outs for cornice.

To sheath roof.

To nail valley tins in place.

To shingle roof.

(4) Exterior finish: To set outside door frames.

To set window frames.

To build cornice.

To nail corner boards in place.

To nail on water table, facia, frieze and all outside trim.

To nail on weather boards on siding.

To place porch rails, columns, etc.

(5) Interior finish: To set floor jambs.

To fit window sash.

To place door, window and other trim.

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(Interior finish - continued)

To fit doors.

To hings doors.

To fit locks.

To lay and scrape floors.

6 The correct use and care of the following tools:

Rule - carpenters 2 or 6 foot

Tape measure

Try square

Framing square

Saws, cross cuts, and rips

Planes, jack, jointer, smooth and block

Chisels (firmer)

Brace and bits

Marking guage

Spirit levels

Plumb bob

Screw drivers

Hammer claw

Sand screen

Shovels (No. 3)

Water Barrel

Water pails (metal)

Hose (garden)

Concrete tamper

Wood float

Mason's steel trowels

Cement edger

Cement groover

Wheelbarrows

Brick hammers

Brick layers trowels

Pointing trowels

Mortar hoe

Rakes (steel)

Pick

Chalk line

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Suggestive Projects

4. Group problems:

   a. Build a brick or concrete block foundation fourteen by six feet or larger. The foundation should be high enough to include cellar windows, window sills and lintels may be cast in concrete. Erect upon the foundation a typical section of a one story frame building.

   b. Individual or Group Problems:

      1. Fire Place
      2. Window and door frames
      3. Saw horses
      4. Scaffold brackets
      5. Window boxes
      6. Steps, wood or concrete
      7. Ladder
      8. Wooden miter box
      9. Concrete garden furniture
      10. A section of brick wall with arch
      11. Short section of brick wall flemish bond
      12. Short section of brick wall American bond
      13. Short section of hollow wall construction

5. Suggestions for Correlation:

   a. English:

      1. Class talks on local building projects. Suggested Magazine articles for school or home reading.
      2. Excursions to near-by building projects with written reports.

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b. Mathematics:

1. Shop problems in mensuration involving the application of the fundamental processes: Fractions, measures, and percentage.
2. Estimating quantities of standard dimensioned materials, brick, concrete block, sheathing, shingles, flooring, framing materials, etc.

c. History - Geography

1. The development of the building industry.
2. A study of materials, forestry, lumbering, milling, transportation, building, manufacture, and their relation to local industry.

d. Drawing:

1. Reading of working drawings.
2. Make a rough set of plans for a small garage or a house.

e. Hygiene:

Class discussion of the following:

1. Heating
2. Lighting
3. Plumbing
4. Damp proofing, drainage, etc.

f. Safety:

1. Precaution taken in the average residence, such as fire cuts on joists and studding, local safety test made on concrete block used within the city limits.
2. The necessity of good scaffolding.
3. Proper handling of tools.

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6. Suggestions for Pre-testing and Testing.

True - False Questions

T F 1. Foundation lay-outs are squared by the 6-8-10 method

T F 2. In laying a brick wall care should be taken that the corners are plumb and that the courses are level

T F 3. When using the American bond every seventh course should be a stretcher course

T F 4. A header course does not bond the face brick to the backing

T F 5. Cement line mortar is composed of sand, lime, cement, and water

T F 6. When starting a brick wall the center is laid first in order that the wall may be kept straight

T F 7. Brick may be broken easily if they are first kerfed with the trowel

T F 8. In sewer construction the bricks are laid in lime mortar

T F 9. Bricks are always ordered by the hundred

T F 10. Bricks are laid with a shove joint

T F 11. There are 15 bricks to each square foot of wall surface

T F 12. In laying the Flemish bond every other brick is laid as a header

T F 13. Hollow wall construction is used when little strength is required

T F 14. Hollow wall construction gives a beautiful surface but is very expensive

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6. Suggestions for Pre-testing and Testing - cont.

T F 15. Flue linings aid in keeping the flues warm.

T F 16. Side-walks are built of cement

T F 17. Concrete will harden under water faster than when left in the open air

T F 18. Concrete is a natural stone

T F 19. When concrete is mixed by hand, the sand and cement should be cut before the gravel is added

T F 20. Faced concrete block are used below the surface of the ground

T F 21. Concrete work should be troweled or floated before it begins to set

T F 22. Concrete should not be spaded after it is placed in the forms

T F 23. A mixture of 1:2:4 may be used for any purpose where concrete is to be used.

T F 24. When building steps the concrete should be very wet

T F 25. Reinforcing concrete adds to its strength

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MULTIPLE CHOICE

1. Box Sills, Corner Posts, Studding, Shingles: are built up of 2' x 10" or 2" x 12" pine material.
2. Bridging, Porch Columns, Rafters; Girders are built up of 2" x 12" material.
3. Before raising the frame of a building it is necessary; To plumb and brace corners posts; Nail rafters in place; Shingle the roof; Put on the siding.
4. When cutting openings for windows the openings should be large enough To insure free motion for: Sash Weights; Sash Locks; Window Panes.
5. Sheathing should be closely matched and nailed with 6-D; 8-D; 10-D; 20-D nails.
6. On a steep roof the amount of shingle exposed to the weather should be 10"; 5-1/2"; 2"; 1" .
7. The length of the common rafter is determined by The thickness of the joists; The pitch of the rafter and the amount of run; The length of the studs; The thickness of the stud.
8. The figures to be used on the framing square in determining rafter lengths are determined by: The pitch of the roof and the kind of rafter; The length of the studs; Thickness of the stucs; The size of the framing square.
9. In roof framing 24 is considered as a: Whole Pitch; Half Pitch; One Third Pitch; One Fourth Pitch.
10. Valley Jack rafters have: Seat cuts; Plumb cuts; Cheek cuts; Miter cuts.
11. Placing rafters 16 inches on center throws the weight of the roof, Over the windows; Over the bridging; Over the stairs; Over the studs.

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MULTIPLE CHOICE (Cont.)

12. When framing a common rafter to a one fourth pitch; 16 and 12; 8 and 12; 12 and 12; 14 and 12; 6 and 12; are used on the framing square.

13. A gable roof is to have a 1/4 pitch and the span of the roof is 30 feet. The figures 6 and 12 are used on the framing square. The square is applied to the rafter 20 times; 15 times; 10 times; 25 times.

14. The "run" of a roof is The total width; One half of the width; One third of the width; One fourth of the width.

15. Look-outs are used as the frame-work of the Steps; Porch; Window; Cornice.

16. Wall board or plaster board should be put on with Finish Nails; Casing Nails; Short Brads; Special Large Head Nails.

17. Joints in porch floors are: Glued; Glazed; Painted; Varnished.

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COMPLETION TEST

1. Concrete forms should be made as near _____ tight as it is possible to make them.
2. Sills should be _____ to the top of the foundation walls.
3. Joists should be spaced _____ inches on center.
4. In order for as little waste as possible to occur in the use of lathes studding should be placed 16 inch on _____.
5. Where heavy loads are carried on the floors of a building the joists should be spaced _____ inches on center.
6. The studding should be _____ at all windows and doors.
7. The uprights of scaffold staging are made of _____ material.
8. The name of the pieces of material used to frame a pair of steps is called a _____.
9. The plumb cut on a stringer for a pair of steps is called the _____.
10. The level cut on a stringer for a pair of steps is called the _____.
11. "To the weather" is the term used to designate the amount of shingle that is _____.
12. Standard seams are placed upon a _____ roof by a tinner.
13. Flat and soldered seams are placed by the tinner on a _____ roof.
14. Gutters and down spouts are used for carrying the _____ off a building.
15. Finish material on outside walls of a building are usually nailed upon the _____ of a frame building.
16. Window and door frames in a frame building are placed after the building has been _____ and sheathed.

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COMPLETION TEST (cont.)

17. Plastering is put on metal and wood _____.
18. Inside finish is nailed on a building after the plaster has thoroughly _____.
19. In replacing washers in a faucet, first cut off the _____ supply in the basement.
20. In looking for leaks in gas connections always open the doors and windows before testing with _____.
21. Paint is applied to the woodwork of a building to _____ and beautify the materials used in its finish.
22. Floors are oiled to _____ the wood.
23. Cypress is a good wood to use for _____.
24. Anchor bolts are used to fasten the _____ to the foundation.
25. On frame buildings stucco may be used instead of _____ for outside wall covering.

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Building Construction

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AN INDUSTRIAL ARTS CURRICULUM

FOR GRADES FOUR TO TWELVE

INCLUSIVE

A thesis submitted to the Graduate Faculty of the College of Education, University of Cincinnati, in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education

July, 1929.

by

Heber Allen Sotzin

B.A. George Washington Univ. - 1923
M.A. George Washington Univ. - 1926.

PART TWO

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CABINET MAKING

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CHAPTER XVII

CABINET MAKING

(Bench and Machine Work)

8th and 9th Grades for Junior High School
9th Grade Senior High School

I. GENERAL OBJECTIVES

1. To apply in a concrete manner, and thereby vitalize, clarify, and "fix" related subject matter such as mathematics, science, etc.
2. To develop a habit of observation and an insight into the "why" and "wherefore" of things industrial.
3. To set up ideals of good workmanship and develop habits of accuracy, thoroughness and industry in the field of cabinet making.
4. To develop responsibility and an insight into the necessity of co-operation through group problems.
5. To develop civic spirit through school and community projects.
6. To promote health through its recreational value for growing bodies and minds, and its safety lessons.
7. To enable student to make contribution to home through repairs, construction, etc.

II SPECIFIC OBJECTIVES

1. To develop appreciation of a well made article in cabinet making.
2. To impart a knowledge of the fundamentals of construction.
3. To impart a knowledge of artistic proportion in cabinet problems.
4. To develop habits of orderly procedure in planning and determining methods of construction.
5. To develop habits of orderly procedure in construction.
6. To impart a knowledge of woods and other materials used in cabinet making.
7. To impart a knowledge of the conservation of time and materials used in cabinet making.

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II. SPECIFIC OBJECTIVES (cont.)

8. To impart a knowledge of various tools, machines, and processes used in cabinet making.

9. To impart a knowledge of finishing processes used in cabinet making.

III. ABILITIES

(a) Manipulative Abilities to be acquired.

1. To make a working drawing of project, determining methods of construction, and materials to be used.

2. To make out a stock bill.

3. To identify cabinet woods and get out pieces economically.

4. To square wood to size. (Hand and machine)

5. To lay out joints and other construction work systematically.

6. To work accurately to construction lines. (Hand and machine)

7. To lay out and cut out curved or other modifications. (Hand and machine)

8. To prepare surfaces for assembly and finish.

9. To assemble in units or sections.

10. To apply surface decorations.

11. To apply hardware.

12. To apply finishes of different types.

13. To turn and finish projects on the wood turning lathe.

(b) Informational Abilities to be Acquired.

(A) Materials.

1. Woods.-
Tree growth, lumbering, seasoning, classification, piling and care, grain, weights, defects, and uses of cabinet making woods.

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(b) Informational Abilities to be acquired (cont.)

2. Glues.-
Manufacture, composition, preparation, use and care of different glues.

3. Hardware and fastenings.-
Manufacture, classification, and uses of different kinds of nails, screws, dowels, hinges, locks, angles, etc.

4. Sandpaper.-
Manufacture, classification, and uses of different kinds of sand-paper and cloths.

5. Panels, Veneers, and Wood Substitutes.-
Manufacture, classification, and uses.

6. Finishing materials.-

Manufacture, composition, preparation, uses and care of stains, fillers, shellac, varnishes, waxes, paints, enamels, lacquers, brushes, and spraying.

7. Surface Decorations.-
Styles and methods of application of transfers, inlays, carvings, cut-outs, and ornaments.

(B) Construction and Processes.

1. Methods of Construction.-
Relation of strength to artistic proportion.
Necessity of sizes proportional to loads and uses.
Methods of counter action; warping, splitting, expansion and contraction, laminating, splining, direction of grain, etc.

When to use, how laid out, cut, and fit (by hand or machine:-
Butt joints, mortise and tenon joints, lapped joints, mitered joints, case, panel, and dado joints, drawer and box joints, dowels, screw, lag screws, etc.

2. Drawers.-
Slides, guides, stops, clearance, location and styles of trim.

3. Doors.-
Joints, clearance, location and styles of trim, hardware.

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4. Assembling.-
   Procedure by units or sections.
   Procedure in inserting screws, nails, dowels, etc.
   Glueing:
      Matching woods.
      Condition of glue, wood, room temperature.
      Preparation of clamps, and clamping devices.
      Squaring and line-up devices.

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(C) Tools and Machines.

TOOLS

The student should acquire a knowledge of the following hand tools as to their types, manufacture, composition, temper, uses, names, and uses of their parts, methods of holding tool and work for good workmanship and prevention of accidents.

1. Cutting tools.-
   Method of sharpening, proper angle in grinding, whetting and tests for sharpness.

   Chisel.
   Uses in paring, cutting, sidewise, cutting end grain, mortising.
   Use of templates.
   Draw-knife.
   Use in roughing stock to line, position of tool, and direction of cut.
   Bench-knife.
   Uses in scribing fine straight lines across grain.
   Rip-saw.
   Shape of teeth, "points" per inch, chiseling action, filing, uses in cutting with the grain.
   Cross-cut saw.
   Shape of teeth, "points" per inch, chiseling action, filing, uses in cutting across the grain.
   Back-saw.
   Uses in cutting small work.
   Compass and turning-saw.
   Uses in cutting modifications.

2. Planes--.
   Assembly, sharpening, adjustment, and care of:

   Block-plane, smooth-plane and Jack-plane.
   Uses in squaring faces, edges and ends of stock, "jointing" wood for gluing, and cutting bevels and chamfers.
   Rabbeting-plane.
   Uses in cutting out recesses and rabbets.
   Router-plane.
   Uses in dadoing and grooving.
   Spoke-shave.
   Uses in cutting curves, chamfers, and other modifications.

3. Boring Tools.-
   Brad-awl.
   Uses in making brad holes.
   Brace and Bits or drills.
   Adjustment of brace chuck or drill chuck.
   Sizes of drills and bits, types, and their graduation.
   Uses of jigs and templates in boring.
   Action of bit parts and sharpening of them.

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3. Boring Tools (cont.O)

Adjustment and use of expansive-bits.

4. Scraping tools.

Files.

Uses in smoothing small modifications where no cutting tool can be used effectively.

Appreciation of probable abuses.

File-card.

Uses in cleaning files.

Scraper.

Assembly, sharpening, burnishing, adjustment, and care.

Uses in smoothing surfaces.

5. Stones.-

To use oil and whet-stones in putting an edge on cutting tools.

6. Pounding tools.-

Hammer.

To drive and draw nails.

Mallet.

To drive chisels.

Nail-set.

To set nails below the surface of wood.

7. Holding Tools.-

Vise and bench-stop.

To adjust and hold wood.

Saw-horses.

To use in sawing wood.

Handscrews and clamps.

To adjust and "clamp" wood.

To make jigs for clamping and holding.

Screw-driver.

To grind and re-shape blade.

To insert screws.

Pincers.

To draw nails. To grip and cut small pieces of wire or metal.

8. Measuring and Marking Tools.-

Rule.

To read and apply the graduations.

Tri-square.

To test wood for squareness and straightness.

To use as a guide in scribing lines.

Framing-square.

To test wood and use as a guide in scribing lines.

To lay out octagons.

To determine board feet with its use.

Dividers.

To sharpen and adjust.

To step off distances and scribe arcs and circles.

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8. Measuring and Marking tools (cont.)

Marking-gage.
To sharpen and adjust.
To make neat lines at required distances.

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Woodworking Machines

The student should acquire a knowledge of the following woodworking machines as to their types, manufacture, uses, capacities, care, oiling, maintainence, names, use of parts, adjustment, methods of operating for good workmanship and prevention of accidents.

1. Band-saw.
   Nature of saws, sizes, cutting speed, method of brazing, sharpenings, coiling, and care.
   Adjustment of table, saw-guide, saw tension, tracking, and guard.
   Uses in cutting straight or curved cuts and resawing.
   Uses and methods of making jigs for special work.

2. Surfacer.
   Nature and function of knives, cutting speed, direction of cut, grinding, and setting.
   Use and adjustment of feed-rolls, table, pressure-bar, chip-breaker, weights, idler.
   Capacity, relation of size of cut to width and hardness of stock, "graining" stock, preliminary work necessary before planing.
   Uses in planing stock to width and thickness.
   Uses and methods of making jigs for special work, production work, taper, bevel, and chamfer planing.

3. Jointer.
   Nature of knives, cutting speed, direction of cut, grinding and setting.
   Uses and adjustment of tables and fence.
   Capacity, relation of size of cut to width and hardness of stock, direction of grain in using.
   Uses and methods of making jigs for special work, production work, tapering, beveling, and chamfering.
   Uses in trueing faces and squaring edges and ends, and rabbeting.

4. Circular-saw.
   Nature of rip, cross-cut, grooving, drunk saws, special heads, sharpening, setting, and adjusting, cutting speed, direction of cut.
   Adjustment of table, saws, fence, cross-slide, saw-guard.
   Adjustment Capacity and variety of work possible.
   Uses in ripping and cross-cutting to size.
   Methods of making and using special guards and jigs in cutting tenons, grooves, dadoes, rabbets, and special modifications.

5. Grind-stone and Grinder.
   Nature and types of abrasives, method of "dressing", grinding speeds.
   Adjustment of tool-rest, special devices for accurate angle grinding.
   Uses in grinding edged tools.

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6. Mortiser.
   Nature of bits, chisels, cutting speed, methods of inserting cutting tools.
   Adjustment of table and stops.

   Uses in mortising and drilling with special chuck.
   Methods of making and using jigs in special work and quantity mortising and drilling.

7. Sander. (belt, disc, and spindle.)
   Nature of sanding belts and discs, sanding speed, method of gluing and applying.
   Adjustment of table, belt tension, and tracking.
   Uses of belt sander in smoothing edges, ends, bevels, angles, curves.
   Uses of lathe, drill press, or mortiser as spindle sander, on modifications, and making of spindles for same.
   Uses and methods of making jigs for special work.

8. Turning lathe.
   Nature of machine, lathe tools and methods of sharpening, cutting speed, types of turning.
   Adjustment of tail-stock, tool-rest and holder belts.
   Methods of sharpening and using the gouge, scraping chisel, parting tool, diamond point, round nose, and skew chisel in turning articles to correct size and shape from drawings.
   Adjustment and uses of outside and inside calipers.
   Methods of sanding, finishing, and polishing lathe projects.

9. Sprayer.
   Nature and function of pump, storage tank, transformer, safety valve, and gun.
   Methods of regulating transformer and gun in relation to materials used, and reasons for same.
   Methods of applying different finishing materials and use of masks.
   Care and cleaning of gun, spraying booth, pump, transformer.

10. Belts.
    Kinds, uses, proper tension, effect of temperature and humidity on same, methods of repairing and care.

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4. SUGGESTIVE PROJECTS

Projects undertaken in school shops should not only be chosen because of their educational value in imparting the foregoing abilities and informations, but should also be in keeping with the following suggestions:

The projects should:-

1. Be along the line of the pupil's interests.
2. Be useful and practical.
3. Be within his ability.
4. Conform to the materials and equipment readily available.

A simple uniform class project is recommended in beginning this course, for the purpose of reviewing and enlarging previous experiences, discovering individual differences, and familiarizing the student with shop practices and organization. A maximum time limit, from the opening of school to the Christmas holidays is recommended. This project should involve:-

1. Squaring at least one piece of wood by hand.
2. Making mortises and tenons.
3. Locating and boring screw-holes.
4. Group production methods up to assembly.
5. Original design in one or more units as ends, legs, etc.
6. Jointing and glueing a top or similar surface.
7. Assembling.
8. Smoothing and finishing.

Suggested projects of suitable nature for this are as follows:

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Suggested projects for subsequent work:

1. Airplane models
2. Basketball backstop
3. Bench, piano
4. " work
5. Board, bread
6. Board, bulletin
7. Board, checker
8. Board, ironing
9. Board, sleeve
10. Boats
11. Bookcase
12. Book ends
13. Book stand
14. Boxes
15. Broom holder
16. Cabinet, music
17. Cabinet, radio
18. Cabinet, filing
19. Canoe paddle
20. Chairs
21. Chest
22. Chifferobe
23. Clock case
24. Clothesrack
25. Coaster
26. Collection case
27. Desk
28. Doll furniture
29. Doll house
30. Door stop
31. Diving boards
32. Flower boxes
33. Frames
34. Football goals
35. Hat rack
36. Hall tree
37. Hurdles
38. Horse, saw
39. House, dog
30. House, bird
41. Ink well holder
42. Kiddie car
43. Knife and fork tray
44. Lamps
45. Pedestal
46. Porch swing
47. Refinishing furniture
48. Repairing furniture
49. Racquets, aerial dart
50. Rabbit pens
51. Screens, fireplace
52. Serving tray
53. Sewing board
54. Sewing table
55. Ship
56. Skiis
57. Sled
58. Smoking cabinet
59. Stand, victrola
60. Standards, jumping
61. Step ladder
62. Stools
63. Table, bedside
64. Table, card
65. Table, dressing
66. Table, library
67. Table, serving
68. Table, kitchen
69. T-square
70. Tie rack
71. Toys
72. Trailer
73. Traps
74. Trellis
75. Truck
76. Wagon
77. Waste basket

Woodturning Lathe Projects.

1. A simple formal exercise in spindle turning involving turning a cylinder, squaring ends, blocking out, turning beads and coves.

2. Choice of darning sphere, potato masher, rolling pin.

3. Suggestions for subsequent projects.

    1. Bats
    2. Box, jewel
    3. Candlesticks
    4. Clockcase
    5. Handle, tool
    6. Handle, vise
    7. Inkwell holder
    8. Lamp, table
    9. Lamp, floor
    10. Lamp, bridge
    11. Legs, table
    12. Mallet
    13. Pedestal
    14. Smoking stand
    15. Wheels

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5. Suggestive Correlations

(a) Mathematics
1. Addition, subtraction, multiplication, and division.
2. Computation in linear, square, cubic, board, angular, weight, heat, andliquid measure.
3. Laying out, bisecting, and transferring angles and lines.
4. Calculation of speeds of pulleys and shafts.
5. Laying off equal or required distances on lines or circles.
6. Solution and interpretation of formulae.
7. Laying out of regular poylygons.
8. Interpretations and application of tool and material calibrations (Drill sizes, screw sizes, etc.)
9. Location of points of application of hardware. (hinges, pulls, lid-supports, etc.)

(b) English.
1. Correct spelling and use of shop and technical terms.
2. Interpretation of text, articles, instruction sheets, tables.
3. Oral and written discussions and assignments.
4. A well kept note-book.

(c) Science.

Botany.
1. Classification of trees and study of their growth.
2. Texture, weight, strength, color, hardness, and uses of common cabinet-making woods.
3. Nature and formation of annular rings, medullary rays, grain, heartwood, sapwood, warping, bowing, twisting, shakes, checks, insect holes, and methods of taking advantage of, eliminating, or counteracting same.
4. Radial, tangential, cross-section, rotary, burl, and stump cuts.

Physical geography
1. Sources of supply and manufacture of cabinet making woods, materials, tools and machines.

Physics and Mechanics.
1. Strengths of cabinet making materials.
2. Sizes of different members in relation to loads and strains.
3. Relation of spped to power.
4. Levers, inclined planes, braces, screws, strains, and stresses.
5. Effect of heat, friction, and lubricants.
6. Adhesion, cohesion, surface tension, solution, mixture, suspension, evaporation of glue, finishings, lacquers, and other cabinet making materials.
7. Physics of light and color.
8. Compression and condensation (spraying)
9. Power transmission, belts, pulleys, gears, electric motors.

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Chemistry.

1. Composition of tools and machinery metals, and chemistry of glues, finishes, and other materials.

(d) Drawing and Art.

1. Interpretation and application of mechanical drawing; full size or to scale.
2. Making of shop sketches and working drawings.
3. Principles of design in relation to proportion, contour, harmony, simplicity, appropriateness, and utility.
4. Colors, surface decorations, hardware.

(e) Hygiene.

1. Room temperature, light, ventilation.
2. Suitable aprons, coveralls, etc., to protect person.
3. Position of work and proper posture.
4. Dust collection system and fume suction in spraying booths.
5. Provision for washing and cleaning up.
6. Care of injuries.

(f) Safety.

1. Observing demonstrations and getting permission to use power driven machines.
2. Dangers of loose clothing, littered machines or floors, inattention, diverting attention of others.
3. Uses and suggestions in using guards, goggles, or other safety devices.
4. Specific rules for use of machines.
5. Dangerous tool and machine practices.
6. Necessity for keeping tools and machines in condition.

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(6) Suggestive Tests for Pre-testing and Testing

True-False

T F 1. Seasoning lumber means cutting lumber from logs during certain seasons of the year

T F 2. The teeth of a crosscut saw are shaped like a series of chisels

T F 3. The bevel on a plane bit used in planing soft wood should be ground to a lesser angle than when used on hard wood

T F 4. Chisels are named or graded according to the lengths of the blades

T F 5. Radial cut boards are more suitable for flooring than tangential or slash sawed boards

T F 6. Auger bits are graduated in32ds of an inch

T F 7. Boards that are to be surfaced after gluing should have the grain running in the same direction

T F 8. Chestnut is harder wood than oak

T F 9. The surfacer or planer will plane the upper surface of a twisted board true if the knives are sharpened and adjusted properly

T F 10. A hammer should be held close to the head when driving nails

T F 11. Before heating flake glue it should be soaked in cold water until soft

T F 12. A piece of wood one inch thick, one foot wide, and one foot long contains one board foot

T F 13. Wood cylinders, if firmly held by hand, may be cut on the band saw

T F 14 Green lumber tears up more in planing than dry-kilned lumber

T F 15. Machines should never be oiled while in motion

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T F 16. Nail holes should be countersunk so that the heads of the nails will set below the surface

T F 17. The more glue used in a joint, the stronger will be the joint

T F 18. Number 0 sandpaper is finer than number I.

T F 19. A board joined up from several narrow pieces will be more apt to warp than a single wide board

T F 20. Lathe projects should be blocked out into a series of different sized cylinders before shapes are turned

T F 21. Planer marks will not show as much after staining as before staining

T F 22. Oil stains do not fade as much as water stains

T F 23. The best grades of rubbing varnish dry more slowly than inferior grades

T F 24 In finishing, the general rule is to apply the material to the parts least seen, first, and the parts most seen, last

T F 25 Checks or cracks often appear in varnished surfaces as a result of too much shellac used as an undercoat

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7 Tests.

(b) Multiple choice

1. Quarter sawed lumber is produced from trees by radial cut; tangential cut; rotary cut; and cross-section cut.
2. The best way to discover if a board is twisted is to test; By eye; With a rule; With a square; By laying on a true surface.
3. Poplar most closely resembles: Maple, Basswood; Oak; Cherry.
4. In gluing up stock, the most important factor is: To get the glue very thick; Make sure that the surfaces will make good contact before clamping; Get the boards hot; Use great pressure on the clamps.
5. For the most accurate marking across the grain one should use: A pencil; Knife, Gage; Nail.
6. The first choice of tools to use in removing mill marks from the surface of wood is: A scraper; Plane; File; Sandpaper.
7. Joints are laid out and cut out in most cases before modifying the shapes of pieces because: It can readily be seen where the joints should be; There is no danger in cutting off wood where a joint may fall; Joints can be more accurately laid out when the wood is square; Pieces may be ruined in modifying and work will be wasted.
8. If screws are difficult to insert it is an indication that: A screw-driver bit should be used; a hammer should be used; the holes are not properly drilled; the threads on the screw are too coarse.
9. The saw that is used on small work in cutting straight cuts with or across the grain is: Rip saw; Cross-saw; Compass saw; Back saw.
10. If joints do not fit tightly one should: Fill them up with glue; Refit them; Reinforce with nails; Fill crevices with putty or filler.

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11. A surface is true when: It is level; All points are in the same plane; It is smooth; It lays solidly on a true surface.
12. A yard stick is used: For making measurements; As a guide in drawing straight lines; as a straight-edge in testing wood; To remove waste stock from a circular saw.
13. Dowels are used in Gluing boards: To assist glue in holding the pieces together; To line up surfaces or pieces; To keep pieces from warping; To indicate which sides of pieces are to be glued.
14. The board feet in a piece of wood is found by multiplying: The "X W." L"; The" XW'Xl'; Th"XW"Xl'; Th"XW'XL'.
15. When running a piece of wood over the jointer it is found that the cut on the last few inches of the board is deeper than the rest of the cut, it indicates, - that the front table is too low; The front table is too high; The rear table is too low; The rear table is too high.
16. Of the following woods the most suitable to use in making the top of a work bench is: Pine; Oak; Maple; Walnut.
17. If in operating the planer a roar occurs, accompanied with a slowing down of the machine indicating an error in setting, one should first shut off the machine; Lower the Table; Push in tension Lever; Call the instructor.
18. A piece of wood 3/4" x 6" x 18" has been machined to size with the exception of the width. The best way to plane it to width is: To dress it down on the planer; Dress it down on the jointer; Tip it on circular saw and finish on jointer; Rip it on the band saw and finish on the jointer.

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19. Crosscut saws are distinguished from rip saws: By the size of the teeth; By the shape of the teeth; By the "set" of the saws; Because one is used in sawing with the grain and the other across it.
20. If wood has a torn appearance, on the surface of lathe projects, as a rule it indicates: The lathe is running too slow; The tool is dull; More pressure should be used; The wood is poor.
21. Stains are used to: Preserve the wood; Make defects less noticeable; Bring out the beauty of the grain; Protect the surface.
22. Varnish is thinned with: Alcohol; Linseed oil; Turpentine; Water.
23. In staining woods the grain is raised most by: Oil stains; Water stains; Spirit stains; Acid stains.
24. Pumice stone is used to: Rub varnish; Sharpen tools; Make putty; Make filler.
25. Shellac is used in wood finishing because it: Brings out the grain; Colors the wood; Acts as a sealer and filler; Dries quickly.

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7. Tests

(c) Completion.

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1. A board that is curved across the width is said to be _____.
2. Green lumber must be _____ before it is suitable for cabinet making purposes.
3. The machine used for truing surfaces of boards is called the _____.
4. The second side of a board planed is called the _____.
5. For accurate measuring, the rule should be held on _____.
6. In drilling screw holes, the hole through the first piece of wood should be the same size as the _____ of the screw.
7. In grinding plane-bits and chisels care should be exercised that they do not get hot and draw the _____.
8. The ends of the two pieces used in making a right angle mitre joint are cut at an angle of ____ degrees.
9. For most accurate work, _____ should be drawn across the grain, and _____ lines with the grain.
10. To use the dividers in scribing a circle, it is necessary to know the location of the center and the _____ of the circle.
11. The age of a tree can be told by counting the _____.
12. The device used to hold work or tools in performing a number of like operations on like pieces of wood is called a _____.
13. Glue joints have their greatest holding power where edge grain comes in contact with _____ grain.
14. Wood splits in the same direction as the _____.
15. In ripping boards to width on the circular saw, _____ of an inch should be allowed for finishing on the jointer.
16. For removing tears in surfaces of wood in which the grain runs in several directions, a _____ is used.
17. The process by which unnecessary stock is removed from pieces, the shape changed, and the appearance improved is called _____.
18. In order to obtain a good jointed edge free from ripples or waves, a piece of work should be run _____ over the jointer.
19. Before starting work on any project it is necessary to have a good working _____.

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7. Tests (concluded)

c. Completion

20. Wooden handscrews should be wiped off occasionally with _____ to prevent glue from sticking to them.

21. Work on which water stain is used should be sponged off with _____ and re-sanded before applying finish.

22. Fumed oak finish may be produced by subjecting projects constructed of oak to the fumes of _____.

23. Shellac is dissolved in _____ and lightened in color by the addition of _____.

24. Filler is first wiped off _____ the grain.

25. If water is allowed to get into shellac it will cause it to _____.

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CHAPTER XVIII

DRAWING

(a) Mechanical Drawing for Grades Seven to Twelve Inclusive.

(b) Architectural Drawing for Grades Eleven and Twelve.

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MECHANICAL DRAWING

General Objectives

1. To acquaint the pupil with a universal language of graphic representation.
2. To acquaint the pupil with the principles of drawing as employed in industry.
3. To train the pupil in the intelligent and accurate planning of a project.
4. To develop the power of visualization.
5. To develop the ability to read mechanical drawings, working drawings, and sketches.
6. To develop the ability to draw intelligible mechanical drawings, working drawings, and sketches.
7. To do neat, accurate, and legible lettering and dimensioning of drawings.

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MECHANICAL DRAWING
FOR THE SEVENTH AND EIGHTH GRADES
(8--4 PLAN OF SCHOOL ORGANIZATION)

The course, as outlined, is intended for ten industrial arts periods, one lesson of ninety minutes each per week beginning with the opening of the school year.

As a course for beginners in mechanical drawing, the introduction of too many new factors at the same time should be avoided in order to avoid confusion which may result in discouragement and dislike for the work. Success can be best achieved by a careful, methodical procedure and the use of well selected projects arranged in proper sequence according to their order of difficulty.

The mastery of the fundamentals in drawing, the acquisition of skills and speed, and the development of the power of visualization and representation can only be gained through extended practice, by the drawing of a large variety of objects of modified shapes, and outlines beginning with the simplest and progressing gradually to the more complex.

The work of the seventh grade should be confined to straight line work only, while that of the eighth grade should involve circles and arcs. The drawing in both grades should be in pencil only.

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NOTE:-

7th Grade

Since the time is limited (10 lessons per year) it is recommended that the border lines, titles, and exact location of the object on the sheet be eliminated. The name of the object and the pupil's name and grade may be written at the bottom of the sheet.

8th Grade

Border lines should be drawn 1/2" from the four edges, allowing a 3/4" space above the lower edge for lettering. The various views should be so spaced as to give a balance between the views and border lines. Title and pupil's name should be printed, using Gothic letters 3/16" high.

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Specific Objectives, 7th Grade.

1. To enable pupils to read and understand a simple mechanical drawing.

2. To enable pupils to make a simple mechanical drawing from a model or an isometric drawing.

3. To enable pupils to make a simple mechanical sketch of an object which they would like to make.

4. To provide a means for expressing ideas.

5. To develop a reasonable amount of skill in the use of drawing tools.

6. To develop the power of visualization of views in relation to each other.

7. To correlate with other school work.

8. To discover interests and aptitudes of pupils in mechanical drawing.

9. To furnish an apperceptive background for mechanical drawing.

10. To meet the demands of general education.

(2) Abilities

(a) Manipulative abilities to be acquired

1. To fasten a piece of drawing paper upon the drawing board.

2. To read the scale to an eighth of an inch and to transfer such measurements to the paper.

3. To use the T-square and triangles to draw horizontal, vertical, and oblique lines.

4. To visualize the three views of a simple object in their relation to each other and to make a sketch of the same.

5. To make a three-view drawing of objects which require:

A. Vertical and horizonal straight lines with all edges visible.

1. A plain rectangular block or cube with faces at right angles to each other.

2. A rectangular block of modified shape or outline as

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(a) a notched block
(b) a tenon shaped block
(c) an ell-shaped block
(d) a tee-shaped block
(e) a Greek cross

3. A plain rectangular block with surface consisting of edges parallel to one or more of the faces as

(a) a tongued block
(b) a lugged block
(c) a block with an end lap joint.

B. Vertical and horizontal full and broken lines with one or more edges invisible

1. A channeled block

2. A hollow block

3. A tee-slot block

4. A dado joint

5. A cross lap joint

C. Foreshortened or inclined lines representing edges which do not appear at their full length in one or more of the views as

1. A bracket with triangular shaped braces.

2. A wedge shaped block

Select from each of the above groups as many problems or their equivalents as may be necessary for the development of the fundamental factors involved.

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METHOD OF PROCEDURE

1. Study the object to be drawn and make a three-view mechanical sketch of the same.

2. Dimension the sketch as required.

3. Square the drawing paper upon the drawing board.

4. Make the layout upon the drawing paper according to the sketch. Beginning at a designated point, as for instance, one inch from the left edge and down 1-1/2 in. from the top edge of the paper, place marks for the horizontal and vertical measurements upon the drawing paper. Complete the layout by drawing construction lines through these marks.

5. Strengthen the outline of the figure.

6. Rule a margin of one-half inch around the finished drawing. Measure down 3/4 in. from the lower margin line and draw a line through this point meeting the vertical margin lines extended, so as to form a space for the designated title, etc.

INFORMATIONAL ABILITIES TO BE ACQUIRED.

1. Mechanical drawing is a graphical method of representing and recording ideas and for this reason it is used by almost all branches of industry.

2. Proper care and correct use of drawing tools is essential for good work.

3. Drawing pencils are graded according to the hardness of their leads, 3H being a very good grade for beginners, while a lower number designates a softer and a higher number a harder lead.

4. Drawing boards should be made of soft wood so as to permit the use of thumb tacks without much effort.

5. Edges of drawing boards, T-square and triangles

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should be straight and the angles correct, in order to make accurate drawings.

6. Lines should vary in character and weight according to their use.

(a) Firm lines represent visible edges or the outline of the figure.

(b) Medium weight lines are used for extension and dimension lines.

(c) light lines are used for construction lines in the making of lay-outs.

(d) Dash lines indicate invisible edges, the dashes to be about an eighth of an inch long with spaces of about 1/16 in. between them. The dash lines should begin and end with a dash unless the line is a continuation of a full line in which case it should begin and end with a space.

(e) A foreshortened line represents an edge which does not appear at its full length.

7. Extension lines should not touch the outline of the figure.

8. Dimension lines should not be too close to the figure.

9. Horizontal dimensions should read from left to right and vertical dimensions from bottom to top of drawing.

10. Neatness and cleanliness add much to the appearance and value of a drawing.

Suggestive Problems

(A) To make a three-view mechanical drawing of:

1. A plain box

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2. A neck-tie box with chamfered bottom
3. A simple book-stand with chamfered bottom
4. A comb-box of modified outline
5. Add any simple drawings that will carry out desired objectives and principles.

References (See general references p. 339)

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EIGHTH GRADE

I Specific Objective:

The specific objectives in the eighth grade are similar to those in the seventh grade with the addition of:-

(a) Drawing objects that involve arcs, curves and circles.

(b) Drawing simple sectional views.

II Abilities

(a) Manipulative Abilities to be Acquired

1. To rule a 1/2 in. border around the drawing paper with a 3/4" space above the lower border line for the printing of the title, etc.
2. To place a two or three-view mechanical drawing of any simple object, as the case may be, in the working space of the drawing paper with a space of 3/4" or 1 " between views.
3. To draw circles of any given diameter and also arcs of any given radius.
4. To draw straight lines tangent to circles and arcs and to draw circles and arcs tangent to straight lines.
5. To draw oblique lines with T-square, triangle, or with both T-square and triangle.
6. To draw arcs such as fillets and rounded edges.
7. To locate and draw center lines.
8. To make a two or three-view working drawing of the following objects or their equivalents by using:

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A. Straight lines and circles for:

1. Emery wheel, target, metal washer, round ink-bottle stand.

2. Mallett head, hollow cylinder, square ink bottle holder, cone pulley.

3. Lathe face plate, pipe flange.

B. Straight lines, circles and arcs including tangents for

1. Horse shoe magnet, slotted washer, link, crank

C. Sectional views of a

2. Hollow cylinder, emery wheel, cone pulley, crank, etc.

9, Make a good, neat, well spaced, and clearly dimensioned mechanical drawing of any simple object embodying the above principles.

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Informational Abilities to be Acquired

1. Mechanical drawing is employed in most all branches of industry.

2. A compass is used to draw circles and arcs.

3. A compass, while making a circle, should be inclined slightly in the direction of the revolution, producing the line with a dragging rather than a proding motion.

4. A compass should be held at the top and rotated by the thumb and one finger.

5. Center lines have the same weight as dimension lines and are used to denote the centers of circles, arcs, and the axes of cylinders. They consist of alternate long and short lines of about 1/2 in. and 1/8 in. respectively with a break of about 1/16 in. between. If made in pencil, center lines are to be unbroken.

6. A sectional view or section represents surfaces of objects as they appear when cut straight thru on any given plane.

7. A section is indicated by parallel cross hatch lines usually drawn across the view at an angle of 45 degrees about 1/16 in. apart, having the weight of extension lines.

8. Tangents may be drawn with T square, triangle or with both.

9. Neatness, care and accuracy in the use of drawing tools and materials always result in better work.

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(3) Suggestive Problems

(1) Draw a two or three view mechanical drawing of the following:-

(2) Bookstand

(3) Footstool

(4) Library bookstand

(5) Match box

(6) Taboret

(7) Table lamp vase

(8) Telephone stand)

(9) Smoking stand

(10) Umbrella stand

(11) Add any other simple object that can be used as a woodworking project.

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Note: Books marked (cont.)

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MECHANICAL DRAWING (JUNIOR H.S.)

I. Specific Objectives-seventh grade

1. To develop the powers of visualization as applied to mechanical construction.
2. To develop an appreciation of neatness and accuracy in making drawings
3. To develop the ability to read a simple isometric or orthographic drawing.
4. To teach the theory of simple straight line orthographic projection.
5. To teach the theory of simple straight line isometrick drawing.
6. To have the pupils develop an appreciation of the importance, purpose, and value of mechanical drawing in the industrial world.

II. Abilities

A. Manipulative Abilities to be Acquired

1. To draw vertical, horizontal, and oblique lines.
2. To clean a drawing.
3. To tack drawing paper to drawing board.
4. To select and sharpen both the lettering and drawing pencils.
5. To space a drawing on the sheet to present a balanced appearance.
6. To make a free-hand orthographic sketch of some simple straight line object.
7. To represent a simple straight line object in isometric.

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8. To dimension a drawing.
9. To print neatly.
10. To determine a mark for any given drawing thru the use of the Mechanical Drawing scale. (Published by E.W.Christy, Manual Arts Press, Peoria, Ill.)

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EIGHTH GRADE

1. Specific Objective
    1. The proper method of procedure in spacing a curved line object on the sheet.
    2. The proper method and order of procedure in inking.
    3. To teach the theory of simple curved lined isometric drawing.
    4. To make comparative studies of occupations closely allied to, and dependent upon drafting, such as engineering, architecture, furniture, manufacturing, etc.

2. Abilities
    a. Manipulative Abilities to be Acquired.
        1. To draw and locate center lines
        2. To draw straight lines tangent to circles.
        3. To draw circles or arcs tangent to straight lines.
        4. To draw an object to some other scale than full size.
        5. To make a tracing.
        6. To make a blue print.
        7. To make a free hand orthographic sketch of some simple curved line.

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9th Grade

I. Specific objectives

1. To teach detailing from an assembly drawing.
2. To teach the theory of development of surfaces.
3. To teach an applied form of geometric construction, as the need for the same arises, in the representation of objects in orthographic projection.
4. To teach elementary architectural drawing - making and reading a simple plan and elevation drawing.
5. To help pupils use their drafting experience as part of their guidance program.

2. Abilities

(a) Manipulative Abilities to be Acquired

1. To make a detail drawing from an assembly drawing.
2. To draw conventional representations.
3. To develop the true length of a straight line when the various views show it only in oblique projection.
4. To develop the pattern for some simple object which might be made from sheet metal.
5. To read a simple architectural plan and elevation.
6. To draw irregular curves with a French curve.

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(3) Information relative to
Operations or processes.

Grades. 7	8	9	
"	"	"	Cleaning a drawing
"	"	"	Filing drawings
	"	"	Calipering with outside calipers
	"	"	Calipering with inside calipers
		"	Adjusting beam compass
"	"	"	Making conventional representations
"	"	"	Checking a drawing

Construction

	"	"	Making an assembly drawing
		"	Making the detail drawings from the assembly drawings.
	"	"	Tracing a drawing
	"	"	Making an isometric drawing of some straight lined object
	"	"	Making an isometric drawing of some curved line object
	"	"	Constructing geometric figures
"	"	"	The orthographic representation of some straight lined object that has no hidden edges and the lines of which are vertical and horizontal
"	"	"	The orthographic representation of some straight lined object that has hidden edges and the lines of which are vertical and horizontal.
"	"	"	The orthographic representation of some straight lined object that has hidden edges and the lines of which may be vertical, horizontal or oblique
	"	"	The orthographic representation of some curved lined object that has no hidden edges
	"	"	The orthographic representation of some curved lined object that has hidden edges
		"	The orthographic representation of some object which necessitates that one or more of the views be represented in section
		"	The development of some simple object that may be made from sheet metal.

Tools

	"	"	Blue print machine
	"	"	Sheet washer
"	"	"	Drawing boards
"	"	"	Books, text
	"	"	Calipers, inside
	"	"	Calipers, outside
"	"	"	Cabinet, file
		"	Compass, beam
	"	"	Compass, black board
		"	Curve, French.
			Drawing instruments, consisting of:-
	"	"	Ruling pen
	"	"	Steel spring bow dividers
"	"	"	Steel spring bow pencil
	"	"	Steel spring bow pen
"	"	"	Plain dividers

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Grades 7	8	9	Tools
"	"	"	Compass with adjustable needle point, pencil point, lengthening bar and pen (this last part is not used in the 7th grade)
"	"	"	Drawing models
	"	"	Protractor, gravity
		"	Rules, 12" steel
		"	Rules, 6" steel
"	"	"	Scales, triangular boxwood architects
"	"	"	Shears
"	"	"	Stools
"	"	"	Tables, drawing
		"	Tape, steel
"	"	"	"T" square
"	"	"	Triangles 30^{o} - 60^{o}
	"	"	" 45^{o}
"	"	"	Trimmer, paper

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4. Suggestive Problems 7th Grade (Jr. H.S.)

347.

Problems taken from the following books

(Mechanical Drawing Problems - John F.Faber - Bruce Pub. Co.)
(Freehand Drafting - Anthony E. Zipprich - D. Van Nostrand Co.)
(WorkingDrawings - Arthur B. Babbitt - Henry Holt & Co.)
Additional problems to be selected from shop objects, etc.

Principles

To describe objects by the correct views and the proper arrangement of same. This would include all straight lines under

A. Horizontal and vertical solid lines
B. Invisible
C. Oblique
D. Combination of A B C
E. Dimensions

Group I

Describing objects in picture form (Isometric Drawing) where no curves are involved

Group II

Projects

A.	Rectangular Blocks	Faber Page 1	Rectangular Blocks .. Zipprich Page 48 Rectangular Blocks..Babbitt page 49	
B.	Mortised Blocks	Faber page 5	Angle Bar..... Zipprich page 51 Mortised blocks..Babbitt page 50	
	Grooved Blocks	Faber page 6	T Bar..... Zipprich page 51 Grooved blocks..Babbitt page 52	
	Ribbed blocks	Faber page 6	Z Bar..... Zipprich page 52	
C.	Chamfered blocks	Faber page 3	Eraser..... Zipprich page 49 Pyramids....Babbitt page 57	
	Bread board	Faber page 11	Wedge..... Zipprich page 50 Wedges...Babbitt page 57	
D.	Compound Rest	Faber page 11	I Beam..... Zipprich page 52	

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D

Channel .....Zipprich page 52
Saddle.....Babbitt page 62
Special Wedge.....Zipprich page 53
Dove Tail Slide.....Babbitt page 62
Mast Step.....Zipprich page 53
Angle plate.....Babbitt page 62
Truss.....Zipprich page 54
Dove Tail Cross Slide
Babbitt page 63
Brackett.....Zipprich page 54
Vise Jaw Casting....Babbitt page 63
Forged piece.....Zipprich page 54
Double Tee Slot Slide
Babbitt page 63
Cross Slide.....Babbitt page 64
Knee.....Babbitt page 64
Sliding head.....Babbitt page 64
Tool Post Rest.....Babbitt page 64

E. Covered in each of the above

Taking any of the drawings previously made in Group I. A, B.C, D and working directly from them transfers them into isometric views.

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Problems taken from the following books:-

Mechanical Drawing Problems-- John F. Faber.....Bruce Publish. Co.
Freehand Drafting---------- Anthony E. Zipprich --Van Nostrand Co.
Working Drawings---------- Arthur B. Babbitt-----Henry Holt & Co.

8th Grade (Jr. H.S.)

Group I.

To describe objects which are round, cylindrical, or a combination of arcs, circles and straight lines. Also to foster the projection of the proper views and their relative positions.

(A) Circles
(B) Arcs
(C) Tangents
(D) Dimensioning

Project	Reference		
(Flanged bushing	Faber	page	12
(Hollow cylinder	"	"	8
(Bushing	"	"	8
(Cylinder	"	"	7
(Bearing plate	"	"	42
(Piston	"	"	44
(Face plate	"	"	47
(Clamp block	"	"	13
(Roller bracket	"	"	14
(Roller bearing	"	"	15
(Die block	"	"	16
(Adjustable support	"	"	17
(Angle iron	"	"	18
(Link	"	"	19
(Support bracket	"	"	29
(Release clip	"	"	32
(Collar	"	"	39
(Eccentric	"	"	40
(Cable drum	"	"	41
(Flange seat	"	"	42
(Flanged Pulley	"	"	46
(Cone Pulley	"	"	46
(Coupling	"	"	47
(Sleeve board top	"	"	16
(Cable coupling	"	"	21
(Rocker arm	"	"	23
(Stuffing box gland	"	"	24
(Hinge	"	"	25
Rocker arm	"	"	27
(Bell crank bracket	"	"	28
(Connecting rod	"	"	37
(Crank arm	"	"	37
(Lever	Babbitt	"	97
(Bell crank	"	"	97

Project		Reference	
Washer	Zipprich	Page	55
Plug	Zipprich	"	55
Spool	Zipprich	"	56
Bored block	Zipprich	"	55
Link	Zipprich	"	56
Rivet	"	"	56
Funnel	"	"	56
Oar lock socket	"	"	67
Cylinders	Babbitt	"	96
Bearing blocks	"	"	97

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Group 2.

To further develop the idea of Orthographic Projection; I.E. when Two views are given to locate and develop the missing view.

Project	Reference			Project	Reference		
Brace Arm Fulcrum	Faber	Page	81	Packing gland	Babbitt	page	105
Trunion Plate	"	"	81	Bearing	"	"	106
Bearing cap	"	"	82	Bracket	"	"	109
Control lever	"	"	82	Vertical bearing	"	"	109
Yoke	Babbitt	"	101	Angle plate	"	"	113
Eccentric bushing	"	"	101	Swivel bearing	"	"	114
Anchor plate	"	"	102	Cap for bearing	"	"	115
Connecting Rod strap	"	"	103	Base for swivel vise	"	"	116
Vise wrench stand	"	"	104	Bearing for planer Center	"	"	118
Plain bearing	"	"	104				

Group 3

To describe objects which would otherwise be too large to put on paper by drawing them to scale.

Project	Reference		
Eccentric	Babbitt	page	148
Hand wheel	"	"	146
Pilot "	"	"	146
Gear blank	"	"	145
Face plate	"	"	144

Note-- A selection of any of the problems of Group I may be used to develop this idea.

Group 4

Broken views are used to describe objects on paper which are exceptionally long and of the same cross section.

Project	Reference		
Track rail	Faber	page	30
Bearing bracket	"	"	30

Note-- Also any object such as pipes, rods, etc.

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Group 5.

The sectional view is used to clearly describe interior construction, thereby eliminating the use of the dotted line. The sectional view is particularly useful when representing complicated objects.

Project	Reference		Project	Reference	
Wire spool	Faber	page 38	Flange seat	Faber	page 43
Drive collar	"	" 38	Track wheel	"	43
Special gear blank	"	" 38	Plunger	"	44
Collar	"	" 39	End plate	"	45
Sheave wheel	"	" 40	Flanged pulley	"	46
Eccentric	"	" 40	Core pulley	"	46
Back wheel	"	" 41	Lathe detail	"	48
Cable drum	"	" 41	Plug	"	48
Flange seat	"	" 42	Water Gauge Tee	"	50
Bearing plate	"	" 42	Coupling	"	50
			Condulet	Zipprich	82

Group 6.

Inking or tracing on paper or linen.)
Blueprinting.) This completes the entire drawing room procedure.

This may or may not represent the work done above.

Group 7.

Describing objects in picture form (Isometric Drawing)
Choosing those objects that contain circles and arcs.

Problems of this group are also to be selected rrom any of the preceding groups. They are to be worked from the orthographic to the isometric.

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9th Grade (Jr. H. S.)

Problems taken from the following books

Mechanical Drawing Problems - John F. Faber - Bruce Pub. Co.
Freehand Drafting - Anthony E. Zipprich - D. Van Nostrand & Co.
Working drawings - Arthur B. Babbitt - Henry Holt & Co.

Principles

To describe objects in orthographic projection by freehand sketching, which provides a quick and convenient method of describing any industrial or engineering problem.

Group I

Detailing or drawing and dimensioning the necessary views of each piece of any machine or the like. This is practically nothing more than what has been done in the 8th Grade except these parts are all grouped on one sheet of paper.

Group II

Assembling of the parts detailed above in group II allows for complete description and relation of each piece in the completed project.

Group III

A short informational course in architectural drawing; symbols and their meanings; reading a simple plan and elevation, etc.

Projects

Any of the objects which are to be found in or around any shop, such as parts of machinery etc. suggestions on pages 110 and 111 of Zipprich.

These jobs to be the selection of the boy as far as his ability will permit. Such things as vises, hand grinders, valves, small drill presses and the like which they may be attempting to make in the shope.

This job would necessarily be the assembly of the object detailed above.
See book references on "Arthitectural Drawing"

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4. Suggestive Correlations

Health

1. Direction of light in drafting room
2. Fresh air
3. The distance of eyes from paper
4. Physical requirements of the drafting occupation
    a. Good eyesight
    b. Good lungs
    c. Physical makeup which permits the following of a sedentary occupation.

Science

1. Chemistry involved in blue print making
2. Making of water-proof ink
3. Removing stains from Bichromate of Potash solution

Mathematics

1. Applied math. (arithmetic, algebra, geometry)
2. Mathematical formulas

Hygiene

1. Handling of supplies and instruments which are being used by many pupils from class to class.

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(5) Suggestions for Pre-Testing and Testing.

Seventh Grade

a) True-False

T F 1. All mechanical drawings should be drawn exactly to scale

T F 2. The head of the T-square should be held against the right hand edge of the board

T F 3. Mechanical drawings are usually made with soft pencils

T F 4. A 1-H pencil is harder than a 9-H

T F 5. Horizontal lines should be drawn from left to right

T F 6. Vertical lines should be drawn from top to bottom

T F 7. When erasing, always rub lengthwise to the line being erased

T F 8. Hidden edges are represented by solid lines

T F 9. Visible edges are represented by broken lines

T F 10. Dimension lines are heavier than construction lines

T F 11. Dividers should not be used to scribe circles

T F 12. The lead in a compass should be sharpened to a chisel point

T F 13. Dimensions on a mechanical drawing are of little value

T F 14 Vertical figures or dimensions should read from the bottom and right end of sheet

T F 15. The radius is half the diameter of a circle

T F 16. An incomplete circle or arc is dimensioned by its radius

T F 17. Three views are always used in making a mechanical drawing

T F 18. Lettering may be improved with constant practice

T F 19 The views of a mechanical drawing should be equally spaced from top, bottom, right, and left hand edges of the drawing sheet

T F 20. When tacking a drawing sheet to a drawing board, the upper edge of the sheet should be parallel to the upper edge of the T-square

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(B) MULTIPLE CHOICE

7th Grade

1. Drawings should be read from Bottom; Right Side; Left Side.
2. Dimension lines should be Same Weight; Lighter; Heavier than object lines.
3. Extension lines should be Same; Lighter; Heavier than object lines
4. Dash lines should be Same; Lighter; Heavier than the object lines
5. When drawing a line the pencil should be Pushed; Pulled across the paper.
6. Construction lines should be Same; Lighter; Heavier than object lines.
7. The T square is used as a straight edge to make Horizontal; Oblique; Vertical lines.
8. Vertical lines are drawn with the T square; Compass; Triangle.
9. The division line in fractions should be A Horizontal line; Vertical line; Oblique line.
10. Dash lines are used to represent Visible; Invisible; Oblique edges.
11. Vertical dimensions read from Right Bottom; Left side of drawing.
12. Construction lines touch border lines; Run through the border line; Do not touch the border lines.
13. When writing a mixed number as 2-1/2" the fraction should be the Same Height; Lower; Higher than the 2.
14. The pencil should be Pushed; Jerked; Pulled across the paper when drawing a line.
15. The Overall Dimension; Detail Dimensions are placed nearest the view.
16. Extension lines Touch the object lines; Run through the object lines; Break before reaching the object lines.
17. Arrow heads should be Sharp; Blunt; curved.
18. Arrow heads should be about 1/2"; 1/4"; 1/8" long.
19. Vertical lines; Oblique Lines; Horizontal lines are parallel with the surface of still water.

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Multiple Choice (cont.)

20. An isometric drawing is represented by 1; 2; 3 views.

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(C) Completion

Seventh Grade

1. The drawing paper that we use measured _____ inches by _____ inches long.
2. After our drawing sheets are ruled the working space measures _____ inches long by _____ inches high.
3. After our drawing sheets are ruled the title space measures _____ inches long by _____ inches high.
4. All lettering is to be _____ inches high.
5. The T-square is used from the _____ hand edge of the drawing board.
6. The T-square is used for drawing all _____ lines.
7. The part of the T-square which is held against the edge of the drawing board is called the _____.
8. The part of the T-square which is used as a straight edge is called the _____.
9. In mechanical drawing we generally show _____ views of an object.
10. The three views are generally called the _____ view, _____ view and _____ view.
11. The top view is placed _____ the side view.
12. The side view is placed _____ the top view.
13. The side view is placed _____ of the front view.
14. The standard inch is divided into _____ halves.
15. The standard inch is divided into _____ quarters.
16. The standard inch is divided into _____ eighths.
17. The standard inch is divided into _____ sixteenths.
18. There are _____ inches to one foot.
19. There are _____ feet in one yard.
20. Mechanical drawing is sometimes called a _____.

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Eighth Grade

True-False

T F 1. A draftsman should strive for clarity, neatness and accuracy

T F 2. Knowledge of mechanical drawing is of no value to the machinist

T F 3. A writing and ruling pen are both used for the same purpose

T F 4. When inking a drawing, circles and arcs are inked before the straight lines

T F 5. When inking horizontal lines, it is best to draw from the bottom of the sheet toward the top

T F 6. When inking vertical lines it is best to draw from the left to the right of sheet

T F 7. All lines on a drawing are inked with equal weight

T F 8. A drawing must be inked before it can be traced

T F 9. Only one blue print can be made from a tracing

T F 10. In making blue prints, the time exposure varies according to conditions

T F 11. A line is tangent to a circle when it touches a circle at only one point

T F 12. A protractor is used to measure the size of any angle

T F 13. A right angle contains ninety degrees

T F 14. Isometric drawing represents an object in three dimensions

T F 15. The lines constituting the isometric axis are one hundred and twenty degrees apart

T F 16. All lines not parallel to the isometric axis are said to be non-isometric.

T F 17. A mechanic must know as much about a drawing as the draftsman in order to be able to read it

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T F 18. A pencil used for lettering a drawing should be sharpened in a different manner from a pencil to be used for drawing sharp lines

T F 19. Drawing is a universal language

T F 20. A skilled mechanic has few opportunities to use mechanical drawing

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8th Grade

Multiple Choice Test in Mechanical Drawing

1. The scale is used for Drawing straight lines; Oblique lines; Measuring.
2. The compass is used to Draw Circles; Arcs of circles; Irregular curves.
3. The dividers are used to Draw dircles; Pull thumb tacks; Step off distances.
4. The ruling pen is used to Letter a drawing; To rule the sheet; Draw lines.
5. The ruling pen is Dipped into the bottle to apply ink: Filled with the aid of the quill which is embedded in the stopped; The ink is poured between the nibs.
6. The legs of the bow compass and dividers should be Opened; Oiled; Closed when they are put away.
7. A writing pen is used to Letter a drawing; Draw oblique lines; Draw straight lines.
8. When making a scaled drawing the Largest;Medium; Smallest scale should be used.
9. In making a quarter size drawing, the edge of the scale with the numbers 3; 16; 3/16; 1/4; 1/2; 3/8 on the end should be used.
10. Broken views are used when the object is too Long; Small; Short to be shown in full size on the paper.
11. When drawing a symmetrical object, the dimensions should be so placed as to be On either side of: Neither side of the center line.
12. A center line is used to show Hidden edges; Visible edges; Center symmatrical objects.
13. Center lines should be Left on;Inked in; Erased from a finished drawing.

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14. When inking a drawing there is Definite order of procedure; No order of procedure; Many varities of procedure to be followed.
15. Straight lines; Circles; Center lines are inked first when making a drawing which involves all three kinds of lines.
16. The Dull; Slick side of the tracing cloth is turned up when tacking it on a drawing to be traced.
17. The length and width lines in an isometric drawing are drawn at an angle of 30°; 90°; 60° to the horizontal plane.
18. A view is sometimes shown in section To show more clearly the construction of the object; To make a better and more complicated looking drawing; To give the pupil more experience in drawing lines.
19. A half section shows the drawing with 1/2; 1/8; 1/4 of view cut away.
20. A full section shows the drawing with 1/2; 1/8; 1/4 of view cut away.

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Eighth Grade

1. In order to draw a circle that measures 3 inches in diameter the compass is set to _____ inches.
2. The circumference of any circle is obtained by multiplying the diameter by _____.
3. A straight line that touches a circle at one point on its circumference is called a _____.
4. A drilled hole is indicated in a sectional view by _____.
5. A drilled hole is indicated in a side view by _____/
6. The distance between two circles is determined by the distance between their _____.
7. In isometric drawing three axes are used which are _____ degrees apart.
8. An angle is measured in _____.
9. The $30^{\circ} \times 60^{\circ}$ triangle for drawing is comprised of the following angles _____.
10. The 45° triangle for drawing is comprised of the following angles _____.
11. The scale is used for _____.
12. In a sectional view the cross hatch lines are usually drawn at an angle of _____ degrees.
13. The number, such as 3H, that appears on a drawing pencil is used to denote its degree of _____.
14. The instrument used to put in irregular curves is called a _____.
15. The instrument used to measure any angle is called a _____.
16. Write in numerals "five feet - four inches". _____.
17. All horizontal dimensions should be made to read from the _____.
18. All vertical dimensions should be made to read from the _____.

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19. We square our drawings on the board by the use of _____.

20. If a drawing is too large to draw full size it should be drawn to some other _____.

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Ninth Grade

True-False

T F 1. A French curve is also called an irregular curve

T F 2. Calipers are used to measure diameters

T F 3. A scale and a rule are used for the same purpose

T F 4. Mechanical drawing is called a "Universal Language".

T F 5. An orthographic drawing and a working drawing are the same.

T F 6. An assembly drawing is a drawing of the individual parts of a machine.

T F 7. A detail drawing shows the entire object assembled.

T F 8. Drawings are made on tracing linen with a pencil and then inked.

T F 9. Assembly drawings should be fully dimensioned

T F 10. Detail drawings should be fully dimensioned

T F 11. Only solid objects can be shown in section

T F 12. The purpose of a sectional view is to show more clearly the inside construction of an object.

T F 13. The development of a cone and its layout mean the same thing

T F 14. The slant height of the side of a pyramid is always a true length line

T F 15. The altitude of a cone is always its true height

T F 16. A free hand sketch of some machine part is never used in the shop

T F 17. Free hand sketches should be dimensioned

T F 18. A hard pencil is suitable for sketching

T F 19. Threads are drawn in a conventional way on a mechanical drawing

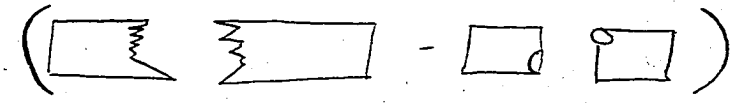
T F 20. Inside calipers are used to measure interior diameters of an object

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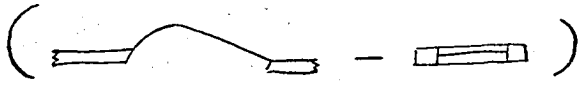
9th Grade

Multiple Choice Test in Mechanical Drawing

1. In making a detail drawing there is A definite order; A fairly definite order; No definite order to be followed.
2. An assembly drawing Should ; May; Should not accompany a detailed drawing.
3. Accompanying notes such as name of part, material used, number of parts required, etc. Should; May; Should not accompany each detailed drawing.
4. Conventional representations are made in mechanical drawings to Save Time; Make a better looking drawing; Because it is customary.
5. The conventional break for wood is (check correct sketch)



6. For house plans the scale used should be 3"-1'; 1-1/2"-1'; 1/4"-1'.
7. The conventional representation for a window is (check correct sketch)



8. The floor plan of a house is a drawing showing the Front view; Side view; Rear view; Top view of the house.
9. The height of a house is shown in the Plan; Building Code; Elevation of a house.
10. There are 1; 2; 3; 4 elevations to a complete set of house plans.
11. There are 1; 2; 3; 4 plan views to a complete set of plans for a two story house.
12. In making the development of a cylindrical object the Compass; Scale; Dividers are used for measuring off distances.
13. A development is the type of drawing usually used to show objects made of Wood; Cast Iron; Sheet Metal.

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14. The basic geometrical figure involved in the development of a funnel is The Square; Cylinder; Cone, Rectangle.
15. The "French Curve" is used for Drawing Circles; Arcs of Circles; Irregular Curves.
16. The inside and outside calipers are used to take the measurements of Rectangular; Square; Cylindrical objects.
17. A cross-hatched surface on a drawing designates a Conventional Break; A working drawing; Sectional View of the object.
18. Notes and specifications Should always; Should Seldom; Should Never be used on a complicated drawing to clarify the same.
19. Mechanical drawing is a Fair; Poor; Good practical application of arithmetic.
20. Mechanical drawing is the universal language of The Doctor; the Office Worker; The Lawyer; the Salesman; Of Industry; Of Agrigulture.

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COMPLETION

9th Grade

1. That type of drawing which shows building construction is called _____ drawing.
2. In Architectual Drawing a "stud" is sometimes called a "2 by 4", but it actually measures _____ .
3. If we make a horizontal section or cut thru a building just above the window sills and then imagine the portion above this cut removed, we shall by looking directly or vertically downward see what is known as a _____ view.
4. In Architectual Drawing the side or end view of a house is called an _____.
5. In building a frame house the timber or timbers that are laid on top of the foundation, prior to erecting any of the frame work, is called a _____.
6. The 2" x 4" pieces used in the construction of the walls of a frame house are called _____.
7. All studs and joists are so placed that the distance from center to center measures _____ inches.
8. The standard size of brick adopted by the Common Brick Manufacturer's Association and the American Institute of Architects measures_____.
9. The short pieces that are nailed diagonally between joists to stiffen them latterly are called_____.
10. A lath measures _____ inches long.
11. A drawing that is composed of a number of assembled parts is called an _____ drawing.
12. A drawing of a single piece, giving a complete and exact description of its form, dimensions, and construction is called a _____ drawing.

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13. The distance across the flats of any hexagon nut or bolt is determined by the following formula_____.

14. Two lines which are the same distance apart throughout their entire length are said to be _____.

15. Developments are used very extensively in the _____ trade.

16. A hexagon has _____ sides.

17. An octagon has _____ sides.

18. Before a blue print can be made it is necessary to make a _____ of the pencil drawing.

19. _____ is used in determining the outside diam. of a cylinder.

20. _____ is used in determining the inside diameter of a hollow cylinder.

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Topics to be Covered	Book Reference No.	Location of Reference Material
	12	Entire Book
	3	Pages 22, 23, 24, 25
	19	Chapter 2
	6	Pages 28, 29, 30, 31
LETTERING	17	" 4, 5, 6
	7	" 24, 25, 26, 27, 28
	9	" 10, 11, 12, 13
	1	" 36, 37
	13	" 201 to 238-114-117-112-107,108-109-91
	6	" 34, 35, 36
	7	" 249 to 259
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	11	194 to 200
	17	Page 22 to 140
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	18	Page 79
	1	Section 4
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SCALED DRAWINGS	7	Page 265 to 275
	13	Page 76 to 79
	11	Page 187 to 191
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DETAIL DRAWINGS	1	" 66 to 68
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DEVELOPMENTS	11	Chapter 8
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	13	Page 50-55
	11	Chapter 3
	9	Page 25-26
INKING DRAWINGS	17	" 10-11
	1	Section 8
	7	Page 159-160
	13	Chapter 7
	9	Page 52
ISOMETRIC DRAWING	18	Chapter 8
	11	" 7
	7	Page 305
	17	Section 3

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Topic to be covered	Book Reference No.	Location of Reference Material
ARCHITECTURAL DRAWING	7	Page 295 to 304
	11	Chapter 14
	16	Entire book
	5	" "
THE ALPHABET OF LINES	13	Page 94
	17	" 3
	11	" 27
	2	Page 10
	6	" 35
	10	" 116
	13	Chapter 3
	11	" 6
THE PRINCIPLE OF PROJECTION	18	Chapter 5
	6	page 38-39
	9	" 20-21
	3	" 11
	13	" 63
	1	" 23,24
	3	" 13, 14
SPACING AND PLACING OF VIEWS	9	" 22,24
HOW TO FIGURE SPACING AND PLACING OF VIEWS	7	" 34, 35
	1	" 24, 25
	6	" 41-41
STEPS TO FOLLOW IN MAKING A STRAIGHT LINE MECHANICAL DRAWING	1	" 23 and section 6
	3	" 14, 15, 16
	2	" 11
	7	" 35
	13	Page 81, 82, 83, 84
	9	" 27
DIMENSIONING OF STRAIGHT LINE OBJECTS	3	" 63, 64
	1	" 25, 26, 27, 28, 29, 30, 31
	6	" 46, 47
	11	Chapter 10
	17	Page 10-11
	11	" 191-192-193
CONSTRUCTION OF OBJECTS INVOLVING ARCS AND CIRCLES	18	" 21,22,23
	3	Section 5
	9	Page 33
	2	" 13

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Topic to be covered	Book Reference No.	Location of Reference Material
	1	Section 7
DIMENSIONING OF	13	Page 81, 82, 83, 84
OBJECTS INVOLVING	3	" 63, 64
ARCS AND CIRCLES	9	" 26, 27, 28
FREEHAND SKETCHING	18	Entire book
	7	Chapter 2

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Mechanical Drawing (Senior H.S.)

1. General Objectives:

The general objective of Mechanical Drawing is to give the student, through the application of the principles of orthographic and related projections, the proper method of representing the true form and size of objects.

Ninth Year

2. Specific Objectives:

To attaain a knowledge of the principles of orthographic projection; simple isometric drawing; the dimensioning of a mechanical drawing; the lettering of a mechanical drawing, the tracing and blueprinting of a mechanical drawing; of sectioning, and such other technic as may be deemed necessary in this year.

3. Abilities:

(a) Manipulative abilities to be acquired.

1. To draw lines of varying widths or weights with pencil and ruling pen.

2. To place paper on the drawing board.

3. To use, adjust, and keep in good working conditions the various instruments of a mechanical drawing set.

4. To letter a mechanical drawing.

5. To trace a mechanical drawing.

6. To make a blueprint.

(b) Informational abilities to be acquired

1. Mechanical drawing paper-stock, color, surface, fiber.

2. Tracing paper-stock, color, surface, care.

3. Tracing cloth-stock, surface, care.

4. Blueprint paper-stock, ciating, use, care, chemical coating.

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5. Mechanical drawing pencils-grade or degree of hardness, process of manufacturing, graphite material.
6. Mechanical drawing ink-composition, nature, source, coloring matter.
7. Mechanical drawing instruments-name, care and use of each.

(4) Suggestive Problems*

1. Rectangular forms involving visible edges only.
2. Rectangular forms involving visible and invisible edges.
3. Objects involving oblique edge or edges.
4. Cylindrical forms involving the circle and center line.
5. Objects involving a combination of straight anc curved lines.
6. Drawings introducing simple sectioning.
7. Simple drawings introducing isometric drawings.

(5) References:

French, T.E. Engineering Drawing,
Chapt, II, III, V, VI, VIII, (selection and use of instruments, lettering, orthographic projection, isometric drawing)
McGraw Hill Co., N.Y. 1918.

French, T.E. - Svenson, C. L. - High School Mechanical Drawing,
Chapts. IV and V.
(Dimensioning and technic of finished drawing)
McGraw - Hill Co., N.Y. 1919.

Miller, H.W. - Mechanical Drawing, Chapt, VII
(Isometric Drawing) Manual Arts Press, Peoria, Ill.1921.

NOTE--

Informations for different types of paper may be obtained from the published catalogues which may be had for the asking. The instructor should, also, obtain catalogues from pencil manufacturers for information on pencils.

Minimum requirement of achievement:-

No less than ten complete mechanical drawings should be completed during the year.

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Suggestions for Pre-Testing and Testing

(A) True-False

T F 1. A mechanical drawing shows the form and size of the object

T F 2. Three views are always necessary in a mechanical drawing

T F 3. The top view is always above the front view

T F 4. All lines of a mechanical drawing are of equal weight

T F 5. Good letters and figures are essential to a good drawing

T F 6. It is unnecessary to have over-all dimensions in a drawing

T F 7. Exactness is not required in mechanical drawing

T F 8. Dimensions should be placed where they mean the most

T F 9. Dimension lines should not cross each other

T F 10. Two center lines are necessary when circles are to be drawn

T F 11. It is more exact to measure with the scale than to project from one view to another

T F 12. Tracings are always made with water-proof ink

T F 13. Blueprints are always made with artificial light

T F 14. A third view can not be drawn by projecting from two other views

T F 15. Only a few blueprints can be made from one tracing

T F 16. The art of inking is easily acquired

T F 17. The projection of a line is always the true-length of the line

T F 18. It is valuable to know how to find the true-length of a line

T F 19. Materials of objects are represented by conventions that are standard

T F 20. Sectional views are seldom used

T F 21. Mechanical drawing is necessary in shop work

T F 22. Soft pencils are best for making mechanical drawings

T F 23. Irregular curves may be used in place of a ruling pen

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T F 24. White paper is best for mechanical drawings

T F 25. Invisible edges are seldom shown in mechanical drawings

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(B) MULTIPLE CHOICE

1. Straight lines are drawn with T-Square; Triangle; Scale; Book Edge.
2. The first view to draw in constructing a hexagonal pyramid is Top; Front; Side; Bottom.
3. Dimensions are placed at Left side; Right side; Top side; Bottom side.
4. The best drawing paper is Heavy; Light; Medium; Extra Heavy.
5. Drawing paper should be Strong; Fibered; Weak Fibered; Glazed; Pressed surface.
6. The best grade pencil for lettering is H; 2H; 3H; 4H.
7. It is best to make drawings from Objects; Blueprints; Pictures; Books.
8. It is best, when convenient, to make a drawing Fullsize; Half Size; Quarter size; Third size.
9. The best blueprint paper based upon time exposure is Slow; Rapid; Semi-rapid; Medium.
10. The best object lines are Heavy; Light; Medium, Extra Heavy.
11. Center lines are Heavy solid; Light solid; Light Broken; Light dashed.
12. The front view is on The Horizontal Plane; Front Vertical Plane; Right vertical plane; Left vertical plane.
13. Lower case letters are 1/4" high; 3/16" high; 1/8" high, 3/32" high.
14. Good drawing instruments are made of German Silver; Nickel; Steel; Brass.
15. The best drawing instruments are made in Germany; United States; Japan; France.
16. Triangles are 30°; 60°; 45°; $30\text{-}60^{\circ}$.
17. Mechanical drawing belongs to Science; Mathematics; Art; History.
18. Mechanical drawing is valuable in--Machine Tool Manufacturing;

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Agrigulture; Chemistry; Road construction.

19. Triangular scales are best when made of Aluminum; Box wood, Bass wood; White Pine.

20. The best triangles are made of Hard wood; Metal amber; Celluloid.

21. Pencils are easily held when Cylindrical; Square; Hexagonal; Octagonal.

22. Lettering pens should be Stiff; Flexible; Medium; Special.

23. Drawing boards should be made of Oak; Bass wood, Gum; White pine.

24. Tracings are made on Wrapping Paper; Tissue Paper; Vellum; Prepared Linen Cloth.

25. Blueprints are printed by Candle Light; Sun light; Electric Light; Oil light.

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Completion Test

1. A T-square is used for drawing _____ lines.
2. The top view of a mechanical drawing is drawn on the _____ plane.
3. There are two planes of _____.
4. True-length lines are used in the _____ trade and _____ trade.
5. The classes of triangles are _____ and _____.
6. The development of a surface is often called a _____ or a _____.
7. The principle of the helix is applied to the drawing of _____.
8. Eccentric wheels are often called _____ wheels.
9. The line that joins two solids is called their _____.
10. Most blueprints are printed by _____ machines powered with_____.
11. One tracing can be used for making _____ blueprints.
12. A tracing is inked with _____ ink.
13. Blueprinting is similar to_____.
14. The purpose of an isometric drawing is to clarify the _____ of the object.
15. The instrument for drawing irregular curves is called a _____.
16. The best T-squares have _____ edges.
17. Screw threads are often represented by _____ lines.
18. Sectional views are used to show _____ of the object.
19. Over-all dimensions are considered the best _____ in dimensioning.
20. The best test of a mechanical drawing is its _____ and _____.
21. An expert in mechanical drawing is known as a _____.
22. All cross-section lines are inclined at an _____ of _____ degrees
23. It is important to understand the _____ scale in mechanical drawing, and the _____ scale in engineering.
24. The architects scale is graduated in _____ of an inch, and the

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engineer's scale in _____ of an inch.

25. The most important skill to be acquired in mechanical drawing is _____.

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Tenth Year

I. Specific Objectives

1. To attain the knowledge of the principles of orthographic projection in their application to developments of the surfaces of solids.

2. To attain an understanding of the method of determining the line of intersection of different types of solids.

3. To attain an understanding of the method of determining the true length of a line.

4. To attain an understanding of the methods of bisecting lines, angles, the construction of polygons, and irregular curves.

2. Abilities

(a) Manipulative abilities to be acquired.

All the abilities acquired in the ninth year with the following additions:

1. The ability to use the principles of orthographic projection in the layout of sheet-metal problems, and in determining the line of intersection of solids.

Note:- It is necessary that the student understand that before he can successfully and skillfully lay out the sheet-metal pattern, he must be able to make the orthographic drawing of the object from which he is to choose the several elements that determine the pattern.

Informations:

All the informations of the ninth year plus those informations relating to the true length of the lines; the application of the true length of lines to pattern layout; the intersection of solids; the different type of curves in their application to sheet-metal problems.

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3. Suggestive Problems

1. The development of the surfaces of rectangular, triangular, pyramidal, conical, and cylindrical forms.

2. Pattern layouts of sheet-metal forms.

Note:- The problems should be practical and easily adapted in sheet-metal work, and arranged in a sequence for successful teaching.

It is considered inadvisable to use a formal set of geometric problems for regular drawing exercises, but suggested that such problems be introduced and demonstrated when the occasion arises, for their use in required drawings. References are listed, relative to bisection of a line, arc, etc., and the construction of polygons, such as hexagons, octagons, etc., together with different types or forms of irregular curves such as occur in sheet-metal lay-outs. It is also suggested that such curves as-ellipses, compound, parabolas, and hyperbolas to included. It is recommended that these curves be drawn by the graphic process.

References:-

Daughterty, J.S. Sheet Metal Pattern Drafting and Shop Problems, Chapts I, III, IV. Manual Arts Press, Peoria, Ill, 1921.

French, T.E. Engineering Drawing, Chapt. VII, McGraw Hill Co. N.Y. 1918.

Kittredge, G.W. Metal Workers Pattern Book, David Williams Co. N.Y. 1911.

Minimum requirement of achievement:

Ten complete orthographic drawings, together with the complete layouts or developments of the surfaces of the solids. Several of these should include intersections.

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4. Suggestions for Pre-Testing and Testing

(A) True-False

T F 1. Cylinders are considered as being many-sided prisms, for the purpose of development of the lateral surface.

T F 2. The length of the layout of a solid is equal to the perimeter of its base

T F 3. Auxiliary planes are helpful in pattern drawing

T F 4. The cross-section of a cylinder at any angle not cutting the bases is a parabola.

T F 5. It is unnecessary to show the lap of the seam of edges in pattern layouts

T F 6. Lateral Surfaces of cylinders and cones are easily developed

T F 7. The line of intersection of two cylinders of equal diameters is an arc of a circle

T F 8. True length edges are unnecessary in the "roll-out" of the surfaces of truncated solids

T F 9. A four-piece elbow can be cut out of a rectangular sheet of metal without waste

T F 10. The projection of a line upon a plane of projection is always the true length of the line

T F 11. The orthographic views of an object are unnecessary in the development of the surface.

T F 12. Cutting planes determine the points of intersection of prisms

T F 13. A sheet-metal worker has little need for mechanical drawing

T F 14 In sheet metal work it is desirable to know how to construct different forms of curved lines used in pattern drawings

T F 15. A knowledge of mensuration is quite helpful in the development of the surfaces of solids

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T F 16. Transition pieces do not occur in practical sheet metal work.

T F 17. Triangulation is a process that seldom is used in the layout of transition pieces

T F 18. The frustum of a cone is found by cutting the cone lengthwise

T F 19. Cylinders and cones are never made to intersect in practical sheet metal work

T F 20. The line of intersection of a square elbow is an ellipse

T F 21. Tangents are unnecessary in developing a square elbow

T F 22. There are only two conic sections that have practical value

T F 23. If the circumference of a circle be divided into a great number of equal parts, the more accurately does the "stretch-out" approach the true length of the circumference

T F 24. Plane geometry is not applicable to the development of the surfaces of solids

T F 25. The French or irregular curve is of little use in drawing irregular curves or shapes.

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(B) Multiple Choice

1. Triangulation is used in the development of the surfaces of: Cylinders; Cones; Pyramide; Transition pieces.
2. The shape of the developed surface of a hollow cylinder is a Square; Rectangle; Circle; Ellipse.
3. The "Rolled-out" surface of a pyramid without a base, is a series of squares; Rectangles; Rhombuses; Triangles.
4. The "roll-out" of the surface of a hollow cone is shaped like a Circle; Parabola; Ellipse, Modified triangle.
5. The radius for the development of the lateral surface of a cone is the altitude; Slant Height; Diemeter; Circumference of the base.
6. The radius for the development of the lateral surface of a pyramid is the Slant Edge; Slant Height; Altitude; Perimeter of the base.
7. The "rolled-out" surface of a trucated cone is Oblong; Oval; Irregular; Oblique.
8. The line that represents the perimeter of a square pyramid in the development of the surface is called the circumference, altitude; "Stretch-out"; finder.
9. The planes that are made to pass through a solid are called Intersecting; Projecting; Auxiliary; Cutting.
10. The line formed by two solids meeting in their surfaces is known as Projecting; Intersecting; Centering; Forming.
11. To develop the lateral surface of a solid required; Tact; Skill; Rapidity; Thought.
12. Developed surfaces are practical for making Machinery; Cabinet work; Tinware; Electric motors.
13. Mechanics that use developed surfaces in their work are Electricians; Machinists; Carpenters; Tinners.

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14. The true length of a line is found by revolving the line-perpendicular; Parallel; Oblique; Horizontal to the plane of projection.
15. The intersection of two solids is found by Revolution; Triangulation; Sectioning; Projection.
16. The principles of the development of the surfaces of solids is applied to the forming of Gear wheels; Cams; Cornices; Castings.
17. Cones are designated as Parallel forms; Oblique forms; Profile forms; Flare forms.
18. The "rolled-out" surface of a solid is Imaginary; Real; Perspective; Isometric.
19. The line at the intersection of a right angled cornice is known as a Square; Miter; Oges curve; Irregular curve.
20. The surface of a sphere is developed by the Triangulation method; Projection method; Gore method; transition method.
21. The form used most in work requiring the application of the principles of the development of surfaces is that of Prisms; Cylinders; Pyramids; Cones.
22. The principles of mathematics used most in the development of the surfaces of solids are Mensuration; Algebra; Plane Geometry; Solid Geometry; Trigonometry.
23. The following curves are used most in the development of the surfaces of solids: Compound; Simple; Irregular; Oges.
24. The several parts that are combined to form an arch are called: Arcs; Keys; Segments; Sectors.
25. The ornament over a portico, door or window is named a Pilaster; Pediment; Pedestal; Capital.

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(C) Completion

1. The nearest true length of the circumference of the circle is found by multiplying the _____ by pi.

2. The perimeter of a circle when extended is called the _____.

3. A prism having three sides is called a _____ prism.

4. A cross-section of a cone cut at right angles to the axis is a _____.

5. The additional allowance added to the pattern for seaming is called the _____.

6. If two solids cut into each other, they are said to_____.

7. When a pipe of one form is made to connect with a pipe of another form, the process is called a _____.

8. The planes that determine the points of intersection of solids are named _____ planes.

9. Lines that are drawn to points on the surface of a cylinder are called_____.

10. The edge of a square pyramid that is used for the radius of the developed surface is known as the _____edge.

11. If a circle is parallel to a plane of projection, its projection on that plane will be a _____ line.

12. A reverse curve is known as an _____.

13. Lines that are used in development and which do not really exist are called _____ lines.

14. The _____ drawing is necessary for drawing the development.

15. When a piece is changed in form at one end to fit another piece, it is called a _____ piece.

16. A sheet metal worker often uses short cuts in _____ work.

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17. The top of a cone is named the _____.

18. The point of the intersection of the two sides of an angle is called the _____.

19. A cone whose axis is perpendicular to the base is known as a _____.

20. Solids whose outline is formed of straight lines are _____.

21. A plane that is made to pass through a solid is a _____ plane.

22. Dividers are instruments that are used for _____ in sheet metal drawings.

23. The development of a surface is often called the _____.

24. The purpose of sheet metal drawing is _____.

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Eleventh Year

(I) Specific Objectives:

1. To attain a knowledge of the method of the true development of bolts and screws, together with their conventional representation.

2. To attain a knowledge of the method of the development of different types of gears.

3. To attain a knowledge of machine details as related to the mechanical drawing of such details.

4. To attain a more technical understanding of shop terminology.

(2) Abilities

(a) Manipulative abilities to be acquired.

1. All of the abilities of the ninth and tenth years plus the further skillfull manipulation of the several mechanical drawing instruments and other tools in the production of the mechanical drawings of the more intricate problems of this year.

(3) (b) Informational abilities to be acquired.

1. All of the informations of the ninth and tenth years plus the skillfull use of tables for dimensions for U.S. Standard bolts and nuts; the helix and its application to screw threads; screw threads other than U.S.S.; fasteners other than bolts; gears; design of ribs and spokes of wheels.

(4) Suggestive Problems:

1. The development of a true helix curve.

2. The application of the true helix curve to the development of a true V and Square screw thread.

3. Problems involving conventional types of screw threads.

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4. Gear blanks and gears.

5. Bearings, couplings, etc.

(5) References:

Brown Engineers - Brown and Sharp Gearing,
Brown and Sharp Co.,
Providence, R.I., 1915.

French, T.E. Engineering Drawing,
Page 47-48, Chapts. IX and X,
McGraw-Hill Co., N.Y., 1918.

Minimum requirement of achievement:

No less than ten complete drawings covering different types of problems, should be completed. The judgment of the teacher must be exercised regarding the amount of time required as some problems require more time and effort than others.

Note:- When the pupil has reached the 11th and 12th grades in mechanical drawing the work becomes rather specialized. The fundamental principles and operations have been acquired previously. Hence the tests that are devised are dependent upon the particular work or drawing pursued by the student.

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Twelfth Year

(1) Specific Objectives

1. To attain a knowledge of the layout of assembly drawings from a series of detailed drawings of an object.

2. To attain a knowledge of the mechanical drawing of detail drawings from assembly drawings.

3. To attain a knowledge of simple cam or eccentric drawing.

(2) Abilities:

(A) Manipulative abilities to be acquired.

1. All the abilities of the ninth, tenth and eleventh years plus the ability to plan and execute layouts for assembly and detail drawings, and the ability to plan and develop a simple uniform-motion cam.

(B) Informational abilities to be acquired.

1. All the informations of the ninth, tenth and eleventh years plus informations relating to the purpose of assembly and detail d rawings.

2. Assembly Drawings
   The following specific information to be emphasized:
   Locating center and base lines.
   Choice of scale.
   Drawing of the larger parts in the different views.
   Drawing of the smaller parts.
   Maximum distances for stationary and moving parts.

3. Detail Drawings.
   The following specific informations to be emphasized:
   Choice of views.
   Treatment of views.
   Choice of scale.

4. Suggestive Problems
   1. Assembly drawing of a simple machine.
   2. Assembly drawing of a valve.
   3. Assembly drawing of a headstock of a lathe.
   4. Assembly drawing as may be practical and feasible.
   5. Detail drawings made from assembly drawings or assembled machine.
   6. Layout and drawing of simple uniform-motion cam.

References:

French, T.E. Engineering Drawing, pages 161-163, McGraw-Hill Co., N.Y. 1918.

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References (cont.)

Jones, F.D. - Mechanical Drawing, Chapt. X, The Industrial Press, N.Y. 1920.

GENERAL REFERENCES:

1. Brown Engineers — Brown and Sharp Gearing, Brown and Sharp Co., Providence, R.I.

2. Daugherty, J.S. — Sheet Metal Pattern Drafting and Shop Problems, Manual Arts Press, Peoria, Ill. 1922.

3. Ermling, Fischer, Greene, — Mechanical Drawing (1st year) Bruce Pub. Co. Milwaukee, Wis. 1921.

4. French, T.E. — Engineering Drawing, McGraw Hill Co., N.Y. 1918.

5. " " " — Svenson, C.L. Mechanical Drawing for High Schools, McGraw-Hill Co., N.Y. 1919.

6. Jamison, A.P. — Mechanical Drawing, John Wiley Sons Co., N.Y. 1904.

7. Jones, F.D. — Mechanical Drawing, The Industrial Press, N.Y. 1920.

8. Kittredge, G.W. — Metal Workers Pattern Book, David Williams Co., N.Y. 1911.

9. Logue, G.H. — American Machinist Gear Book, McGraw Hill Co., N.Y. 1915.

10. Miller, H.W. — Mechanical Drafting, Manual Arts Press, Peoria, Ill. 1921.

11. Svenson, C.L. — Essentials of Drafting, Van Nostrand Co., N.Y. 1919.

12. " " " — Machine Drawing, Van Nostrand Co., N.Y. 1923.

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ARCHITECTURAL DRAWING

FOR

SENIOR HIGH SCHOOL GRADES ELEVEN AND TWELVE

General objective

Architectural Drawing in the senior high school centers around the home, and since many of the students will become home makers soon after leaving school, they should learn that the home is a place where beauty and utility can be combined for the comfort and happiness of the family.

It is desired that the student develop an interest in architecture. To this end he can find inspiration in many churches, buildings and monuments that are rich in architectural beauty.

The purpose, then, in architectural drawing is to develop an appreciation for well designed homes through a study of the types of domestic architecture and to gain a knowledge of architectural construction and house plans.

This course pre-supposes two years of elementary mechanical drawing.

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Eleventh Year

I. Specific Objectives

To learn the principles involved in house construction and the arrangement of rooms; the principles and practice of dimensioning house plans; and, the conventional architectural representations and symbols.

II. Abilities

(a) Manipulative Abilities to be Acquired.

1. To lay out a floor plan.
2. To lay out large dimensions with an architect's scale.
3. To letter a drawing using architect's letters.
4. To make tracings from which blueprints can be produced.

(B) Informational Abilities to be acquired. References*

1. Architectural Lettering	(1. French and Meiklejohn, (Chapter Iv. ((2. Elwood, (pp. 15, 19, 74. ((Svensen and Shelton, (pp. 7 to 13.
2. Construction	(1. Elwood, (Chapter III. ((Bush and Townsley, (Chapter II.
3. Foundations Concrete, Brick Hollow-tile, Stone	(1. Elwood, (Chapter IV. ((2. Bush & Townsley, (pp. 50 and 51, (Cement Companies Literature.

*All references listed in General Bibliography

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Informational Abilities to be Acquired, (cont.)	References (cont.)
4. Roof, Pitch, Materials, Construction	(1. Elwood, pp.30,40,41,44 (2. Builders' Supply Catalogs
5. Openings for Windows and Doors	(1. Elwood, pp. 24 & 39
6. Cornices	(2. Elwood, pp. 22 and 43
7. Conventional Symbols	(3. Elwood, p.20.
8. Building Materials Wood, brick stone Stucco, cement, tile	(1. Elwood, p. 43, 50 (2. Svensen & Shelton, p.101 (Builders' supply Catalogs
9. Arrangement of Rooms	(1. Bush & Townsley p. 6
10. Dimensioning	(1. Wooster Baird Field, (Plates 21 to 30. (2. Elwood, p. 14, 63, 75, (Windoes and Campbell (Chapter X.
11. Architects' Scale	(Elwood, p. 14. (2. French, p. 8.
12. Laying out plans	(1. Blueprints of house plans (2. Wooster Baird Field, (plate. (21 and plate 22 (3. Brahdy and Landsman, (Chapter X. (4. Windoes & Campbell, (Chapter X.

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3. Suggestive problems.

Select a simple house plan of four or five rooms, or a garage of one or two car capacity. Use this as a preliminary sketch from which the student will detail a set of house plans.

Small house plans.

Elwood, pp. 85, 90, 98.

Brahdy & Landsman, p. 65

Architects' Small House Service Bureau.

Builders' Magazines.

Field Office.

Elwood, p. 86

Brahdy & Landsman, Chapter VI

Garages

Elwood, p. 88

Brahdy & Landsman, Chapter VIII.

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Twelfth Year.

I. Specific objectives:

1. To learn to distinguish different types of domestic architecture.
2. To develop an appreciation of a well designed house.
3. To stimulate an interest in architecture.

II. Abilities

(a) Manipulative Abilities to be Acquired.

1. To draw an original plan of a house.
2. To draw a set of house plans.
3. To draw a house in perspective.
4. To color a perspective or render the elevation in colored crayons only.

(b) Informational Abilities to be Acquired — References.

1. House planning

Site Arrangement of rooms Location of windows and doors.	1. Elwood, Chapter II 2. Bush & Townsley, Chapter I. 3. Svensen & Shelton, Chapter XI

2. Domestic architecture

Colonial Dutch Colonial Bungalow English cottage Spanish Mission Modern American	1. Bush & Townsley, Chapter III. 2. Elwood, pp.17, 20 3. Pictures, Magazines, etc.

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Informational Abilities to be Acquired (cont.)	References(cont.)
3. Chimney and fireplace construction	1. Elwood, p.17,27, 51, 52 2. Farmers' Bulletin #1230, U.S. Department of Ag.
4. Lighting	
Fixtures	1. Elwood, p. 13
Wiring	2. Bush & Townsley, p. 7 & 8 3. Manufacturers' Literature
5. Heating	
Hot air, steam, hot water, vapor	1. Elwood, p. 13 2. Bush & Townsley, p. 8, 3. Svensen & Shelton, 102 4. Manufacturers' Literature.
6. Plumbing	
Fixtures	1. Elwood, p. 26 2. Bush & Townsley, p. 8 3. Manufacturers' Literature
7. Windows	
Box-frame, casement, double-hung, dormers, frames, sash, sizes of	1. Elwood, pp. 17, 20, 24, 46, 41
8. Stair construction.	
Risers, treads, run, rise, carriages, proportion, types-open and closed	1. Elwood, pp. 24, 47

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Informational Abilities to be Acquired (cont.)	References (cont.)
9. Interior trim	1. Elwood, pp. 45 and 46
10. Exterior finish	1. " p. 32
Kinds	2. Manufacturers' Literatore
11. Doors.	
Types	1. Elwood, pp. 24, 31, 45, 45, 51
Frames Sizes	2. Svensen & Shelton, pp. 87, 183,184
12. Built-in conveniences	1. Elwood, p. 26
13. Perspective drawing	1. French, Chapter Xiii
14. Rendering in Colors	
Crayons only	
15. Design of a house	1. Elwood, Chapter II
Principles	Plans of houses.
16. Specifications	1. Elwood, p. 14
	2. Swensen & Shelton p.71 and 118
17. Building Code	3. Svensen & Shelton p. 71

III Suggestive Problems:

1. Make a sketch of an original plan.
2. Draw a set of house plans.
3. Draw the house in perspective.
4. Render the elevation in colors or color the perspective using crayons only.
5. Through pictures, magazines, observations, reports, trips, etc., discuss the types of domestic architecture.

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6. To stimulate an interest in architecture point out to the student the various churches, buildings and monuments that are well designed and are typical types of architecture. This can be accomplished through trips, reports, discussions, pictures, observations, etc.

IV Suggestive Correlations

1. English.

   Correct pronunciation and spelling of terms, etc.

   Proper use of English in reports, oral discussions, and general conversation.

2. History and Geography.

   Reading along the line of architecture.

   Relation between architecture of a country and its history with special reference to the United States.

   How climatic conditions effect the architecture of a community. How the nationality of a community effects the type of architecture.

3. Hygiene.

   Sanitation about the home.

   Lighting and heating a home.

4. Design and color work.

5. Mathematics.

   Correct application of the fundamentals.

   Applied goemetry.

6. Science.

   Construction materials. Strength, fire-proof materials, etc.

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2. Bush, C.V. Townsley,E.D. — Problems in Architectural Drawing, Bruce Pub. Co. Milwaukee, Wis. 1925.

3. Elwood, F.G. — Problems in Architectural Drawing, Manuarl Arts Press, Peoria, Ill. 1924.

4. Frederick, F.F. — Simplified Mechanical Perspective, Manual Arts Press, Peoria, Ill. 1909.

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7. " " " Meiklejohn, R. — (Meiklejohn,R.)Essentials of Lettering, McGraw Hill Co., N.Y. 1912.

8. Kidder, F.E. — The Architects' and Builders' Hand Book, John Wiley & Sons, N.Y., 1921.

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10. Radford, W. A. — Architectural Details, The Radford Architectural Co., Chicago, 1921.

11. Svensen, C.L. — Drafting for Engineers, Chaps. 15 and 16, D. Van Nostrand Co., N.Y. 1927.

12. " " Shelton, E.G. — Architectural Drafting, D. Van Nostrand Co., N.Y. 1929.

13. Windoes, R.F. Campbell, H.B. — (Secondary Schools) Architectural Drafting for Secondary Schools, The Well Pub. Co., St. Paul, Minn, 1917.

14. Current Architectural Magazines

1. Pencil Points, The Pencil Points Press, N.Y.

2. The Architectural Record, The Architectural Record Co., N.Y.

3. The American Builder, The Radford Architectural Co., Chicago.

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5. Suggestions for Pre-Testing and Testing

(A) TRUE - FALSE

T F 1. The ridge is the top of the roof where two slopes meet.

T F 2. The pitch of the roof is the term applied to the amount of slope

T F 3. The pitch of a roof is found by dividing the rise by the span

T F 4. The part of a roof which projects beyond the wall is called the frieze.

T F 5. The outside member of a window or door casing is called a cap

T F 6. The point where finishing board covering the plaster wall meets the floor is called a plancher board

T F 7. A structure projecting from a sloping roof is called a dormer

T F 8. Dimensions for windows and doors are taken from corner of building to center of opening

T F 9. The horizontal section through a building showing the size and location of rooms, also doors and windows in walls, is called an elevation

T F 10. A gambrel roof has two different slopes

T F 11. A gable is the triangular portion on an end wall formed by the sloping of the roof.

T F 12. A hip roof slopes up from all walls of a building

T F 13. The framing timbers which are the direct support of a floor are called rafters

T F 14. The horizontal structural member supporting the wall over an opening is called a lintel

T F 15. The short timber for supporting the protecting cornice is called a gutter

T F 16. The stone or window member across the bottom of a door or window on the outside of a building is called a plate

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T F 17. The top horizontal member of a wall is called a joist

T F 18. The throat is the opening from the fireplace into the smoke chamber

T F 19. In building a house the site is a rather unimportant consideration

T F 20. Studs are always spaced the same as joists

T F 21. Casement windows always swing in

T F 22. A two by four is exactly 2" thick and 4" wide

T F 23. Architecture is a profession rather than a trade

T F 24. America has failed to develop an architecture of its own

T F 25. The majority of homes in the United States are built of wood

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(B) MULTIPLE CHOICE

1. The outside member of a window or door casing is called a Cap; Back-band; Crown moulding; Bed mould.
2. The point where finishing board covering the plastered wall meets the floor is called Frieze; Base board; Soffit; Mop board.
3. A structure projecting from a sloping roof is called a bay; a Dormer; a Gable; A cornice.
4. A roof sloping up from all walls of a building is called a Gambrel roof; A Gable roof; A Hip roof; A Flat roof.
5. The framing timbers which are the direct support of a floor are called Rafters; Joists; Studding; Bridging.
6. The horizontal structural member supporting the wall over an opening is called a Jamb; Sill; Plate; Lintel; Yoke.
7. The short timber for supporting the projecting cornice is called a plate; Lookout; Gutter, Soffit.
8. The wood shelf across the bottom and inside of a window is called the Stile; Sill; Stool; Apron.
9. The stone or wood member across the bottom of a window or door opening on the outside of a building is called a Jamb; Sill; Apron; Lintel.
10. The horizontal broad surface of a step is called a Stringer; Girt; Tread; Riser.
11. A moulding designed to prevent rain water from running down the face of a wall is called a Water spout; Gutter; Drip cap; Crown mould.
12. The horizontal top member of a window frame is called a Lintel; Yoke; Jamb; Plate.
13. A secondary sill coming at the second floor level supporting the floor joists is called a Ribband; Purlin; Strut; Lintel.

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14. Casement windows are constructed that they raise and lower; Swing in, Swing out, Are Stationery.
15. Vertical members separating the sash in a group of windows are called Stiles, Muntins, Mullions, Check rails.
16. The middle member of a window is called the Stile, Middle Rail, Meeting Rail, Check Rail.
17. The half timbered effect in the gable end of a dwelling is characteristic of Dutch Colonial, English, Modern American, Spanish type of architecture.
18. The gambrel roof is characteristic of English, Spanish, Mission, Colonial, Dutch Colonial.
19. The vertical members of a sash are called Pulley Stiles; Yoke stiles; Rails.
20. Joists are usually placed 16"; 18"; 20"; 36" on centers.
21. Horizontal members used midway between the foundation walls to support the floor joists are called plates, Stringers; Sills; Girders.
22. The principal framing members of the roof are Sills, Joists, Rafters; Studs, Plates; Ridge; Girders.
23. The different types of frame construction are Balloon; Braced; Western, Colonial.
24. The pitch of a roof is the term applied to the distance between the corner posts, to the height of roof from plate line to ridge; to the amount of slope; to the distance from floor to roof.
25. The part of the roof which projects beyond the wall is called the frieze; Cornice; Overhang; Gutter.

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(C) COMPLETION

1. The floor joists are usually placed _____ on centers.
2. The different types of frame construction are _____, _____ and _____.
3. The _____ is the timber laid on the foundation walls to support the walls and floors above.
4. Horizontal timbers used midway between the foundation walls to support the floor joists are called _____.
5. The studs are spaced the same as the _____.
6. A secondary sill coming at the second floor level supports the _____ _____ and is called _____ or _____.
7. The principal framing members of the roof are _____, _____ and _____.
8. Shingles are laid with an exposure to the weather from _____ to _____ depending upon the _____ of the roof.
9. Casement windows are of two types, _____ and _____.
10. Vertical members separating the sash in a group of windows are called _____.
11. Dividing strips breaking the glass into smaller panes are called _____.
12. The vertical members of a sash are called _____.
13. The middle members of a window are called _____ or _____.
14. The types of Domestic Architecture are _____, _____, _____, _____, _____, _____ and _____.
15. A characteristic of _____ type of architecture is the gambrel roof.

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16. The half-timbered effect in the gables is a characteristic of _____ _____ type of architecture.

17. The characteristics of Spanish mission type of architecture are _____ _____ _____ _____

18. Cornices are of two types, _____ and _____.

19. Gutters are either _____ or _____.

20. The two types of windows most frequently used are:_____ and _____.

21. The general considerations in the arrangement of rooms are: _____ _____ _____ _____

22. Methods of heating a house are: _____ _____ _____ _____.

23. All architecture may be classified into three distinct groups, viz: _____ _____ _____.

24. Foundations for ordinary dwellings may be _____, _____ or _____ in thickness.

25. The materials for foundation walls may be _____ _____ _____ _____.

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PRINTING

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CHAPTER XIX

PRINTING FOR GRADES SIX, SEVEN, EIGHT, NINE AND TEN

Printing ranks second among the industries of this country. It is so closely interwoven into the experiences of our everyday life that it is usually accepted with very little thought or appreciation.

The subject of printing in our schools lends itself not only to the other activities within the school but to the school community as well. It does not only teach technic but develops as far as possible an appreciation for good printing. A pupil who has acquired an appreciation of good printing has acquired an accomplishment that will be of value in almost any situation in which he later finds himself.

I. GENERAL OBJECTIVES

1. To interest a pupil in school work, through the concrete application of theory to practice, particularly in those subjects so closely related to printing, i.e. English and Mathematics.

2. To provide a means for developing technical skill and knowledge in the field of printing.

3. To develop mastery, through application, of some of the principles of design.

4. To serve as a socializing agency within the school and between the school and the community.

5. To develop and furnish a consumer's appreciation for printed matter.

6. To develop an appreciation of the art in printing.

7. To create a wholesome respect for books and a desire for their use in the home, school, and the library.

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SIXTH GRADE

1. Specific Ofjective

The sixth grade work necessarily consists of the simplest forms of composition. The setting up and proofing of a few well known poems are used as class problems for this work. Much time is devoted to the lay of the case and to the correct method of handling type.

2. Abilities.

(a) Manipulative Abilities to be Acquired.

Composition.

1. Lay of case.
   a. To locate all characters in the case.

2. Set a composing stick
   a. To use metal furniture in settling a stick
   b. To use 12 and 24 point quads in setting a stick
   c. To set a graduated stick

3. Typesetting
   a. To set simple poems
   b. To read type in a stick
   c. To make corrections in a line of type
   d. To test a line for tightness

4. Proofing
   a. To take either a stone proof or a galley proof

(b) Informational Abilities to be Acquired.

Composition

1. To know why the printer's case is so arranged.
2. To know the history of the capital J and U and their arrangement.
3. To know the relative values of the quads and spaces.
4. To know why the spaces are kept on the inside of quads.
5. To know which side of the proof-paper is used for the proof.
6. To know the position of the galley when taking a proof in a proof-press.

References: (See general references, p. 454)

1. Composition

A. Raithby	pages	35-49	(Comp.)
b. "	"	50-54	(Type*)
c. Polk	"	39-54	"
d. "	"	26-30	(Comp)
e. Hague	"	19-25	"
f. "	"	28-32	(Type)

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4. Suggestive Projects.

In the first term of printing the simplest forms of composition are set up. Much of the time in this first term is spent in learning the case. Naturally quite a number of projects are used to help the student to learn the case and to handle the type. The projects should be very flexible as each instructor knows best the pupils' power in each of his classes.

Project I.--To learn the case.
Sticking b, d, p. q, n, u, l, one, cap. I, i, !, j. 6, 9, semi-colon, colon, apostrophe, comma, period and hyphen. Stick a number of each letter and character at the end of each line correct by taking out wrong letters.

Project II.--To learn the case.
Sticking one letter, character, or number from each sort box in alphabetical and numerical sequence without justifying.

Project III.--To distinguish between various sizes of quads and spaces. Set two lines of em quads, two lines of en quads, and one line of 3 em spaces.

Project IV.--To acquaint pupil with various size spaces.- Set up lines with 4, 5, 3, em spaces and en quads used in separate lines.

Having learned the case thoroughly the pupil is now ready to set poetry and simple straight composition.

Project I.--Line justification.-Setting "The quick brown fox jumps over the lazy dog."

This project serves two purposes. It is the first simple exercise of setting straight matter and serves in making the learner move proficient with the case. In this project every lower case letter in the alphabet is used, which means that the pupil still is learning the case, only in a more practical way.

The next projects in simple straight matter may be selected by the instructor for setting as to its significance it bears to the student and his printing work--as;

Project II.--"The successful compositor starts slowly and justifies each line accurately."--etc.

Projects in the setting of poetry are very flexible, the instructor selecting the poems that are fitting for the occasion or the time of the year. It is well to use poems that have a great number of punctuation marks, so that the student becomes accustomed to most of them in setting poetry.

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Project III.--

Just this minute

If we're thoughtful, just a minute
In whate'er we say or do;
If we put a purpose in it
That is honest thru' and thru'
We shall gladden life and give it
Grace to make it all sublime;
For, though life is long, we live it
Just a minute at a time.
etc.

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5. SUGGESTIONS FOR PRE-TESTING AND TESTING

True-False

T F 1. There are more lower case letters used than capitals.

T F 2. A capital W is smaller than a lower case W

T F 3. The letter (e) compartment is the smallest in the case

T F 4. The letter l and capital I are exactly alike

T F 5. Type is ruined easily

T F 6. The three-em quad is larger than the two-em quad

T F 7. The em quad is used to indent a paragraph

T F 8. Always use a small space at the end of the lines

T F 9. Type is set with the nicks toward the line to follow

T F 10. Each line should be set tightly in the stick

T F 11. The stick is used in setting type

T F 12. The stick should be set accurately before using

T F 13. Type cannot be read while it is in the stick

T F 14. Furniture is used between the lines in a stick

T F 15. Leads are used between the lines

T F 16. Leads are used to set a stick

T F 17. String cannot be used to tie up a job

T F 18. A job should be tied up in a galley

T F 19. A galley is used in the same manner as a type case

T F 20. 10 point type is larger than 6 point type

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(b) MULTIPLE CHOICE

1. The largest box in the type case is

    1. o
    2. a
    3. e
    4. i

2. Boxes in the type case are not all the same size because

    1. It is easier to find the letters
    2. It is easier to learn the case
    3. More of some letters are used than others, and so require larger boxes.

3. Capital J and U are placed at the end of the case because

    1. They are used more often than other capital letters.
    2. They are easier to reach in the case.
    3. J and U were not in the alphabet when the capitalcase was planned.

4. The kind of job case which is used most commonly is the
    1. Triple case.
    2. California Job Case.
    3. News Cases.

5. A composing stick should be set with
    1. A line gauge.
    2. Wooden furniture.
    3. Metal furniture.
    4. Leads or slugs.

6. Type should be read
    1. From right to left
    2. From left to right
    3. Upside down.

7. The proper space to use between words is
    1. A nut quad.
    2. A three-em space.
    3. An em quad
    4. A five-em space.

8. An em quad is
    1. Twice as long as it is wide.
    2. Square
    3. Three times as long as it is wide.

9. A nut quad is
    1. One-half the size of an em quad.
    2. One-third the size of an em quad

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3. Twice as large as an em quad.

10. A three-em space is
    1. One-half of an em quad.
    2. One-third of an em quad.
    3. One-fourth of an em quad.

11. A three-em quad is
    1. Equal to the size of three em quads.
    2. Equal to the size of two em quads.
    3. Twice as long as it is wide.

12. A five-em space is
    1. Five times the size of an em quad.
    2. One-fifth of an em quad.
    3. Twice as large as an em-quad.

13. Letters are placed in the stick
    1. With the nicks down.
    2. With the nicks up.
    3. With the nicks slanting.

14. Corrections should be made
    1. After the line has been justified.
    2. After the type has been taken from the stick.
    3. Before the line has been justified.

15. In placing spaces in a line with quads, always place the spaces
    1. At the end of the line.
    2. Next to the last letter in the line.
    3. Between the quads.

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(C) COMPLETION

1. A printer must have _____, _____, _____ and a press in order to print.
2. Type is set in a tool called a _____.
3. Type is kept in a drawer containing compartments which are called _____ and the whole drawer is called a type _____.
4. Lines used in printing are made from _____, _____.
5. Words are separated from one another when setting type by pieces of metal called _____.
6. Paragraphs are indented usually by the use of _____.
7. There are _____ kinds of quads and _____ kinds of space found in a type case.
8. Every line of type should be set _____ in a stick.
9. Ligature are _____ joined together.
10. Small letters are called _____ _____letters.

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SEVENTH GRADE

1. Objective:

In many schools beginning printing starts in the seventh grade instead of the sixth. If no previous work has been given in the subject, when the pupil or class starts in the seventh, the sixth grade outline is followed until completed before taking up the seventh grade work. However, this work can be condensed somewhat and covered in a short time by eliminating some of the exercise work in poetry composition.

Having learned the lay of the case and the method of handling type, the pupil now is given some simple copy to do in straight matter. This is either in the form of paragraphs to be set, proofed, and graded, or in the form of live copy for the school publication. All presswork in the seventh grade is limited to simple press feeding on jobs that do not require close register.

2. Abilities.

(a) Manipulative Abilities to be Acquired.

Composition

1. Straight matter
   - a. To justify a line of type
   - b. To dump a stick of type
   - c. To form a galley lock-up
   - d. To take a galley proof
   - e. To transfer a form from the galley to the stone and vice versa
   - f. To lead type
   - g. To clean type
   - h. To distribute type that has been set in straight matter

Presswork

1. Press feeding
   - a. To feed a press on simple jobs using the method used by press feeders in the trade. (See Polk pp. 116-17)
2. To slip-sheet
3. To ink a press
4. To place a form in a press (See Polk pp.112-13)
5. To remove a form from a press
6. To clean a press
7. To put on a new tympan
8. To oil a press

(b) Informational Abilities to be Acquired

Composition

1. To know how to differentiate between the different characters in the case, especially the difficult ones, such as b, d, p, q, n. u. l, I, 6, 9.

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SEVENTH GRADE (Cont.)

2. To know the simple rules of composition that apply to straight matter. (See Polk pp. 44-49)
3. To know how to use the different space combinations in justifying the lines of straight matter.
4. To know the proper position of the galley and the proper way to stand while reading type in the galley.

Presswork

1. To know what "offset" means and how slip-sheets are used to avoid it.
2. To know why it is necessary, when inking a press, to deposit the ink on the left side of the plate.
3. To know what may happen if the form is put in the press wrong.
4. To know the importance of placing the form right-side up on the stone.(See Polk pp.112-113)
5. To know the location of all the important oil holes on the press.
6. To know the method used in counting sheets of paper.
7. To know how sheets are jogged.

3. References: (See general references)

Composition

1.	Raithby	Pages 96-100, 155-168
2.	Hague	" 28-37, 41-43
3.	Polk	" 44-64

Presswork

1.	Polk	" 99-110, 111-117
2.	Hague	" 171-185
3.	Amer. Handbook of Printing	165-184

4. Suggestive Projects.

In case this is the first term of printing, as given in some schools, the projects will be similar to those used in the 6th grade. Perhaps less time will be spent on the fundamentals, as these pupils are more mature. In case it is the term following the 6th grade the projects will deal more with straight composition, which is live matter.

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Project I.--Setting the school paper; paying particular attention to proper indentions, uniformity of spacing and accurate justification. Rules of composition should be closely followed.

Project II.-- Proofing and correcting paragraphs set.

If presswork is given in this term of printing, the simplest forms of work should be run at a slow speed and work that does not require close register.

Project I.-- Running blank cards (4 x 6) without type in press. This is to teach the pupil the operation of the press and the feeding of same.

Project II.-- Running live copy, (small cards of bristol or cardboard) with type in press. Calling cards, business cards, etc.

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5. SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) True - False

T F 1. To justify a line means that the spaces should be as even as possible

T F 2. In setting straight matter spaces can be used at the ends of the lines

T F 3. When reading type the letter b looks like the letter p

T F 4. Furniture should never be used around the type in a galley

T F 5. A knot is tied on one end of a string before tying up a job

T F 6. A proof may be taken on a table or any other flat surface in the shop

T F 7. When spacing a line it is best to have equal spaces on both sides of small words

T F 8. An em quad is used between sentences

T F 9. A nick is used on type, so that the different letters can be found more easily

T F 10. The nicks are the same in all type

T F 11. Large type is spaced the same distance as small type

T F 12. The secret of obtaining a good planer or stone proof lies in the manner of placing and removing the planer

T F 13. In inking a press, the disk should be completely covered with ink before the press starts

T F 14. In jogging sheets of paper about 800 sheets should be jogged at a time

T F 15. In counting paper it is best to count by fives

T F 16. Type must be cleaned before distributing

T F 17. The apostrophe is used exactly like a comma

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T F 18. When locking up a form the quoins should be as tight as possible

T F 19. Brass rule should never be cut down

T F 20. Black ink is used more often in printing than any other colored ink

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(B) MULTIPLE CHOICE

1. To make a line longer, when setting type, change the three-em space which is placed first between the words to

    1. An em quad
    2. Two five-em spaces
    3. A nut quad

2. If, after changing the three-emspaces to nut quads, the line is still loose, change the nut quads to

    1. Two three-em spaces
    2. One three-em space and one five-em space
    3. One nut quad and one five-em space

3. The proper way to justify a line when setting straight matter is to

    1. place spaces at the end of the line
    2. Increase the size of the spaces between the words
    3. Place spaces at the beginning of a line

4. The proper space to place between sentences is

    1. An em quad
    2. A nut quad
    3. Two three-em spaces and a nut quad

5. The space which properly follows a comma is

    1. A nut quad
    2. Two five-em spaces
    3. A three-em space

6. A form should be placed in the press

    1. With the quoins to the top and right
    2. With the quoins to the bottom and left
    3. With the quoins to the bottom and right

7. The proper way to piece leads and slugs is to

    1. Use two leads of equal length
    2. Use long and short leads alternately
    3. Use a short lead and then a long lead

8. Wood furniture is used for

    1. Locking the form in the chase
    2. Setting a composing stick
    3. Blanking out where a white space is wanted in the form

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MULTIPLE CHOICE (Cont.)

9. Reglets are made from

   1. Brass
   2. Steel
   3. Wood
   4. Lead

10. The kind of presses used in our shop are

   1. Cylinder
   2. Platen
   3. Rotary
   4. Kelly

11. When distributing leads and slugs they should be

   1. Graduated in a galley
   2. Each piece measured separately with the line gauge
   3. Graduated in degrees

12. A pica contains

   1. 15 points
   2. 10 "
   3. 12 "

13. A pica is

   1. One-fourth of an inch
   2. One-eighth " " "
   3. One-sixth " " "

14. A nonpareil is

   1. One-half of a pica
   2. One-fourth of a pica
   3. One-third of a pica

15. An inch contains

   1. Six points
   2. Seventy-two points
   3. Twelve points

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(C) COMPLETION

1. The em quad is used to separate _____.
2. A line is said to be _____ when properly spaced and tight in the stick.
3. Spaces should be kept on the _____ of quads.
4. A comma should be spaced with _____ space.
5. Type standing at a slant is said to be _____.
6. Bold type prints a _____ face.
7. The space between words should _____equal.
8. Type is read from _____.
9. Type occupying the middle of the line is said to be _____.
10. Type is read with the nick_____.

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EIGHTH GRADE

1. Objective:

Having developed a working knowledge of the fundamentals in simple composition in the sixth and seventh grades the pupil now begins ~~to~~ some simple forms of display composition. This requires the use of more new materials and processes in composition, presswork, and imposition.

2. Abilities.

(a) Manipulative Abilities to be Acquired.

Composition

1. Display type jobs
   a. To work from a layout
   b. To distribute display type forms
2. Initial letter
   a. To adjust the space around the initial
3. Proof-readers' marks
   a. To use the more common marks
4. Type corrections
   a. To remove line from form to stick, make desired corrections and transfer line back to the form.
5. Tying up type forms
   a. To tie up a type form
   b. To untie and care for page cord
6. Brass rule border
   a. To arrange brass rule border

Imposition:

1. Simple lock-up
   a. To place form in position in chase
   b. To place quoins
   c. To arrange furniture around form
   d. To tighten quoins
   e. To plane form
   f. To test for tightness

Presswork

1. Setting the guides
   a. To determine proper margins and make the guides fast
2. Adjustment of impression
   a. To regulate the amount of impression by either adding to or reducing the amount of packing
3. Press-feeding
   a. To feed letterheads.....500 per hour
   b. To feed 4" x 6" cards.....800 " "
   c. To feed envelopes.....1000 " "

Miscellaneous

1. To use bone folder
2. To pad stock
3. To operate stapler

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EIGHTH GRADE (Cont.)

(b) Informational Abilities to be Acquired.

Composition

1. To know how to follow layouts and specifications
2. To know the use and understand the requirements of the initial letter
3. To know how to write the more commonly used proofreaders' marks and to know their use
4. To understand the importance of keeping lines within a form exactly the same length
5. To be familiar with the kinds of brass rule and understand their use in forming rule borders
6. To know the importance of keeping the type squarely on foot while tying up a form
7. To understand why lines are put in a stick while making corrections

Imposition

1. To know why the form is placed with the head to the right, and that the position of the form in the chase is determined by the manner in which the sheet will be fed through the press
2. To know that quoins should be placed at the top and at the right in the lock-up
3. To know two methods of arrangement with reference to furniture in a lock-up
4. To understand why a form is planed
5. To know the form should be tested before going to press

Presswork

1. To know the general rule regarding the side, top and bottom margins of the printed sheet
2. To know by examining a poorly printed sheet whether the ink or the impression is at fault
3. To know the importance of clean hands, correct position of the body, and the rhythmetic motion of the hands and arms while feeding a press

3. References: (See general references)

Composition

1. Hague	pages 35-41-	73-99
2. Polk	" 83-87	197-202
3. Raithby	" 152-161	

Presswork

1. Polk	" 111-117
2. Raithby	" 251-257

Imposition

1. Hague	" 141-152
2. Raithby	" 251-257
3. Polk	" 88-94

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4. Suggestive Projects

In this grade more attention will be paid to the setting of simple display matter, proofing, and correction. Among the new types of work to be introduced are the following:

Project I-- Make a layout and set a title page.

Project II.-- Initial letter composition. The application of this job is found in book and magazine composition where the initial is used at the beginning of chapters and articles. It is also used for decorative purposes.

Project III.-- Composing simple tables, using numerals, and the alignment of the same.

Project IV.-- Job with rule border.

It is necessary to put rule border around many display jobs, such as "ads", programs, etc., and this problem will acquaint the student with the steps involved. Emphasis is placed upon accuracy of measurements and junction of corners.

Project V.-- Proof and correct a galley of straight matter, using proof-readers' marks.

Project VI.-- Lock up a simple form in a chase.

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SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) True - False

T F 1. When display type is used the job must be set in caps

T F 2. The initial letter is always larger than the body type

T F 3. Proofreaders' marks are used by English teachers to correct written compositions

T F 4. The first proof and the revised proof should be compared

T F 5. Brass rule may be used for border

T F 6. A 1-point brass rule prints heavier than a hair line

T F 7. A form should always be locked up in the center of the chase

T F 8. Furniture varies very little in size for different jobs

T F 9. The quoins should be placed between the type and the furniture

T F 10. The quoins should always be placed at the bottom of the job

T F 11. A job just be tightened as much as possible before planing

T F 12. For purposes of testing, the chase is lifted off the stone to the fingers

T F 13. Guides are always put on the tympan

T F 14. The grippers should be set before the job is put in the press

T F 15. The bottom margin on a printed sheet is always a little smaller than the top margin

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(B) MULTIPLE CHOICE

1. The kind of printing done in our shop is
   1. Letterpress
   2. Copperplate
   3. Lithography

2. Books and magazines are usually printed in
   1. Roman
   2. Italic
   3. Script
   4. Text
   5. Gothic

3. The following mark means a wrong font letter

   1. V
   2. W
   3. X

4. The following mark means "Let it Stand."

   1. X
   2. ?
   3. ------

5. The following mark means "Transpose".

   1. tr
   2. gr
   3. cr

6. Corrections should be made
   1. With the use of tweezers
   2. By placing the line in a stick
   3. By placing the paragraph in a stick

7. In setting a rule border, place the
   1. Beveled side of the rules out
   2. Beveled side of the rules in
   3. Top and bottom rules with the beveled side out and the side rules with the beveled side in

8. Type is set in the
   1. Stock room
   2. Composing room
   3. Press room

9. One-point leads are usually made of
   1. Lead
   2. Brass
   3. Steel

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10. In locking up a form, the side of the chase nearest the worker is
    1. The top of the form
    2. The bottom of the form
    3. The inside of the form

11. When locking a form, it should be planed
    1. Before the quoins are tightened
    2. After the quoins are tightened
    3. Before the type is set

12. String should be removed from the form
    1. When the type is in the galley
    2. When the furniture is placed around the form
    3. After the quoins have been tightened

13. When feeding the press, feed the paper
    1. To the bottom guides first and then to the side guide
    2. To the side guide first and then to the bottom guides
    3. To the top guides first and then to the side guides

14. Sheets are offset when
    1. They are not printed straight
    2. When the ink is smeared
    3. When ink from one is transferred to an other

15. During a press run ink should be applied
    1. To the right side of the disc
    2. To the lower left side of the disc
    3. To the top of the disc

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(C) COMPLETION

1. Type is locked up in a steel or iron frame called a _____
2. In order to lock up type for printing we use a _____, _____, _____, and _____.
3. A printed sheet is held in a press by steel strips called_____.
4. Putting a job on a press for printing is called _____.
5. Leads and slugs are used to _____ type matter.
6. Type lines are measured with a ruler called a _____.
7. Space found in a type case are _____ _____.
8. Type is always read with the nick _____.
9. The sheets of paper stretched across the platen press are called _____.
10. In feeding a press the sheets of paper must always be placed down to the _____.

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NINTH GRADE

1. Objective:

The nature of the work so far has been largely exploratory and will in a somewhat lesser degree continue as such. But owing to the amount of repetition in certain phases of the work the pupils are gradually developing certain skills, that approach specific training. Hence, the work introduced in this grade will extend exploration and introduce some simple produce work for school and pupils' needs.

2. Abilities
(a) Manipulative Abilities to be Acquired
Composition
1. Layout of business card
a. To determine the size of card
b. To determine the size and face of type to be used

2. Overruning
a. To overrun a paragraph or overrun type from one measure to a different one
b.

3. Two or more columns in one measure
a. To set two or more columns in one measure using the method used by compositors

Imposition
1. A one or two-page lock-up
a. To determine the position of the pages in the chase
b. To allow for margins

Presswork
1. Mix colors
a. To secure the desired color of ink by mixing the proper colors

2. Use of ink fountain
a. To set fountain for contact
b. To ink fountain
c. To regulate flow of ink on fountain

Miscellaneous
1. To assemble signatures into pamphlets

(b) Informational Abilities to be Acquired.
Composition
1. To know the principles governing the selection of size and face of type to be used on business card.

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NINTH GRADE (Cont.)

2. To know the importance of arrangement with reference to space, position, and balance in laying out a business card.

3. To know that overruning requires a rejustification of all lines.

4. To know why a scheme is necessary in setting two or more columns in one measure. And to know the result when no such plan is followed.

Imposition

1. To know how to arrange the furniture about a form with two or four pages

2. To have a clear ideaof how the sheet will appear when it comes from the press having taken the impression of the form which the pupil is locking up.

Presswork

1. To know the primary colors and by mixing know how to secure any secondary color.

2. To know and appreciate the accuracy required to adjust an ink fountain on a job press.

References: (See general references)

Composition

1 Raithby	Pages 177-180
2 Hague	" 124-131
3 Polk	" 132-143

Presswork

1 Spicher	" 1-112

Paper cutting

1 Polk	" 203-211
2 Spicher	" 194-196
3 Hague	" 228-233

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4. Suggestive Projects

Project I.	To compose a ticket with a border, making the layout for the same.
Project II.	To compose a program.
Project III	To compose a poster.
Project Iv	To compose a check form.
Project V	To compose a business card.
Project VI	To compose a letter-head.
Project VII	To compose an elvelope card.
Project VIII	To compose singular tabular form with rules.
Project IX	To compose single tabular form with leaders.
Project X	To compose double tabular form.
Project XI	Lock up a two page form.

Note:- It is suggested, that those pupils who will not continue beyond the ninth grade be given some experience in setting up simple tabular work. This work is usually begun in the tenth grade.

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5. SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) TRUE-FALSE TEST

T F 1. The position in which a job is to be locked in the chase depends upon the general shape of the job and the position of the heading.

T F 2. When it is necessary to overrun a few lines in making corrections it is always advisable to re-assemble the matter on a galley or on the stone.

T F 3. The size of business cards have been scientifically standardized, hence, the size and face of type used is always determined by the size of the card.

T F 4. Margins cannot be determined accurately before printing

T F 5. In black inks carbon furnishes the color and varnish gives it a working body.

T F 6. In making simple corrections or overruning a few lines, never hold the stick in the hand while spacing lines, but place the stick on the stand, pull out the paces with tweezers, then proceed with the corrections.

T F 7. Matter that contains two or three columns, consisting simply of a line-up of material, can frequently be set more expeditiously and accurately in one measure than in narrow measures and then assembled.

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NINTH GRADE (Cont.)

T F 8. Tints are made by adding white ink to the body color.

T F 9. In adjusting and using the ink fountain it is never advisable to keep it well filled with ink.

T F 10. The head of the form should always be placed at the left or bottom of the chase.

T F 11. In the strictly formal treatment of professional cards, borders and ornaments should be used to add beauty and dignity to the job.

T F 12. Special dryers, when rightly used, give the desired body to ink and always intensifies and fixes the color.

T F 13. Assembling and spacing out of jobs or pages on a galley is known as the "make-ready".

T F 14. When two type pages are locked up together, spacing must be placed between them to allow for the inner margins on thepages when the job is printed and folded.

T F 15. A form should never be placed too near the center of the chase, because in this position feeding is made difficult and the impression cannot be made even.

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(C) MULTIPLE CHOICE

1. "Overruning of form" means
   1. To run it on the press
   2. To change from one measure to another
   3. To change or correct errors

2. To the printer "color" means
   1. Red, blue, yellow
   2. Any ink on paper
   3. A mixture of tints

3. The term "type-high" means
   1. The width of the type
   2. The distance from the nick to opposite side
   3. The distance from the type feet to the face

4. Colored ink is best mixed by
   1. Placing a quantity of two or more colors on a disk and mixing only what is used
   2. Placing a quantity of two or more colors on a glass and mixing with a spatuka
   3. Stirring two or more colors together in a can

5. In printing the "three color process" we first use
   1. Blue, yellow, red
   2. Yellow, red, blue
   3. Red, blue, yellow

6. If black is to be used in the "three color process" put on
   1. First
   2. After the yellow
   3. After the red
   4. After the blue

7. The word "font" means
   1. The place where we wash our hands
   2. The box in which type is kept
   3. An assortment or outfit of letters of one size and style
   4. The alphabetical arrangement of type in a case

8. Metal furniture is used to
   1. Fill up large spaces in a form
   2. To clamp paper for padding
   3. To assist in getting good impression

9. The bed of a platen press
   1. Carries the paper around the type form
   2. Carries or supports the paper while the impression is made
   3. Presses the type against the paper

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MULTIPLE CHOICE (Cont.)

10. "Tympan" is
    1. A clamp holding the draw-sheet on the platen
    2. The paper against which the type form strikes
    3. The packing beneath the draw-sheet

11. A pica is
    1. A reglet used in a lock-up
    2. A strip of lead to be used between the lines
    3. A unit of measurement

12. The quickest way to get a type form set is to
    1. Set it by hand
    2. Have an electro made
    3. Use a linotype machine

13. The expression "folio" means
    1. 500 sheets of paper
    2. one sheet of paper
    3. 1000 sheets of paper
    4. Paper 17" x 22".

14. Book paper is usually sold in sizes of
    1. 17 x 22
    2. 25 x 38
    3. 22 x 28
    4. In rolls of 500 feet

15. In cutting paper stock it is best to cut
    1. The short way first
    2. The long way first
    3. The way in which the greatest number of pieces can be secured

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(C) COMPLETION

1. The printer measures type according to the _____.
2. Type is usually set in three ways: a._____ b._____ c._____.
3. A pica is _____; a nonpareil is_____; a point is_____ _____.
4. Leads are _____ and _____ points thick and slugs are _____ and _____ points thick.
5. Furniture is known as _____ and _____ furniture.
6. "Make-ready" means _____.
7. The three most important things to be observed in feeding a press are 1_____ 2_____ and 3_____.
8. The sheets drawn across the platen are known as _____ sheets.
9. Type is leveled in a chase with a _____.
10. A person who sets type in a printer's office is called a _____.

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TENTH GRADE

1. Objective

The work in the tenth grade is devoted to some of the more advanced shop problems, such as tabular and rule forms in composition; advanced make-ready in presswork; stock figuring, and cost finding in paper cutting. These problems and the development of those in the preceding grades offer sufficient opportunities to develop a well-balanced course in printing.

2. Abilities

(a) Manipulative Abilities to be Acquired.

Composition

1. Tabular and rule work
   - a. To set either single or double form
   - b. To set form with rule and leaders or forms with rule both ways (work-and-twist)
   - c. To set rule guards at the ends of vertical rules.

2. Two color composition
   - a. To set and make up type where two or more colors are to be printed.

3. Dodger
   - a. To indicate by sketch the sizes and faces of type to be issued.
   - b. To set, make up tie, take proof, and correct form for an ordinary 5" x 8" dodger.

Presswork

1. Make-ready
   - a. To make, apply, overlay, or underlay for zinc etches, halftones and ordinary type forms.

2. Press feeding
   - a. To feed sheets 9" x 13" 1000 per hour
   - b. To feed sheets 5" x 8" 1200 " "
   - c. To feet cards 3" x 5" 1500 " "

Paper cutting

1. Figure and cut paper
   - a. To draw a diagram showing the most economical way of cutting any given problem.
   - b. To cut stock from a diagram
   - c. To figure cost on certain jobs
   - d. To trim booklets and pamphlets
   - e. To count, wrap and label.

(b) Informational Abilities to be Acquired

Composition

1. To know what is meant by a "work-and-twist" job
2. To know how to make columns of figures self-spacing
3. To know how to prdect the rollers on the press by inserting

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TENTH GRADE (Cont.)

rule guards at the ends of vertical rules
4. To know what is meant by a "skeleton form" with reference to two or more color printing
5. To know the three important lines of a dodger
    a. What, where, and when to build the plan of the dodger around these three items.

Presswork

1. To know the difference between "overlay" and "underlay".
2. To know when they should be used
3. To know how to examine the back of the sheet for impression
4. To know the importance of using paste in the right place and the right amount
5. To know the use of book paper, French folio, and tissue in making overlays and underlays

Paper cutting

1. To know the method used in finding the number of times the job-size sheet is contained in the large stock-size sheet. And to know how to base the cost of material from these figures
2. to know how to allow for trim
3. To know that at least 5% is usually allowed for spoilage on a job fed through the press once
4. To know how important it is to keep the stock jogged back evenly against the sides of the cutter while cutting or trimming.
5. To appreciate the neatness required in wrapping printed matter properly.

3. References: (See general references)

Composition
1. Hague pages 124-131
2. Polk " 132-143

Presswork
1. Spicher " 1-112

Paper Cutting
1. Polk " 203-211
2. Spicher " 194-196
3. Hague " 228-233

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Suggestive Projects

In this grade a great deal of repetition will occur in the composing of various forms, but more accurate work is expected and more advanced problems will be undertaken.

Project I.	To compose singular tabular form with rules or leaders
Project II.	To compose a double tabular form.
Project III.	To compose a single column ad. with border
Project IV.	To compose a double column ad. with cuts
Project V.	To compose a two-color motto card
Project VI	Make a make-ready for an envelope corner
Project VII	Make a make-ready for zinc etches, half-tones and ordinary type forms.

Note:- Projects in the cutting of stock and cost finding may be selected by the instructor and worked out in the shop.

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5. SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) True-False

T F 1. It is always advisable to lock up a form in such a manner that the pressman can read the printed matter on the draw-sheet while running the press.

T F 2. The process of raising portions of the tympan with thin pieces of paper or other material for the purpose of equalizing the impression is known as "overlaying".

T F 3. When amounts of money are expressed it is always proper to have dollar mark appear with each figure in the column of the table.

T F 4. To avoid all risk of getting the "spot-up sheet" out of register, always release the tympan sheets by opening the same tympan-bale, preferably the top one.

T F 5. When leaders are used in tables they should run the full width of the column.

T F 6. Composing parts of forms which will later be assembled through register on the press, such as two and three color forms, is called "skeletonizing".

T F 7. Inasmuch as it is impossible to tell just how much impression is being exerted by the type against the sheet, if the type is not well inked, it is advisable to have too much rather than too little ink on the press during the process of make-ready.

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TENTH GRADE (Cont.)

T F 8. When a sheet is printed on both sides of the same form, then cut in two, it is called a "work-and-turn job".

T F 9. Before undertaking the setting of any job the copy should be analyzed and a proof pulled, so as to get some idea of the finished product.

T F 10. A sketch made of a job to be composed of specifications for arrangement, kind, and sizes of type to be used, is known as the "make-ready".

T F 11. In the construction of tables, column rules should run full length and the cross rules should be broken at the intersections.

T F 12. The process of making ready half-tone plates is known as "overlaying".

T F 13. In constructing a table, it is good practice to always use material that must be justified to some pica length.

T F 14. The best method of underlaying is to first mark out the low places on a printed sheet and then paste thin pieces of paper over these low places.

T F 15. When a sheet is printed on one side with one form, and is then printed on the other side with a different form, the job is said to be a "work-and-twist job".

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(C) MULTIPLE CHOICE

1. Press rollers are made of
   1. Rubber
   2. Glue and molasses
   3. Glue and rubber
   4. Glue and linoleum

2. Printing by movable type was discovered by
   1. The Chinese
   2. John Gutenberg
   3. Benjamin Franklin
   4. William Caslon

3. When printing a form in two colors
   1. The red is used with the other color at the same time
   2. A separate form is used for each color
   3. Two sets of rollers are used one set for each color

4. When printing a type form the best method of obtaining equal impression is to
   1. Underlay
   2. Overlay
   3. Overlap

5. "Make-ready" consists of
   1. Pasting an extra sheet of cardboard under the draw sheet
   2. Pasting paper on back of type form
   3. Pasting thin sheets on part of sheet where impression is light

6. When cutting stock it is best to
   1. Make a diagram
   2. Fold up a sheet as a test
   3. Find the area of the small sheet and divide it into the area of the large sheet

7. When cutting stock for booklets it is best to
   1. Cut exact size of the page
   2. Cut twice the size of the page
   3. Allow trim on all edges
   4. Allow trim for side edges only

8. When trimming pamphlets it is best to
   1. Trim each one separately
   2. Fill the cutter full
   3. Use judgment as to proper number to cut

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9. A foot-power staple binder operates best
    1. When kicked hard
    2. When pushed steadily with the foot
    3. One person placing the booklets and another pushing the pedal

10. When counting paper it is best to
    1. Count one sheet at a time
    2. Count by "fives"
    3. Count 25 sheets and estimate them out by feeling

11. Borders and rules are used to
    1. Keep the type from slipping out
    2. Enhance the beauty of the job
    3. Please the teacher

12. In the industrial world printing ranks among the industries
    1. First
    2. Last
    3. Seventh
    4. Near the top

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(C) COMPLETION TEST

1. The nomendature of a piece of type means _____ _____.
2. The author of our test book is _____.
3. The vehicle of printing ink is _____; the pigment is _____.
4. Paper is made from _____, _____, _____, _____, _____, and it takes 90 lbs of _____ to make one pound of paper.
5. The round attachments at the ends of rollers are called _____.
6. Forms are locked up in a chase with _____, _____, _____, and _____.
7. Forms of various kinds are usually printed on _____paper.
8. Dodgers are usually printed on _____ paper.
9. Imposition means _____, _____, _____, _____.
10. The man who does all the "make-ready" on a press is usually known as _____.

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General Information Relative to Printing

The following material is given with the idea of furnishing an outline concerning materials and processes related to the printing industry.

Materials

1. Paper
   a. Kinds and finishes
   b. Standard sizes and weights
   c. Manufacture

2. Type
   a. Kinds
   b. Sizes, fonts and height
   c. Quads and spaces

3. Ink
   a. Kinds and uses
   b. Colors
   c. Manufacture

4. Rollers
   a. Kinds (summer and winter)
   b. Ingredients and manufacture
   c. Care

5. Leads and slugs
   a. Sizes and length (labor saving)

6. Brass Rule
   a. Kinds and sizes
   b. Uses and care
   c. Manufacture

7. Furniture
   a. Wood
   b. Metal
   c. Reglets

8. Ornaments
   a. Conventional
   b. Engraver's
   c. Halftones and zincs

9. Electrotypes
   a. Copper and nickle plates
   b. Wax engraving

Operations

1. Composition
   a. Hand composition

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Operations (cont.)

b. Machine composition
c. (1) Linotype
(2) Monotype

2. Press work
a. Platen press
(1) Clam-shell
(2) Sliding platen

b. Cylinder press

c. Rotary press

d. Offset press

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SUGGESTIVE CORRELATIONS

English Grammar

I. The dictionary
   1. How to use the dictionary
   2. Spelling
   3. Division of words
   4. Compound words
   5. Possessives

II. Capitals and printer's marks
   1. Punctuation
      a. Names and uses
   2. Capitalization
      a. Capital letter uses
      b. Caps and small caps
   3. Appreviations
   4. Reference marks
   5. Signs
   6. Italics
   7. Footnotes

III Proofreaders marks and copy preparation
   1. Copy materials
   2. Style
   3. Editing
   4. Necessity of proofreading
   5. The marks
   6. Copyholders
   7. Reading proof

At the outset the pupil should be taught to realize the importance to the printer of a correct knowledge of the English language, and all instruction in English should be given from this standpoint. The English course, therefore, should coordinate very closely with the print-shop practise. Emphasis should be given to the mechanics of written expression, spelling, punctuation, paragraphing, capitalization, proof-reading, etc.

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HISTORY

I. History of printing
   1. Early printers
   2. Method used for preserving records before the invention of printing
      a. Tablets of clay and stone used by Chaldeans and Babylonians
      b. Movable types made of pottery used by Chinese in the 11th century.
      c. Egyptian hieroglyphics
      d. Scroll writings of Israelites, Greeks and Romans
      e. Picture writings on stone and hides by Indians
   3. Early method of printing, using word blocks for stamping in the 15th century
   4. Gutenberg is generally given credit for the invention of movable type made out of metal and printed in a press about the middle of the 15th century
   5. First book printed in English was made in Belgium by Wm. Caxton about 1472
   6. Printing was introduced in the United States in Cambridge, Mass, 1638

SCIENCE

   1. Type metal
      1. Composition of type metal
      2. Manner of designing original letters
      3. Reducing to make brass matrices
      4. Casting
      5. Metal mines where lead, tin and antimony are found
         a. From mines to type founders

II. Point System
   1. Its origin
   2. Inception in this country
   3. Method of measuring prior to adoption
III. Type faces
   1. Development since 1431
   2. Creators' of type faces
IV. Child labor laws
   1. Age
   2. House
V. Development of printing press
   1. Its evolution
VI. Paper making
   1. Rag and wood pulp
   2. Kinds
      a. Use
   3. First paper
      a. Papyrus
   4. From forest to paper mill
   5. Manufacture

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SCIENCE (Cont.)

VII. Inks
  1. Pigments
    a. Carbon
    b. Lampblack
    c. Ivory black
  2. Theory of color
VIII. Composition of printer's rollers
  1. Glycerine, glue and molasses
  2. The function of each ingredient
IX. Hygiene and sanitation
X. Newspaper and book printing
XI. Oils
  1. Gasoline, benzine and lubricating
XII. Lead tin and antimony
  1. Properties of each
XIII. Safety devices

MATHEMATICS

I. Fundamental operations
  1. Addition
  2. Subtraction
  3. Multiplication
  4. Division
  5. Arithmetical signs and symbols
  6. Averages
II. Ratio and proportion
  1. Use of terms
  2. Levers
  3. Pulleys and screws
III. Printing measurements
  1. The point system
    a. Table of units
    b. Comparison with linear
    c. History and development of point system
  2. Type sizes
  3. Leads, slugs, reglets and furniture
  4. The line gauge
    a. Its use
IV. Type and copy calculations
  1. Words in given space
  2. Amount of space occupied by copy
  3. Calculating ems of composed matter
V. Paper Calculation
  1. Sizes and weights
  2. Prices
  3. Stock cutting
  4. Cost estimating
VI. Decimals

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SAFETY

I. State law regarding safety devices for printing machines
   1. Belt guards
   2. Fly wheel guards
   3. Platen guards
II. Electric motors
III. Oils
   1. Care of same
   2. Spontaneous combustion
   3. Closed containers
IV. Oil soaked rags.
V. Lead poisoning
   1. Dangers and how to avoid them
VI. Precaution in running the press.
   1. Avoid loose clothing
   2. Avoid distraction
   3. Study the press upon which you are working
VII. Treatment of bruises and cuts.
VIII. Benzine and lye; their effect upon the skin
IX. Precautions on paper cutter
X. Ventilation.
XI. Lighting
XII. Sanitation

DESIGN

I. Drawing type cases
II. Drawing and construction of letters and naming parts
III. Purpose
IV. Harmony
V. Proportion
VI. Balance
VII. Series of type
IX. Appropriateness
X. Decoration
XI. Margins and white space.

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METALWORK

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CHAPTER XX

METAL WORK

(a) Machine shop for the ninth grade junior high school and twelfth grade senior high school.

(b) Forging for the tenth grace.

(c) Sheet metal for grades seven, eight, nine and ten.

General Objective

1. To give the pupil through participation, observation, and reading an insight and appreciation of the basic features of the metal working industrial.
2. To give the pupils a knowledge of the fundamental principles, operations, and processes employed in the metal working industries.
3. To acquaint the pupils with the tools and materials employed in the various metal trades.
4. To develop an appreciation for the necessity of accurate and delicate work in the machine trades.
5. To apply the mathematics and science of the class room to practical problems.

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(a) MACHINE SHOP

For convenience the work in this field is divided into the following:

Lathe

Grinder

Drill press

Shaper and Planer

Milling Machine

Vise-assembly construction

NOTE:- The curriculum for Metal Work is planned for Junior and Senior High Schools, enough work being laid out to care for advanced students.

THE LATHE

1. Specific Objectives.

1. To acquaint pupils with the engine lathe and develop an appreciation for the basic machine tool
2. To teach pupils the relation of the lathe to modern industrial practice
3. To give pupils an understanding of the specialized developments of the lathesuch as the turret lathe screw machine etc., and their importance to modern production methods
4. To give pupils a working knowledge of the engine lathe, its intelligent operation and care
5. To teach pupils to set up a given job in a lathe
6. To teach pupils to machine a given job to the best advantage in regard to accuracy, economy of time and safety

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2. Abilities

Manipulative Abilities to be Acquired.

1. To operate an engine lathe
2. To grind necessary lathe tools
3. To use common machinist tools
4. To center stock
5. To face stock
6. To rough turn
7. To finish turn
8. To shoulder turning
9. To radius forming
10. To file and polish
11. To knurl
12. To chase threads
13. To align lathe centers
14. To true up and grind lathe centers
15. To turn tapers
16. To remove and mount face plate
17. To mount and remove chuck
18. To center work in chuck
19. To drill stock
20. To bore stock
21. To ream stock
22. To tap stock
23. To cut -off stock
24. To turn stock on mandrels

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(b) Informational Abilities to be Acquired.

1. Materials

Metals

Machinery steel Mild steel cold rolled steel carbon tool steel High speed steel Cast iron Brass Bronze Copper Aluminum	---	Source of Manufacture of Specific uses Characteristics for identification. Properties Machinery

Polishing Materials

Emery cloth Flint cloth Powdered emery Powdered glass	---	Grading of cloth Grading of powdered emery and glass Uses of each

Lubricants

Machine oil Lard oil Red lead Soap water Sol Cut etc.	---	Source of Need for Use of

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2. PROCESSES AND OPERATIONS

Centering stock.....	Methods of holding work to be machined Methods of locating centers Use of center punch Use of combination drill and countersink, sizes, etc.
Facing stock.....	Adjusting work on centers Setting facing tool Method of facing; need for facing Lubrication of centers
Straight Turning.....	Alignment of centers Truing centers Setting of cutting tool Use of graduations on cross-feed screw Cutting speed; feed, chip Roughing cuts Finishing cuts Need for filing - kinds of files to use Cautions to observe Polishing - use of emery cloth Shoulder turning - kinds of shoulders Necking for grinding Preventiontion of spring Use of steady and follow rests Knurling Use of mandrels Standard of mandrels Expansion of mandrels Gang mandrels Screw mandrels
Taper Turning.....	Kinds of tapers Use of tapers Methods of turning tapers a. Off-setting tail stock b. Compound rest c. Taper turning attachment Rule for off-set when tapering Setting of cutting tool Boring taper holes Fitting tapers
Chuck Work.....	Kinds of chucks Mounting of chucks Adjusting work in chucks Facing work in chuck Cutting off stock Prevention of chatter drilling--methods of

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Chuck work (cont.).....	a. dull chuck b. Drill holder c. Tail stock Ja T.S. drills support drill on dead center using dog on drill against tool post Reaming Kinds of reamers; use of reamers a. Machine reamers b. Hand reamers c. Taper reamers Boring - Reason for a. Grinding of tool b. Setting tool c. Preventing spring and chatter d. Correct method of measuring holes
Face plate work (Machine operations same as for chuck work	Need for large face plates Mounting of face plates Use of bolts; U clamps Parallel strips; angle plate Use of center tester Use of dial indicator Need for counter balance

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3. Tools

Facing
Round nose
Shoulder turning
Finishing
Radius forming
Boring
Threading
Machine reamers
drills
Action of cutting tools
Grinding of cutting tools
   a. clearance
   b. rake - need for, etc.
Setting of cutting tools
Care of Emery wheel
Sharping drills
Methods for holding machine
Reamers and drills

4. Measuring and Laying Out Tools

Scale
Calipers
Dividers
Combination square
Parallel lass
Ball pein hammer
Scratch awl
Center punch
Micrometsrs
Thread gauge
Fillet gauge
Surface gauges
Dial indicators
Surface plate

Using and reading scale
Setting dividers and calipers
Reading Micrometers
Use of gauges -
Grinding of center punch and scratch awl
Use of surface gauge
Use of dial indicator
Use and care of surface plates

5. Holding and Tightening tools

Tool bit holders
Lathe dogs
Draw-in attachments
Drill chuch
Drill sleeves

Care of tool holders
Selecting proper dog
Use of draw in attachments
Care and mfg. of wrenches
Size, care and use of drill sleeves

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5. Holding and Tightening Tools (cont.)

Wrenches -	
U clamps	Use of U clamps, etc. in face-plate work
Parallel strips	
Counter-balances	

(3) Suggestive projects for lathe work

1. Mandrels; standard, screw, and gang
2. Tap wrenches
3. Screw drivers
4. Punches
5. Hammer heads
6. Bolts and studs
7. Face plates for wood turning lathes
8. Turning and burring wheels for sheet metal work
9. Beaching rolls for sheet metal work
10. Hollow punches
11. Bushings
12. Screws for vises
13. Plumb bobs
14. Small jacks and jack screw
15. Small gas engine
16. Small steam engine

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(4) Suggestions for Correlation

English

The correct pronunciation and spelling of tools, materials, operations, and processes. Topical assignments for investigation. Oral and written reports.
Class discussions and demonstrations

History

The importance of machine tools to man
The development of machine tools and their use in modern industry
A study of materials and their relation to local industries

Art

The application of the fundamentals of good design to the projects constructed
An appreciation of the principles of construction as applied to the machine tool industry

Mathematics

a. Linear measurements, lay-out of machinists rule setting calipers from scale, fractions 1/2" to 1/4"
b. Finding centers of circles
   1. By eye
   2. Centering machine
   3. Center square
   4. Parallels and dividers
b. Reading decimals. Computing decimal equivalents, reading and using micrometers, depth gauges, limit gauges, etc.
d. Circular measurement to 1 degree
   Understanding of angles
   Complementary and including angles
e. Set - over for taper work
   1. S= 1/2 T x L
   2. By approximation
f. To set lathe to cut given number of threads per inch
   1. Using gear table
   2. Measure threads per inch
   3. Standard threads per inch
g. Figure root diameter of any thread
   1. By measuring
   2. Hand book tables
h. Compute speed - feed - chip
   1. R.P.M. using indicator
   2. Figuring size of pulley
i. Figure tap drill sizes
   1. Drill gauges
   2. Hand book tables

Science

a. Lubrication
   1. Need
   2. Expansion with heat
   3. Friction
      a. Use of friction to drive parts of machines and as a locking device between surfaces.

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b. Use of screw to produce pressure
   1. To move parts of machines
   2. To hold parts together
c. Principle of lever to magnify motion
   1. Clamping work with straps and bolts
d. Use of gears and pulley to change speeds
e. Changes in tool steel due to hardening and tempering

Drawing

a. Make shop sketch and read blueprints
   1. Take dimensions from finished piece
   2. Take dimensions from sketch or from assembly drawing
   3. Sections, invisible lines-angles
   4. Conventional methods of representing machine shop data
   5. Supply missing dimensions on drawing and recognize errors

Safety

1. Guards for belts and moving parts
2. Care of self; precautions to observe
3. Care of machines
4. First aid

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GRINDER

I. Specific Objectives

1. To know the types of work for which the use of the grinder is necessary, preferable, and optional

2. To know the relation of the grinder to modern industrial practice

3. To understand the fundamental principles of cutting with abrasive wheels

2. Abilities

(a) Manipulative Abilities to be Acquired:

1. To sharpen ordinary tools on hand (floor) grinder

2. To sharpen drills, reamers, milling cutters

3. To grind cylindrical and taper work on universal grinder

4. To grind internal and angular work on universal grinder

5. To do surface grinding

(b) Informational Abilities to be Acquired

1. Materials
   a. Kind of materials to be ground, particularly the differences between hardened and unhardened steels
   b. Abrasive materials (Emery, Carborundum, Alundum, etc.)
   c. Speed, grain, and grade of wheels suitable for various classes of work.

2. Operations, processes, and use of grinding tools. (Universal grinder)
   a. Hanging wheels
   b. Truing wheels with diamond
   c. Lining table
   d. Setting work speed
   e. Setting feed rate
   f. Setting stops
   g. Setting sizing device
   h. Use of rests
   i. Use of cooling bath
   j. Calipers and gages

3. Tools
   a. Types of machines
      1. Hand grinders
      2. Drill grinders
      3. Cutter grinders,
      4. Plain and Universal cylindrical grinders
      5. Surface grinders
      6. Internal (cylinder) grinders

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Grinder (cont.)

(3) Suggestive projects (Universal grinder)

1. Straight shaft
   Exercise in lining table
2. Shafts for shop use
   Substitute the grinder for file and emery cloth in accord with actual industrial practice
3. Lathe centers
4. Drill chuck shanks

(4) Suggestive correlations

1. English
   Correct pronunciation and spelling of tools, operations and processes.
   Topical assignments for investigation; oral and written reports.

2. History
   Study of the development of grinders and grinding wheels

3. Mathematics
   Speeds, R.P.M. and periphery of wheels and work
   Feed; relation to width of wheel

4. Science
   Centrifugal force; bursting effect
   Expansion
   Warping of long work
   Use of spring tail stock

5. Drawing
   Drawing of work to be ground should specify necking at shoulders

6. Hygiene
   Change or pasteurize lubricant

7. Safety
   Handle wheels with care
   Leave blotting paper on wheels
   Set table stops very carefully
   Stand clear when starting

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DRILL PRESS

1. Specific Objectives

    1. To teach pupils to know the types of work for which a drill press is necessary.

    2. To teach pupils the relation of the drill press to modern industrial practice.

    3. To give pupils a working knowledge of the drill press and its intelligent operation and care.

    4. To teach pupils to set up a given job on the drill press, to the best advantage, in regard to accuracy, economy of time, and safety.

2. Abilities
(a) Manipulative Abilities to be Acquired.

    1. To rough drill and countersink to punch marks on ordinary kinds of stock where location is approximate.

    2. To drill holes to punch mark on ordinary kinds of stock where holes are accurately located to each other.

    3. To locate and drill holes with the highest degree of accuracy.

    4. To bore.

    5. To counterbore.

    6. To stop face.

    7. To seam.

    8. To tap.

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(b) Informational Abilities to be Acquired.

1. Materials

Metals to be Drilled or Otherwise Machined on Drill press.	Cast iron Machine steel Mild steel Cold rolled steel Tool steel Brass Bronze Copper Aluminum	Recognition of properties Machining difficulties of each. Need for lubrication Cautions to observe.

2. Operation

Drilling----	Locating centers Testing for trueness of drill Changing centers with chisel or gauge Cutting spuds and jeeds Need for lubrication Cautions to observe
Boring ---	Need Tools used Speeds of cutting tool Cautions to observe
Counterboring ---	Need Tools used Lubrication speeds Cautions to observe

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Reaming ---
- Need
- Cutting speed and feed
- Lubrication
- Cautions to observe

Tapping ---
- Need
- Cutting speed
- Lubrication
- Cautions to observe

Drill Press---
- Kinds; care of
  - a. Sensitive
  - b. Power feed
  - c. Arrangement for tapping
  - d. Use of back gears

Holders of cutting tools
- Dull chucks
  - a. Care in use
  - b. Taper used
- Dull sockets
- Drill sleeves
  - a. Care in use
  - b. Taper used
  - c. Method of removing
  - d. Cautions to observe when inserting sockets and sleeves

Drills-----
- Kinds of drills
  - A. Twist drills
    1. Straight shank
    2. Taper shank
    3. Combination drills and countersinks
  - B. Flat drills
  - C. Three fluted drills
  - D. Straight fluted drills
- Sharpening of
  - A. By hand
  - B. By drill grinder
- Care of drills

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Boring bars--
- Straight shank
- Taper shank
- Grinding of cutting hts.
- Measuring of holes

Counterbores--
- Sizes of
- Care of

Reamers-----
- Kinds of
  - a. Chucking or machine reamers
  - b. Shell reamers
  - c. Adjustable reamers
  - d. Taper reamers
  - e. Hand reamers
- Specific uses and care of

Taps---
- Kinds of
  - Hand taps
  - Machine screw
  - Machine taps
  - Pulley taps
  - Gun taps
- Specific uses and care of

(4) Measuring and laying out tools

- Scale
- Center punch
- Machinists hammer
- Scriber
- Trammel points
- Dinders
- Drill gauges
- Machinests square

Methods of laying out; use of chalk, blue vitriol.
Reason for scribing outside diameter of hole to be drilled.

(5) Holding Tools (for work)

- Clamp--U and flat bolts
- Angle plate
- Parallel bard
- Step blocks
- V blocks
- Drill press use
- Drill press jigs

Cautions to observe when changing work to table angle plate, etc.
Protection of drill press table.
Care of tools.

(6) Holding tools (cutting)

- Drill chucks
- Drill sockets
- Drill sleeves

Method for removing from Drill press spindle cautious
To observe when inserting sockets, aleeves and drill chuck.
Use and care of wrenches.

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(3) Suggestions for Correlation

1. English
   The correct pronunciation and spelling of tools, operations, materials, etc.
   Class discussions and demonstrations

2. History
   The importance of machine tools to man. The development of the drill press and inportance to modern industry.

3. Mathematics
   Linear measurement - inches to 1/64". Addition and subtraction. Parts of a circle - radius, diameter, circumference. To divide a circle into any number of equal parts. To measure size of drills, depth of holes, etc. Compute decimal equivalents. Compute cutting speed-jeeds.

4. Science
   Use of lever for magnifying pressure. Use of friction for transmitting power. Use of rack and pinion for converting rotary to linear motion. Use of lubrication and cutting compounds. Elasticity of metals, preventing springs, etc.

5. Drawing
   1. To lay off work from sketch or detail drawing.
   2. Method of dimensioning holes as to size of hole and location of hole.
   3. To take off drilling data from assembly drawing, also for tapped holes.

6. Safety
   1. Care of machine
   2. Care in setting up work to be drilled
   3. Stop machine when changing or measuring work
   4. Use of brush for cleaning drill press
   5. Wear proper clothing.

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SHAPER AND PLANER

1. Specific objections
   1. To acquaint pupils with the planer and shaper
   2. To teach pupils to determine which of the two machines he should use for a given job.
   3. To teach pupils to set up a given job on either machine
   4. To teach pupils to machine a given shaper or planer job understanding something of the limits of the machine and cutter.
   5. To teach pupils the relation of the shaper and planer to modern industrial practice.

2. Abilities
   (a) Manipulative Abilities to be acquired.
   1. To grind shaper and planer tools.
   2. To set up work on work tables using clamps, bolts, jacks, parallels, etc. or vise.
   3. To select cutting speeds and feeds.
   4. To set stops for length of cut on planer and adjust ram for length on shaper.
   5. To plane or shape flat surfaces
   6. To plane or shape vertical surfaces
   7. To plane or shape angular work
   8. To plane or shape irregular work
   9. To plane tongues, grooves, dove-tails,key ways, etc.
   10. To oil and carefof machines.

   (b) Informational Abilities to be Acquired.

   1. Materials
   Metals to be shaped or planed

Cast iron	identifying
Steel	working properties
Bronze	cautions to observe in
Brass	machining
Copper	source of material
Aluminum	Specific uses

Material for cutting tools

Carbon steel	advantages and
High speed steel	disadvantages of each
Self hardening etc.	Hardening and tempering of cutting tools.

2. Tools
   (a) Shaper - Construction
   Specific uses
   Operation
   Care

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(b) Planer - Construction
Specific uses
Operation
Care

(c) Cutting Tools

Cutting tool for shaper and planer are essentially the same form; planer tools being usually larger.

Roughing tool
Down cutting tool
Shovel nose tool
Side tool
Squaring tool
Cutting-off tool
Angle cutting tool
Spring or goose neck tool
Shear tool
T-slot tool

Grinding
Cutting tools
Clearance angles, etc.
Setting of cutting tools
Specific uses of each.

(d) Holding and clamping accessories.

Shaper or planer vise
Angle plates
Parallel bars
Degree parallels
Hold downs or grippers
Thread bolts
Flat clamps
U clamps
Bent clamps
Pin clamps
Step blocks
Shims
Planer jacks
Planer poppets
Planer stops
Planer toe dogs
V blocks

Internal strains
External strains
Proper placing of
Clamps stops etc.
Testing of angle slates, vise jaws, parallels, etc. for accuracy.
Seasoning of cast iron.

(c) Measuring tools (care and specific uses.

Scale
Micrometers
Depth gauge
Surface gauge
Test indicator
Bevel protractor
Calipers

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(3) Operations and Processes.

(a) Shaper operations

Planing rectangular piece
Square and parallel
Squaring ends
Planing irregular surface
Planing tongue and grooves
Planing slots, keyways, etc.
Planing dovetails
Roughing and finishing cuts

Setting work in vise on table, etc.
Correct methods of making measurements
Setting length of stroke, cutting speed, and feeds.
Cautions to observe

(b) Planer operations

Leveling work on platen or work table
Roughing cuts
Finishing cuts
Planing T-slots
Horizontal and vertical surfaces, rectangular pieces, angular or bevel surfaces, slots, tongues, grooves, keyways, etc.

" "
(same as for shaper)

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(3) Suggestions for Correlations

ENGLISH

Correct pronunciation and spelling of tools, materials, operations, and processes.
Topical assignments for investigation.
Oral and written reports.

HISTORY

Development of planers and shapers.
Study of material and their relation to local Industries.

MATHEMATICS

Linear measurement - right angles, perpendiculars, planes at right angles, circular measure to 1° (swivel head) - Complementary angles - decimal equivalents.

SCIENCE

Friction; Expansion; Contraction; lever and screw to produce motion and magnify power; strength for materials.

DRAWING

To read and understand machine drawings and make sketches.

SAFETY

Care of a machine
Care in setting work in table and adjusting machines.
First aid.

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MILLING MACHINE

(1) Specific Objectives.

1. To know the types of work for which the use of the miller is necessary, preferable, and optional.

2. To know the relation of the miller to modern industrial production.

3. To understand the fundamental principles of cutting with multiple tooth tools (milling cutters, hobs.)

4. To understand the methods of angular spacing.

(2) Abilities.

(a) Manipulative Abilities to be Acquired.

1. To set up for work
   Table, vise, centers.

2. To assemble and set up arbor or cutter in spindle.

3. To select and compute surface speeds.

4. To determine depth of cuts.

5. To use accessory devices,
   a. Micrometer adjustments
   b. Feed stops
   c. Table and knee clamps
   d. Lubricating or cooling baths, air blast.

6. To set up work for tapers.

7. To set up work for angular spacing.

8. To set up work for spiral (helical) milling.

(b) Informational Abilities to be acquired.

1. Materials to be milled
   Suitable speeds, feeds, cuts, lubrication and cooling for the various materials to be milled.
   Type of cutters for the various materials.
   Spacing of teeth.
   Clearance ~~of~~ angles.
   Rake angles (or spiral angle of fluting)

   Materials of which cutters are made
   Suitable speeds, feeds, cuts, lubrication and cooling for cutters made of various materials.
   Carbon steel
   High speed or tungsten steels.
   Stellite, carboloy, etc.

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2. Operations and Processes, (The classification of these based on cutter types).
   - Slab milling
   - Side milling
   - Form milling
   - Key-seating and splining
   - Slotting, sawing
   - End milling
   - T-slotting
   - Face milling
   - Boring
   - Gear cutting
   - Helical and spiral gears, spiral fluting.

3. Tools
   Types of milling machines
   - Knee and column, plain or universal
   - Vertical
   - Rotary table
   - Lincoln
   - Duplex (opposed spindles)
   - Planer type (multiple spindles)

   Suggestive projects
   1. Slab milling
      .Parallels
      Pair of side mills.
   2. Key-seat or splines on shaft, tail-spindle, etc.
      Plain or Woodruff cutter
   3. Slotting screw heads, slitting plates
      Saws
   4. Spur gears
      Form milling, indexing
   5. Lathe rest base
      End milling, T-slotting
   6. Engine cylinger
      Boring, facing
   7. Fluting taps and reamers
      Direct indexing, worm and wheel indexing, form milling, tapers, spiral feed, swiveled table.
   8. Worm and spiral gearing.
      Spiral feed, swiveled table.

4. Suggestions for Correlation

   Mathematics.
   - Micrometer dials
   - Surface speed
   - Chip thickness.
   - Chip volume per tooth per minute
   - Worm and wheel indexing

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Change gears for spiral (helical) milling
Conversion, taper per foot, degrees, and vice versa.

Science
Laws of friction, (Clamping work, cutters, arbors)
Law of moments. (Work performed by various cutters
Expansion and contraction, warping, cooling bath

Drawing
Interpretation of conventional machine design in terms of milling processes.

Hygiene
Change or pasteurize lubricant

Safety
Do not brush chips from cutter with fingers
Stop spindle while changing or measuring work

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BENCH AND ASSEMBLY WORK

1. Specific objectives.

    1. To teach pupils the use of tools that are controlled by hand
    2. To teach pupils to use the correct tools for a given job.
    3. To teach pupils the necessity for hand work and its relation to general machine shop practice.

2. Abilities

(a) Manipulative Abilities to be Acquired.

To be able to use the following tools:

Machinists' hammer
Cold chisel
Hack saw
Screw driver
Wrenches
Center punch
Scriber
Dividers and trammel points
Files
Machinists square
Stocks and dies
Hand tape
Hand reamers
Scrapers

(b) Informational Abilities to be Acquired.

Names, care, uses and characteristics of the following:

1. Tools

Hammers
- Ball pein
- Cross pein
- Straight pein
- Lead or babbit

Cold Chisels
- Flat
- Cape
- Diamond point
- Round nose
- Gouge

-- grinding of cold chisels. Specific uses.

Hack saws
- Fine and coarse tooth — Reasons for different size teeth. Methods of holding cutting action.

Screw driver ---------- Grinding, Tempering

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WRenches, Tap wrench S. Wrench Double head Pin spanner Fan Spanner Monkey wrench Pipe wrench Socket wrench	----	Size of wrenches Selection of proper wrench to use Cautions when using wrenches
Files Mill Flat Hand Pillar Square Round Three square Half round Warding	----	Use Kind of teeth, single cut Double cut, Sizes Method of holding draw filing Need for handles Care of files
Stocks and Dies U.S.S. S.A.E. A.S.M.E. Pipe	---	Sizes of stocks and dies uses of each care of each
Hand taps Taper Plug Bottoming	---	Size care
Reamers Hand	---	Size Care Sharpening
Scrapers		

2. Operations and Processes

Laying out-----		Chalking surfaces Use of blue vitrol Use of surface plate Use of laying out tools
Chipping and filing	--	Selection of chisel cautions to observewhen using chisel. Selection of proper file. Use of file card. Testing of filed surfaces. Cautions to observe.

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Cutting threads by hand.

Use of stock and die	Adjusting of Dies Lubrication Roughing cuts
Use of hand tap	Finishing cuts Selection of tap Making tap cut Oversize holds Removing broken taps
Hand reaming Straight reamers Taper reamers	Need of hand reamers Cautions when using reamers Lubrication of reamers Care of reamers.
Scraping	Need for scraping Sharpening of scrapers Testing of work

3. Suggestive Correlations

English
Correct pronunciation of tools, materials, processes, etc.
Oral and written reports.
Class discussions and demonstrations.

Mathematics
Linear measure, circular measure, decimal equivalents, Angular measure

Science
Expansion, contraction, spring, use of lever to magnify power, etc.

Drawing
Make shop sketch; take off linear dimensions from the print, read angles, lay off shapes and dimensions from sketch detail or assembly drawing.
Take data concerning threads and tapped holes from sketch, blue print, or assembly drawing.

Safety
Care of tools
Care of self
First aid

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4. SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) TRUE - FALSE

T F 1. "Quick change gears" on modern lathes means that the gears on the stud and screw can be changed quickly

T F 2. In producing a circular hole by removing solid metal the tool used is called a drill

T F 3. A standard 16" crank shaper will hold and plane a cube of that size

T F 4. To obtain a given cutting speed per minute of the tool, the shaper must have twice as many strokes for a cut 2" long as for a cut 4" long

T F 5. To increase the force of a lathe increase the R.P.M.

T F 6. Drill chucks will hold either straight shank or taper shank drills

T F 7. When turning tapers the cutting point of the tool must be set on center

T F 8. For accuracy the top of the platen of a planer is planed on its own bed before it leaves the factory

T F 9. Milling is a process of cutting metals with multiple tooth cutters

T F 10. To enlarge cored, punched, or drilled holes where considerable metal is to be removed it is best to use a three fluted drill

T F 11. The automatic feed of a universal grinder will feed evenly and allow for wear of the wheel so that all pieces will be the same size.

T F 12. It is practically impossible to drill a hole to the exact size of the drill

T F 13. After threading work is started the threading tool can not be removed from the tool post

T F 14. Machinery steel is faced from the circumference to the center hole

T F 15. The time that it takes to produce a finished piece of lathe work is entirely dependent upon the cutting speed

T F 16. The rapid dulling of a drill especially at the outer ends of the lips, is evidence that the R.P.M. is too high

T F 17. Turpentine is a good lubricant for unannealed steel and hard spots in cast iron

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T F 18. We usually associate "Jigs" with milling machines and "Fixtures" with the drill press

T F 19. When using a taper shank drill in the spindle of a drill press it is necessary that the shank be well oiled

T F 20. Simple indexing is based upon the fact that 40 turns of the index crank causes the spindle to make one complete revolution

T F 21. The file used most frequently for lathe work is the mill file

T F 22. An abrasive wheel is a cutting tool

T F 23. One should be certain that the lock pin is in the whole of the pulley before starting a power lathe when changing from direct to backgeared spindle speeds

T F 24. When cutting gears on the milling machine the cutter arbor is placed on the centers of the dividing head and tail stock

T F 25. The first cut on cast iron should be one with a light chip and fast cutting speed

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(B) MULTIPLE CHOICE

1. The miller which has a swivel table is a
    1. Plain miller
    2. Universal miller
    3. Duplexmiller
    4. Planer type miller

2. Lathe centers have
    1. Morse taper
    2. Jarno taper
    3. Brown & Sharpe taper
    4. LeBlond taper

3. When chasing threads the carriage moves when
    1. Longitudinal feed control is engaged
    2. Split nut is engaged
    3. Carriage clamping screw is tightened
    4. Feed pinion handle is pulled out

4. The compound rest is part of the
    1. Apron
    2. Bed
    3. Carriage
    4. Head stock

5. The turning direction in which the carriage moves is controlled by changing the
    1. Back gears
    2. Tumbler gears
    3. Countershaft
    4. Apron reverse

6. Milling cutters are least dulled when using
    1. Heavy cut with slow speed
    2. Heavy cut with high speed
    3. Light cut with high speed
    4. Light cut with slow speed

7. The table speed of a planer
    1. Is faster on the cutting stroke
    2. Is faster on the return stroke
    3. Is the same for both strokes
    4. Is faster on the cutting stroke when taking long cuts

8. An Armstrong tool holder for turning provides
    1. Side rake
    2. Front rake
    3. Top rake
    4. No rake

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9. In tapping a thru hole it is best to finish with a
   1. Taper tap
   2. Gun tap
   3. Plug tap
   4. Bottoming tap

10. Tap drills are
   1. Smaller than root diameter of threaded piece
   2. Larger than root diameter of threaded piece
   3. Same as root diameter of threaded piece
   4. Same as outside diameter of threaded piece

11. The breakage of cutting tools is more likely with
   1. Light cut with high speed
   2. Heavy cut with slow speed
   3. Light cut with slow speed
   4. Heavy cut with high speed

12. To do parallel turning the tail stock of a lathe is adjusted
   1. Vertically
   2. Transversly
   3. Longitudinally
   4. Perpendicularly to bed

13. Machinery steel can be
   1. Hardened
   2. Tempered
   3. Annealed
   4. Case hardened

14. Threading tools are set most accurately
   1. By eye
   2. By bevel protractor
   3. With center gauge
   4. With dial indicator

15. A drilled hole to be threaded with specified tap must be drilled with a
   1. S.S. drill
   2. Tap drill
   3. Taper shank drill
   4. Three fluted drill

16. When cutting threads in a lathe the motion of the spindle is transmitted to the lead screw by the
   1. Belt
   2. Apron reverse gears
   3. Friction clutch
   4. Train of gears

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17. Supplementary angles are angles whose sum equal
    1. 90°
    2. 45°
    3. 180°
    4. 120°

18. In grinding steel shafts the depth of the cut per transverse is approximately
    1. .00005"
    2. .0005"
    3. .005"
    4. .050"

19. S.A.E. threads are the same form as
    1. U.S.S. threads
    2. Acme threads
    3. V threads
    4. Whitworth threads

20. Of the following, the one that contains most carbon is
    1. Structural steel
    2. Tool steel
    3. Mild steel
    4. Cold rolled steel

21. An abrupt taper is obtained
    1. By off-setting tail stock
    2. By using taper attachment
    3. By filing by hand
    4. By use of compound rest

22. When using the universal grinder back rests are necessary for
    1. Long heavy pieces
    2. Unhardened work
    3. Long slender pieces
    4. Hardened work

23. Calipers are tools used for
    1. Scribing circles
    2. Testing hardness of metals
    3. Testing sizes of stock
    4. Finding centers of circles

24. Work that is to be finished all over and trued with a finish hole is held
    1. In a chuck
    2. On a face plate
    3. On a plug fastened in a chuck and turned to fit hole
    4. On a mandrell

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(C) COMPLETION

1. Before drilling and countersinking center holes in a piece of stock the _____ must be located and _____.

2. If the work table of a shaper has a feed screw with 8 threads per inch, one revolution of the handle will move the table _____ thousands

3. A _____ should be turned in the surface of a shaft at each shoulder before grinding

4. For reasons of safety, the set screw on a lathe dog should have a _____.

5. The work table of a shaper may be fed _____ either by hand or power and may be adjusted _____ by hand to provide for different jobs

6. When taking vertical cuts on a planer always set the top of the apron _____ from the surface of the cut to be taken

7. In machine construction a piece of metal arranged to provide an adjustment for a bearing is called a _____.

8. A planer platen, for the sake of permanency, should be rough planed and then allowed to _____ before it is finish planed and the sliding surfaces are scraped

9. When using the milling machine to produce a single flat surplace parallel to the axis of the cutter, the operation is called _____ _____.

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10. When facing steel bars in a lathe always work from the _____ to the _____.

11. A sure way of spoiling a piece of work and the tool is to attempt to cut a piece of work in two when held _____.

12. The process of checking the surface or rolling depressions into the surface of a piece of stock is called _____.

13. Tungsten steel milling cutters are run _____ then carbon steel cutters.

14. The wheel of a universal grinder is trued with a _____.

15. When grinding milling cutters keep the wheel cleanand true and take light, fast cuts to avoid drawing the _____ of the cutter.

16. A sensitive drill press is designed primarily for drilling small holes with _____ feed.

17. The operation of sizing and finishing a hole by means of a cutting tool having several cutting edges is called _____.

18. To make a recess for a flat head screw the hole must be _____.

19. When a high degree of accuracy and finish is desired, a hole should be reamed with a _____ reamer.

20. A reamer should never be _____ _____.

21. A _____ is a master tool for cutting internal threads.

22. Taps under 1/4 inch such as 8-32, 10-24, etc. are catalogued as

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_____taps.

23. The dead center and live center of an engine lathe should be in alignment for all operations except _____.

24. A _____ is a tool which when pressed into a finished hole in a piece of work provides centers on which the piece may be machined.

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FORGING

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METAL WORK

(B) FORGING

1. SPECIFIC OBJECTIVES

1. To acquaint pupils with forge shop procedures.
2. To teach pupils the relation of forge work to modern industry.
3. To teach pupils an appreciation of hand forging and the joy and satisfaction that comes through hand work.
4. To afford an opportunity for the working and shaping of metals

2. ABILITIES

(a) Manipulative Abilities to be Acquired.

1. To build a forge fire
2. To cut off stock
3. To draw out metal
4. To upset metal
5. To bend metal
6. To twist metal
7. To punch metal
8. To rivet metal
9. To weld metal
10. To harden and temper metal
11. To anneal metal

(b) Informational Abilities to be Acquired

1. MATERIALS

(a) STEEL and IRON	Machinery steel Mild steel Tool steel Swedish iron Wrought iron	---	source Manufacture Identification Working properties Specific uses
(b) FUEL	Charcoal Coke Crude oil Gas Soft coal	---	Source Composition Advantage Disadvantages Specific uses
(c) COOLING MEDIUMS			
	Fresh water Salt water Fish oil Air blast	--- 	Advantages Disadvantages Specific uses

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(d) CASE HARDENING

cyanide of potassium		methods of use
potash	-----	cautions to observe
C.N.Compounds		dangers

(c) SMOOTHING ANDPOLISHING

emery cloth	-------	grades
files		sizes
		specific uses

2. OPERATIONS AND PROCESSES

a. Building Fire
Cleaning fire place
making green c oal
Making coke
Oxidizing fire

b. Drawing Out Metal
Decrease thickness, width, or both and increase length
Decrease diameter
Point stock
Flare stock

c. Upsetting Metal
Increase length and width or thickness or both
Increase diemeter

d. Twisting Metal
Method of holding stock
Tools used

e. Punching Metal
Methods used
Advantages of punched hole
Lever punch for small holes in cold stock

f. Cutting Off Stock
Cold cutter
Hot cutter
Hardie
Grinding and care of above tools

g. Bending Metal
Use of vise
Use of edge of anvil
Use of jigs
Use of scroll horn
Use of scroll wrench
Proper heat
True curves
Preventing fractures

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h. Hardening and Tempering
Purpose
Care of fire
Heating stock
Using one heat for hardening and tempering
Use of heated block after hardening
Use of Molten Metal

i. Case Hardening
Purpose
Materials used
Methods
Park hardening

j. Annealing
Purpose
Materials used
Methods

k. Welding
With forge fire
With oxy-acetelyene
With electric arc
Use of fluxes
Cautions to observe

3. TOOLS

a. Anvil
B. Forge
C. Vise
D. Hammers
Ball pein
Cross pein
Straight pein
Sledge

e. Tongs
Common
Curves
Flat stock
"V"

f. Punches
Square
Round

g. Cutting Tools
Cold Chisel
Cold cutter
Hack saw
Hardie
Hot cutter

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Lever Shears (hand
Power shears

h. Forming tools
Fuller
Swages
Heading tool
Mendrel
Scroll Horn
Scroll Wrench
Swage Block

i. Laying out, Measuring and Testing Tools
Bevel square
Blacksmith Squere
Calipers
Center punch
Dividers
Measuring wheel
Scratch awl
Trammel points

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3. SUGGESTIVE PROJECTS

1. Andirons
2. Aquariams
3. Center punch
4. Curtain poles and hangers
5. Curtain brackets
6. Ferneries
7. Fire tool sets
8. Hammer heads
9. Hooks
10. Ice tongs
11. Ice picks
12. Knives
13. Lamp bases
14. Pin punches
15. Rivet sets
16. Sign brackets
17. Scratch awl
18. Smoking stands
19. Solid punches
20. Steples
21. Wall brackets
22. Wrought iron lamps

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(4) SUGGESTIONS FOR CORRELATION

A. English

1. The correct pronunciation and spelling of tools, materials, operations, and processes.
2. Topical assignments for investigation
3. Oral and written reports
4. Class discussions and demonstrations

B. Mathematics

1. Shop problems involving fundamentals of arithmetic, fractions, mensuration, cubic and linear measure.
2. To estimate a bill of material.

C. History - Geography

1. The importance of fire to man.
2. The development of hand tools and industrial processes related to iron work.
3. A study of materials and their relation to local industries.

D. Science

1. Expansion and contraction of metals.
2. Changes in tool-steel in hardening.
3. Use of the screw to produce pressure.
4. Use of the lever to magnify motion and power.

E. Art

1. The application of the fundamentals of good design to the projects constructed.
2. An appreciation of the principles of color, decoration and finish.

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F. Drawing

1. To make shop sketches
2. To read blueprints
3. To design wrought iron articles for home use.

G. Hygiene

1. Importance of proper ventilation.
2. Importance of proper lighting.
3. Importance of proper temperature.
4. Importance of suitable working conditions.
5. Protection from fumes and gases.

H. Safety

1. The importance of safety precautions.
2. The proper handling of tools and materials.
3. Immediate attention and report of any injury.
4. Proper precautions pertaining to fire hazards.
5. Danger from fumes and gases.

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5. SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) TRUE - FALSE

T F 1. The principal part of a forge is a cast iron hearth with a bowl or depression in the center for a fire

T F 2. The opening in the bottom of the forge bowl is called a tuyere

T F 3. The horn of an anvil is harder than the anvil face

T F 4. When making hot and cold chisels, both are tempered alike

T F 5. Hot and cold chisels may be used for the same kind of work

T F 6. Any kind of coal is suitable for forge work

T F 7. Scale is the result of an oxidizing fire

T F 8. Machinery steel is the purest form of commercial iron

T F 9. Charcoal is the purest fuel known for forging tool steel

T F 10. When making a right angle bend always bend the stick over a sharp edge

T F 11. Common iron cannot be worked at a low heat

T F 12. When making a cold chisel or any tool out of carbon steel, re-heating the stock gives a better tool

T F 13. Iron which has been overheated is brittle and easily broken

T F 14. "Set Hammer" is a general classification for almost any tool provided with a handle and struck with another hammer

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T F 15. Tongs should always be carefully fitted to the work they are intended to hold

T F 16. To calculate the length of stock needed for all bent shapes, measure the length of an imaginary line drawn thru the center of the stock

T F 17. The amount of stock needed for a ring 6" inside diameter and made of 1/4" x 3/4" material is equal to 6 x 3.1416

T F 18. When drawing part of a bar of 3/4" round stock down to 3/8" diameter, it should be kept approximately round at all times

T F 19. When we temper a piece of tool steel we are annealing it to the correct hardness

T F 20. If one part only of a piece of stock is to be upset, the heat must be confined to that part

T F 21. To punch a clean hole in a piece of hot stock, punch from the one side only

T F 22. A 2 foot piece of 1/2" square stock will be about 2" shorter after being twisted

T F 23. As quenching medium for hardening and tempering, oil is much slower than water

T F 24. A small quantity of sulphur and phosphorous in forge coal is beneficial to heated iron

T F 25. A cold shut is generally formed in the sharp corner of a forging

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(B) MULTIPLE CHOICE

1. Good forging coal should
   1. Crumble easily
   2. Split in layers
   3. Be dull looking
   4. Contain sulphur

2. Green coal is
   1. Freshly mined coal
   2. Green in appearance
   3. Coal dampened with water
   4. A trade name for forge coal

3. Iron oxide is formed most quickly when
   1. Iron is at normal temperature
   2. Iron is below normal temperature
   3. Iron is at black heat
   4. Iron is at white heat

4. Coal chisels should be ground to an included angle of approximately
   1. 30°
   2. 45°
   3. 60°
   4. 36°

5. The cutting tool for hot stock is
   1. Hardie
   2. Hack saw
   3. Cold chisel
   4. Power shears

6. The cutting edge of a cold chisel should ordinarily be
   1. Ground straight
   2. Ground convex
   3. Ground concave
   4. Ground fairly blunt

7. Water, as a cooling medium for hardening and tempering should be
   1. Luke warm
   2. Ice cold
   3. Ordinary temperature of room
   4. Hot

8. Cold chisels are tempered to a
   1. Blue color
   2. Light straw
   3. Dark straw
   4. Purple

9. Hand hammers are hardened and tempered so that the
   1. Ends are extremely hard
   2. Hammer is of same hardness all over

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3. Ends only are hardened and drawn
4. So that the head is harder than the end opposite

10. In training for general education, forging is important because
    1. It developes the muscular structure of the student
    2. It acquaints the student with the fundamental principles of working metals
    3. It teaches him to be careful not to waste material
    4. It teaches him the names of a variety of metal working tools

11. Quenching red hot tool steel in water
    1. Produces no important change
    2. Hardens it by reason of chemical reaction due to oxygen and hydrogen in water
    3. Makes it hard by process of freezing
    4. Does not allow time for rearrangement of carbon and iron particles which occur in gradual cooling

12. If iron is heated to white heat
    1. Work it quickly
    2. Allow it to cool on face of anvil
    3. Quench it slightly in water
    4. Put in the fire with the blast shut off

13. The carbon content is the greatest in
    1. Tool steel
    2. Cold rolled steel
    3. Wrought iron
    4. Mild steel

14. Case hardening is the process of surface hardening iron by adding to the "skin" of the iron
    1. Sulphur
    2. Charcoal
    3. Carbon
    4. Potash

15. Tempering colors measure or indicate
    1. Hardness of steel
    2. Temperature of fire
    3. Temperature of water
    4. Temperature of work

16. Shoulders are first formed with
    1. Hot chisel
    2. Flatter
    3. Fullers
    4. Set hammer

17. Our purest form of commercial iron is
    1. Pig iron
    2. Wrought iron
    3. Mild steel
    4. Tool steel

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18. Bars of tool steel
    1. Are hammered to shape instead of rolled in order to produce more compact metal
    2. Have a smooth surface because they have been pickled in acid
    3. Have a rough surface caused by rolling scale into them
    4. Are rolled to shape cold

19. Coke makes less smoke than coal because
    1. It makes a hotter fire
    2. It is harder and does not pack so tight
    3. It is coal from which the impurities have been removed
    4. It is used without water

20. Sledge hammers are sold according to the
    1. Length of the handle
    2. Width of the face
    3. Weight
    4. Shape

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OBJECTIVE TEST FOR FORGE WORK

(C) COMPLETION

1. Coal to burn properly requires a certain amount of _____.
2. Whenever a piece of hot iron comes in contact with air the _____ attacks the iron and forms iron _____.
3. The process by which a hard surface is produced over soft center or core is called _____.
4. Good forge coal _____ very easily by hand.
5. If a forge fire is not an _____ one there is not much danger of injury to the iron by burning and the forming of scale.
6. Tool steel can be distinguished from wrought iron by the different _____ which each throws off when held against an abrasive wheel.
7. Always protect the _____ when using the emery wheel.
8. Forge tools which are used to smooth down the rough places on round work are called _____.
9. Forge tools that are used to remove rough places and hammer marks on flat or square stock are called _____.
10. To make _____ subject soft coal to heat without burning it.
11. Wrought iron is _____ in structure while cast iron is _____.
12. The base for all of our iron and steel is _____.
13. Never use a _____ fire for forging.
14. _____ is not used very much for forging because it heats metal very slowly, and is expensive.

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15. Forge tools which are used for making depressions for shoulders are called _____.
16. For truing rings or bands formed from either round or flat stock use the _____.
17. A charcoal fire adds a certain amount of _____ to steel.
18. _____ is reducing the extreme brittleness; relieving the strain after a tool has been hardened.
19. In commercial shops a _____ is used to indicate the correct temperature for hardening and tempering.
20. Increasing the thickness of part of a bar of stock is called _____.
21. Bolt heads are upset and then finished to thickness in a _____.
22. The shape of hot _____ stock will be destroyed if cutt off on the flat of the anvil.
23. _____ are used for laying off circles and stepping off scrolls to find their length.
24. When using a hack saw for cutting iron, a slight pressure is applied on the _____ stroke.
25. The term annealing means to _____.

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SHEET METAL

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METAL WORK

(C) SHEET METAL

I. General Objectives

1. To give an appreciation and insight into the important field of sheet metal; its social significance, and practical value from the consumer's standpoint.

2. To give exploratory and try-out experience of aptitude and interest in this field through shop participation, occupational study, visits, reports, etc.

3. To assist in clarifying such academic subjects as science, mathematics, and drawing.

4. To familiarize the pupil with the various kinds of sheet metal, their sources, and manufacture as well as the acids or fluxes used for soldering.

5. To familiarize the student with the care and use of the various tools and machines and well as the processes used in the craft.

6. To analyse a job and reproduce it either from a model, sketch, or working drawing.

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SEVENTH GRADE

(1) Specific Objective

1. To give an acquaintance with the fundamental processes and hand tools used in sheet-metal work.

2. To lay out and construct simple sheet-metal projects.

(2) Abilities

A. Manipulative Abilities to be Acquired:

1. To make a dimensioned sketch
2. To make out a bill of material
3. To cut material
4. To fold edges
5. To form a cylinder with rolls
6. To form materials with the brake
7. To grove materials with hand-groover or grooving machine
8. To form materials on stakes
9. To wire and edge material
10. To rivet a sheetmetal joint
11. To tin a soldering copper
12. To solder tin plate, copper, galvanized iron and zinc
13. To punch holes with solid or hollow punches.

B. Informational Abilities to be Acquired.

1. Materials

A. To know the names, uses and characteristics of the common kinds of sheetmetal:- Black Iron, Galvanized iron, tin plate.

B. To know the purposes and characteristics of the common soldering fluxes:-

1. Raw muriatic acid
2. Cut acid
3. Boiled acid
4. Killed acid
5. Zinc chloride
6. Rosin
7. Soldering paste
8. Soldering salts

C. To know the purpose of Sal ammoniac
D. To know the composition of solder
E. To know how the size of revets are designated
F. To know how wire is designated

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G. To know the thickness and quality of the common kinds of sheet-metal
H. To be able to distinguish between cut and raw acid and to know which flux to use for the different kinds of sheetmetal.

2. TOOLS

a. To know the names, uses and characteristics of the following tools:
1. Straight strips
2. Solid punch
3. Scratch awl
4. Dividers
5. Steel rule
6. Hammers
7. Mallet
8. Rivet steel
9. Pliers
10. Hand groover
11. Bar folder
12. Cornice brake
13. Forming rolls
14. Wiring machine
15. Turning machine
16. Burning machine

3. SUGGESTIVE PROJECTS

1. Biscuit cutter
2. Cookie cutters (various shapes)
3. Cup
4. Dust pan (hemmed edges)
5. Scoop (flour or sugar)
6. Soap dish

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4. SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) TRUE-FALSE

Seventh Grade

T F 1. Sal ammoniac is a cleaning agent

T F 2. A two pound soldering copper weighs two pounds

T F 3. Galvanized sheet iron is soft iron coated with zinc

T F 4. A bar-folder is used to turn a hem

T F 5. Soldering flux is used to clean soldering coppers

T F 6. When turning a 3/16" hem the bar folder should be set at 3/16"

T F 7. Tin-plate is a pure metal taken from the ground

T F 8. The thickness of galvanized iron is measured by the guage

T F 9. Pliers are used for holding work when soldering

T F 10. Solder is composed of zinc and lead

T F 11. It is best to lay work on iron when punching holes

T F 12. A number 10 gauge wire is smaller than a number 8

T F 13. A hem is turnedon the edge of sheet metal to strengthen it

T F 14 . Tin snips and tin shears are the same

T F 15. Rivets are tinned principally to make them look better

T F 16. The grooves in the forming rolls are for wired and hemmed edges

T F 17. Cutting wire with tin snips injures them

T F 18. The first step in tinning a soldering copper is to file it clean

T F 19. Excess solder is removed with a file

T F 20. A steel hammer should be used when forming sheet metal

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(B) MULTIPLE CHOICE

1. Galvanized iron is iron covered with Lead; Tin; Zinc; Copper.
2. The best flux to riae on Galvanized iron is Rosin; Cut Acid; Borax; Putty.
3. The proper method to light a gas furnish is To turn on the gas, then place a lighted match to the furnace; Place lighted match in the furnace and then turn on the gas; Pour gasoline on the burner with a soldering iron and apply a match.
4. Wire is secured in an edge with a Hammer; Monkey Wrench; Sledge; Mallet.
5. Cut Acid is made by adding Water; Zinc; Copper; Lead to muriatic acid.
6. Wire is usually cut with the Square Shears; Cold Chisel; Pliers; Hack-saw.
7. No. 7 wire is the Same size; Larger; Smaller than No. 11 wire.
8. The soldering iron is made of Steel; Brass; Bismuth; Copper.
9. Raising the rear roll of the forming machine makes a Larger; Slightly Larger; Smaller; Slightly Smaller diameter.
10. All bench machines are turned Clockwise with the left hand; Clockwise with the right hand; Counter-clockwise with the left hand; Counter-clockwise with the right hand.

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(C) COMPLETION

1. An unclean surface must be _____ before it can be soldered.
2. Tinner's solder is composed of _____ and _____.
3. To analyze a job means to _____.
4. To solder tin _____ acid is used.
5. The order of procedure for a job means _____ _____.
6. The term 2 lb. rivets means _____.
7. A circular disc can best be cut with the _____ snips.
8. Salamoniac is used to _____.
9. When folding an edge for a hem the bar folder should be set for a _____ edge.
10. To solder galvanized iron _____ acid is used.
11. Tin plate is composed of _____.
12. To form a cylinder the _____ are used.

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Eighth Grade

1. Specific Objectives
   1. To lay out and develop patterns with tapers
   2. To do simple production work for school equipment
   3. To introduce oxy-acetylene welding and brazing
2. Abilities
   A. Manipulative Abilities to be Acquired:
      1. To make a lay-out and develop simple patterns
      2. To crimp edges
      3. To shrink edges
      4. To burr edges
      5. To peen or close down a seam
      6. To double seam on stake or machine
      7. To turn edges on a machine
      8. To weld and braze with an oxy-acetylene outfit
   B. Informational Abilities to be Acquired.
      1. Materials
         a. The source, manufacture and characteristics of the following kinds of sheetmetal:-
            1. Black iron
            2. Galvanized sheet iron
            3. Tin plate
            4. Copper
            5. Brass
            6. Lead
         b. The source, manufacture and size of rivets and sheetmetal wire
         c. The knowing how to select suitable sheet-metal

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Tools

(A) To know the names, uses and characteristics of the following tools

1. Cutting Tools (hand)
   - Chisels
     - Cold
     - Wire
   - Snips
     - Bench
     - Compound
     - Curved
     - Straight
   - Bolt and rivet cutters
   - Hollow punch
   - Solid punch
   - Wire nippers

2. Cutting Machines (hand)
   - Bar folder
   - Beading machine
   - Burring machine
   - Cornice brake
   - Crimping machine
   - Double seaming machine
   - Forming rolls
   - Grooving machine
   - Setting down machine
   - Turning machine
   - Wiring machine

3. Forming Tools
   - a. Hammers
     - Riveting
     - Peining or setting
     - Raising (ball pein)
   - b. Mallet
     - Blow horn (round head)
     - Conductor (creasing stake)
     - Hatchet
     - Candle mould (beak horn)
     - Needle case
     - Double seaming (hollow mandrel)
     - Square head

4. Laying out Tools
   - Scratch awl
   - Prick Punch
   - Dividers
   - Steel rule
   - Circumference rule
   - Steel straight edge
   - Trammel points

5. Miscellaneous
   - Hand groovers
   - Pliers
     - Gas
     - Button
     - Side cutting
   - Rivet sets

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(3) SUGGESTIVE PROJECTS

1. Bucket with raised lid
2. Canteen
3. Cup with wired edge and grooved seam
4. Flower boxes
5. Fruit jar filler
6. Funnel
7. Large dust pan with wired edges
8. Measures
9. Waste basket

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(4) SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) TRUE - FALSE

Eighth Grade

T F 1. In cutting out a piece the best results are obtained by marking around a pattern three or four times with a scratch awl

T F 2. Tin-plate is mined like coal

T F 3. Black iron is iron painted black

T F 4. A job should be thoroughly analyzed before the order of procedure is listed

T F 5. Muriatic acid will not damage clothing if spilled on it

T F 6. The hole in the side of the rivet should not be used to draw the rivet through the metal

T F 7. Acid swabs or brushes should be left in the proper acid cups at all times

T F 8. Edges for wire are formed in the bar folder by simply adjusting the gauge for width

T F 9. Rivets are measured by the pounds per thousands

T F 10. A piece of 24 gauge metal is stronger than 28 gauge

T F 11. Solder can be melted and poured into a joint

T F 12. When a soldering job is completed the flux should be washed off

T F 13. Small drops of solder should be brushed from the bench and thrown away

T F 14. Once a soldering iron is properly tinned it requires no attention the rest of the time you are using it

T F 15. The soldered seams of jobs made of tin plate should be made smooth with a scraper

T F 16. Soldering copper may be cooled off in a jar containing the dipping solution.

T F 17. Surfaces that do not fit snugly are easily soldered

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Eighth Grade (Cont.)

T F 18. Galvanized iron is black iron coated with zinc

T F 19. When soldering a seam of any surface it should lay directly upon the wooden bench or board

T F 20. The scale or dross on a soldering copper need not be removed before tinning.

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(C) MULTIPLE CHOICE

1. The circumference of a circle is found by multiplying:--Radius x 4; Radius x Diameter; Diameter x 3.1416; Diameter x 2.
2. Seams should be soldered Parallel to the floor; In the direction of the operator; Away from the operator.
3. The burr or edge turned on a bottom should be Larger; Slightly larger; Smaller; Slightly smaller than the one turned on the body of the work
4. When soldering a seam or joint the soldering iron should be drawn over the work Rapidly; Very rapidly; Slowly; Very slowly.
5. Beads or swadges are inserted into work for purposes of Strength; Weight; Ornamentation; Cost.
6. When the gauge on a bench machine is on the side nearest the operator the work travels Parallel to the operator; In the direction of the operator Away from the operator; at 45° to the operator.
7. The groove in the hand-groover or grooving wheel should be The same size; Larger; Slightly larger; Smaller than the seam.
8. To form conical shaped articles it is best to use a Hatchet Stake; Hollow Mandrell; Beak Horn; Blow-Horn Stake.
9. In "setting down" a seam by hand a Mallet; Ball pein Hammer; Square faced hammer; Riveting Hammer is used.
10. Wired edges are finished by passing through the wiring machine 1, 2, 3, 4 times.

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Eighth Grade

(C) COMPLETION

1. The circumference of a circle is _____ times the diameter.
2. The allowance for a grooved seam is _____ times the width of the seam.
3. To cut an inside circular opening use the _____ snips.
4. A _____ is used to make the place where a hole is to be drilled.
5. Dipping solution is made by adding _____ to water.
6. The grooves on the forming rolls are used for _____ _____.
7. A seam is finished by _____ after grooving a seam with a hand groover or machine.
8. When burring a circular disc buckling can be avoided by _____ _____.
9. When folding an edge for wire the bar folder should be set for a _____ edge.
10. In soldering brass _____ acid is used.

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Ninth Grade

I. Specific Objectives

1. To do some production work for school supplies.
2. To make lay-outs and developments involving radical and parallel developments, and some triangulation.
3. To do all the operations and constructions that were learned in the seventh and eighth grades, but in a more advanced degree, including such problems as angles, elbows, t's, etc.

II. Abilities

(A) Manipulative Abilities to be Acquired

1. To draft patterns by radical and parallel development and triangulation.
2. To bead or swage for reinforcing or for making connections.
3. To raise or bump to shape.
4. To flare or stretch for riveted connections.
5. To drill holes.
6. To tin copper, brass, and iron.
7. To build a charcoal fire in a pot.
8. To make and use a jig for various jobs.

(B) Informative Abilities to be Acquired

1. Materials (see 7th. and 8th. grades)
2. Tools (see 7th and 8th grades)
3. Operations and Processes (grades 7,8,9.)
    a. Selection of proper seams for a particular job
    b. Selection of proper metal for a particular job.

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c. To estimate the volume of a container

d. To estimate the proper proportions of a container or measure for a given amount of contents.

e. To understand the principles of the three forms of pattern drafting: -- triangulation, parallel development, and radial development.

f. To know the action of acids on various metals.

g. To know the effect of temperature changes on metal.

h. To know the principles of expanding and contracting.

i. To give information relative to factory and commercial production.

j. To give some occupational information relative to the sheet metal trade.

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(3) SUGGESTIVE PROJECTS

1. Acquarium
2. Cabinet
3. Dipper
4. Elbow for furnace or for ventilating
5. Furnace fittings
6. Carbage cans
7. Large pail with double seamed bottom
8. Medicine cabinet
9. Self opening waste basket
10. Tool boxes
11. Window refrigerator

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(4) Suggestions for Correlation (Grades 7, 8, 9)

(a) English

1. The correct pronunciation andspelling of tools, materials, operations, and processes.
2. Topical assignments for investigation.
3. Oral and written reports.
4. Class discussions.

(b) Mathematics

1. Use of rule or scale
2. Use of steel square
3. Reading micrometer
4. To find area and circumference of circles
5. To find weight of sheet metal from table
6. Using tables of standard wire gages
7. Allowances for metal around wire
8. To find size of an article when height and capacity are given
9. To find the size of an article when diameter and capacity are given
10. To find the angle of meter lines in a preced elbow.
11. References

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b. Selvidge, R.W. Christy, E.W.	Instruction Manual for Sheet Metal Workers, p.122-132, Manual Arts Press, Peoria, Ill. 1925.
c. Trews, M.S. Bird, V.A.	Sheet Metal for Beginners, p. 1-8 Manual Arts Press, Peoria, Ill. 1923.

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C. History - Geography

1. The development of industries related to sheet metal work.

2. A study of the sources, supply, manufacture, and use of sheetmetal materials.

D. Science

1. Characteristics and properties of the following metal:- Tin, lead, zinc, copper, brass, iron, steel.

2. Corrosion of Metal
Cause, prevention, and protection.

3. Sal ammonia
Use
Cohesion and adhesion

4. Effect of acids upon the following metals:-
Copper, zinc, tin, iron, galvanized iron, and solder

5. Contraction and expansion of metal due to temperature changes

6. Melting point of metals

7. Effect of mixing metals

8. References

a. Bromel, J.C. — Sheet Metal Workers Manual, pp. 177-179 The Peck, Stow and Wilcox Co., Southington, Conn. 1922.

b. Selvidge, R.W. Christy, E.W. — Instruction Manual for Sheet Metal Workers, p.133-134 The Manual Arts Press, Peoria, Ill.

c. Welch, R.L. — Elements of Sheet Metal Work, p. 13-23, Bruce pub. Co., Milwaukee, Wis. 1926.

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(e) Art

1. The application of the fundamentals of good design to the articles constructed.

2. An appreciation of the basic principles of color, decoration and finish.

(f) Drawing

1. The importance of drawing in the sheetmetal industry.

2. The ability to make lay-outs and patterns.

3. To know the principles of parallel and radial development, and triangulation.

4. The ability to read simple working drawings, sketches, and blue-prints.

5. References.

a. Daughtery, J.S.	Sheet Metal Pattern Drafting and Shop Problems, Manual Arts Press, Peoria, Ill, 1922.
b. Newbecker, Wm.	Problems in Pattern Drafting American Technical Society, Chicago, Ill. 1926.
c. Welch, R.L.	Elements of Sheet Metal Work p. 23-34; p. 43-46; p. 58-68 The Bruce Pub. Co., Milwaukee Wis. 1926.

(g) Hygiene

1. Importance of proper ventilation
2. " " " lighting
3. " " " position to do effective work
4. " " " cleanliness and sanitation
5. Effect of gaseous fumes

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(h) Safety

1. Precautions in use of scratch awl.
2. Avoid letting metal protrude from rack.
3. Do not use any equipment or material without the teacher's permission.
4. Caution in use of hand shears.
5. Caution in handling sheet metal.
6. Two boys should not use squaring shears at the same time.
7. Avoid use of steel hammer or hand groover.
8. Precaution in use of bar-folder
9. Precaution in use of grooving machine.
10. Precaution in use of cornice-brake.
11. See that all stokes are placed in proper position on bench.
12. Never use a file that does not have a handle.
13. Do not inhale fumes when tinning soldering iron.
14. Precautions in the use of acids.
15. Avoid kinking hack saw blades.
16. Avoid water coming in contact with heated metals.
17. Precautions in lighting gas furnace, to avoid an explosion.
18. Do not use power machinery until guards are properly set.
19. Wear goggles when using grinder.
20. Wear suitable clothing to work around machinery.
21. In case of injury consult the school nurse.
22. Reference

Welch, R.L. Element of Sheet Metal Work, p. 135-137, The Bruce Pub. Co., Milwaukee, Wis. 1926.

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(5) SUGGESTIONS FOR PRE-TESTING AND TESTING

(A) TRUE - FALSE

Ninth Grade

T F 1. Band iron is usually bent in the cornice brake

T F 2. Cut acid is used to solder brass

T F 3. Most of our block-tin comes from England

T F 4. When passing a piece of work, with edges for a grooved seam, through the forming rolls the rear roll is the only one to adjust

T F 5. Small wire may be bent in the bar folder

T F 6. IC tin-plate is lighter than IXX tin-plate

T F 7. Elbow edges are usually turned with special rolls

T F 8. A double seam and a double hem are the same

T F 9. The hatchet stake is used to cut metal

T F 10. It is possible to make as small a grooved seam with 24 gauge iron as it is with IC tin-plate

T F 11. It is unnecessary to pass a wired edge through the wiring machine more than once

T F 12. The base sheet of iron is the same thickness in IXX tin-plate as it is in IC tin-plate

T F 13. The allowance added for a grooved seam is three times the width of the seam

T F 14. Soldering coppers are forged or drawn out to a point while cold

T F 15. Hemmed edges should not be mashed too flat

T F 16. When turning the edge for a grooved seam the bar-folder should be set the full width of the added allowance

T F 17. Wrought iron is made from pig-iron

T F 18. The purpose of soldering flux is to dissolve the oxide and

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prevent oxidation

T F 19. A soldering copper can be tinned with rosin instead of sal ammonica

T F 20. There is more friction in a five-piece elbow than in a three-piece one

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(b) MULTIPLE CHOICE

1. Two 4" pipes have a Greater; Smaller; Same Capacity, as one 8" pipe.
2. To solder overhead seams the soldering iron should be tinned on 1; 2; 3; 4, sides.
3. When using a welding torch the Acid; Oxygen; Water; Acetylene; is furned off first.
4. In laying out a "square to round" fitting Parallel line development; Triangulation; Radial line development; Isometric; is used.
5. The Folder; Rollers; Brake; Hatchet stake; is used to form a "square to round" fitting.
6. In "Blinding" rivets the hole in the End; Top; Bottom; Side, of the rivet set is used.
7. In cutting a 1" hole it is best to use Circle Shears; Straight Shears; Hollow Punch; Solid Punch.
8. The easiest sheetmetal to paint is Galvanized iron; Tinplate; Black iron; Aluminum.
9. A quart cup looks neater with a 3/8"; 1/2"; 1/8"; 5/16" groved seam.
10. In double seaming a bottom on a circular object a Hatchet stake; Hollow Mandrel; Creasing stake; Square Head; is used.

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(C) COMPLETION

1. A soldering iron is tinned _____ for overhead soldering.
2. Standard sizes of tin plate are _____.
3. Standard sizes of galvanized iron are _____.
4. The allowance for a wired edge is _____ the diameter of the wire.
5. A _____ is the best tool to use for double seaming edges on the stake.
6. The turning machine is used to _____.
7. The volume of cylindrical container is found by _____ _____.
8. Brass is made of _____ and _____.
9. _____ oil is used when threading pipe.
10. The teeth of a hack saw should point _____ the handle.

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(6) REFERENCES (Grades 7-8-9)

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ELECTRICAL WORK

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CHAPTER XXI

Electrical Work for Grades Seven, Eight, Nine and Ten

GENERAL OBJECTIVES

1. To supply developmental experience in electricity as a part of general education.
2. To enable a pupil through participation in cooperative electrical problems to better perform his duty as a member of his home, his community, and his country.
3. To develop handiness through electrical repairs and adjustments and in simple construction; thereby contributing to the upkeep of the home.
4. To cultivate appreciation of electricity as an industry and as a convenience.
5. To provide training for intelligent utilization of electricity.
6. To understand some of the fundamental laws and theories of electricity.
7. To provide means to better understand the numerous articles on electricity which appear in current publications.
8. To have some knowledge of the principles of such conveniences as the telephone, radio, vacuum cleaner, cooking appliances, etc.

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SEVENTH GRADE

I. Specific Objectives

1. To give exploratory experiences in the field of electricity.
2. To give some experience in handling and controlling electricity and electrical devices.
3. To be able to execute problems from diagrams and to recognize electrical symbols.

II. Abilities

(a) Manipulative abilities to be acquired:

1. To draw simple circuit diagrams
2. To make splices in small wires
3. To install simple bell circuits
4. To correct minor troubles in bell circuits
5. To install a simple burglar alarm system
6. To adjust vibrating bells
7. To make and repair extension cords
8. To recognize and use batteries--wet, dry, storage

(b) Informational Abilities to be Acquired:

1. To appreciate the importance of electricity
2. To understand the nature of electricity
3. To state the uses of electricity for light, heat, and power purposes
4. To know the purpose of a conductor
5. To know the purpose of an insulator
6. To know how to trace simple bell circuits
7. To know how and where to use common splices
8. To know how a vibrator type bell works
9. To know how a push button works

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10. To know what happens in a closed circuit
11. To know what happens in an open circuit
12. To know what happens in a shorted circuit
13. To know the proper use and care of tools commonly used by electricians
14. To know the difference between A.C. and D.C. current

(c) Suggestive Projects

To wire:

1. One button and one bell
2. One button and two bells
3. Three wire return call
4. Office call system
5. Bell system for a two family house; front and rear door bells
6. Open circuit burglar alarm system
7. Closed circuit burglar alarm system
8. Electric door latch
9. Extension cord
10. Battery night light

REFERENCES 1-2-6-7-8-9 (see bibliography)

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(4) SUGGESTIONS FOR PRE-TESTING AND TESTING

Seventh Grade

(a) True - False

T F 1. An insulator is a substance through which electricity will flow

T F 2. No one knows what electricity is

T F 3. All bell joints must be soldered

T F 4. Two wires of a bell circuit may go under one staple

T F 5. Wires should pass to the right around binding screws

T F 6. All bell joints must be taped

T F 7. The carbon post on a dry cell is the negative terminal

T F 8. Porcelain is a good conductor for electricity

T F 9. The magnets in a door bell are permanent

T F 10. A push button prevents the electricity from flowing

T F 11. Like poles repel and unlike poles attract electric currents.

T F 12. Fuses are used as safety devices

T F 13. An open circuit is one in which current flows

T F 14. Temporary magnets retain their magnetism for a long period of time

T F 15. Direct current flows in only one direction

T F 16. Dry cells do not wear out if they are used constantly

T F 17. No. 14 wire is used for constructing bell circuits

T F 18. Rubber is a nonconductor of electricity

T F 19. Door bells are manufactured in only one size

T F 20. If one of the bells in a series bell circuit is out of order the remainder of the bells will ring

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(B) MULTIPLE CHOICE

1. In order for electricity to flow there must be a Short circuit; Complete circuit; Open circuit.
2. The most commonly used conductor is Iron; Copper; Lead; Brass.
3. The magnets in a door bell are Temporary; Natural; Permanent.
4. Electricians cut wire by using Nippers; Snips; Pincers; Side Cutters.
5. A permanent magnet is made of Soft Iron; Steel; Copper; Aluminum.
6. A prominent electrical inventor is McCormick; Edison; Ford; Wright.
7. Bell joints are Welded; Graced; Spliced; Threaded.
8. A dry cell delivers 2; 3; 1; 1-1/2 volts.
9. The majority of automobile batteries have 2; 3; 4; 8 cells.
10. The most commonly used insulation for electric wire is Paper; Cloth; Rubber; Enamel.

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(C) COMPLETION TEST

1. Substances through which electricity will flow are called _____.
2. In constructing an electrical joint wires must be _____.
3. Wires used in making electrical joints must be as strong as _____.
4. _____ is used to adjust vibrating bells.
5. In constructing an electrical joint the wires must be twisted tightly so that they will _____.
6. Insulators are materials that _____.
7. _____ is used for making a permanent magnet.
8. In a closed circuit an electric bell will _____.
9. Electricians usually use _____ pliers.
10. When two bare wires carrying electricity touch each other a _____ is formed.

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Eighth Grade

I. Specific Objectives to be Acquired

1. To give some knowledge of the electrical occupations and some appreciation of the problems encountered in the electrical industries.
2. To give an understanding of the simple laws of electricity and magnatism and an appreciation of the common electrical devices.
3. To give the information necessary for performing repairs on common current consuming devices.

II Abilities

(a) Manipulative Abilities to be Acquired

1. To use the methods of magnetization and demagnetization.
2. To use the wire gauge
3. To solder wires (splices)
4. To apply tapes
5. To make and use the common splices
6. To apply Ohm's Law to series and parallel circuits
7. To install circuits according to the Underwriters Code (Various types of wiring)
8. To test and service storage batteries

(b) Informational Abilities to be Acquired

1. To know the purpose and use of a magnet
2. To know the types of magnets
3. To know the methods of magnetization and demagnetization
4. To know the laws of magnetism and magnetic fields
5. To know the relation of resistance and carrying capacity to the size of wires

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Eighth Grade (Cont.)

6. To know where the different kinds of splices are used.
7. To know the kinds and purposes of tapes and insulators.
8. To understand OHm's Law and the Power Equasion.
9. To know the sources and effects of direct current
10. To know the underlying principles and essential parts of telephones
11. To understand the principles of the storage battery.

3. Suggestive Projects

1. Make and use various permanent and electro magnets
2. Make a simple motor
3. Make solder and tape the common splices
4. Wire up annunciator circuits
5. Wire up a simple telephone circuit
6. Wire up a single pole switch and a cleat receptacle
7. Wire up a double pole snap switch and a cleat receptacle
8. Wire up a three way circuit
9. Wire up a four way circuit
10. Wire up an electroli er circuit
11. Wire up a number of fixture and convenience outlets

REFERENCES: (see bibliography)

1 to 11; 17 and 18

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(4) Suggestions for Pre-Testing and Testing

Eighth Grade

(a) True - False

T F 1. In removing insulation the knife must be held at right angles to the wire

T F 2. All joints must be soldered except those used in bell work

T F 3. Poor joints may become hot and cause fires

T F 4. Static electricity is electricity in motion

T F 5. A circuit is said to be closed when the current flows

T F 6. A soldering iron is made of copper because it is a good conductor of heat

T F 7. Electricians use an acid flux for soldering

T F 8. Fuses blow when there is an overload or short circuit

T F 9. Dry cells connected in parallel will last longer than if connected in series

T F 10. Like poles attract,unlike poles repel

T F 11. A motor generates electricity

T F 12. The Ohm is the unit of quantity in electricity

T F 13. The volt is the unit of pressure in electricity

T F 14. In an external circuit the current flows from the possitive to the negative

T F 15. A splice need not be soldered to be electrically secure

T F 16. Michrome wire offers great resistance to the flow of current

T F 17. Copper is a magnetic substance

T F 18. A dynamo is either a motor or a generator

T F 19. Storage battery current is the same as dry cell current

T F 20. Smaller wires have less resistance than large wires

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(b) MULTIPLE CHOICE

1. The Watt-Volt-Ohm-Ampere is the unit of resistance.
2. In skinning a wire the knife must be held; Parallel to the wire; at right angles to the wire; Vertical to the wire.
3. To control lights from two places Double pole; Electrolier; Three point single pole; Switches are used.
4. In securing wires under screws always have the wire go; In a clockwise; Counter clockwise; Straight direction.
5. To control lights from more than two places when three point switches are used a; Fourway; Electrolier; Double pole Switch; is necessary.
6. Static electricity is electricity that is; In motion; In a dry cell; in a wet cell; at rest.
7. A soldering iron is made of Iron; Tin; Copper; Aluminum.
8. A soldering paste that corrodes copper is made of, Rosin; Acid; Tallow; Borax.
9. The Ohm is the unit of measure for electrical; Pressure; Power; Resistance; Quantity.
10. Wire used in the heating unit fan electric toaster is Copper; Iron; Aluminum; Michrome.

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(C) COMPLETION

1. To obtain a high voltage dry cells are connected in _____.
2. _____ is the electrolyte in a storage battery.
3. Bell wire is _____ gauge.
4. The ampere is the electrical unit of _____.
5. _____ are materials that fail to carry electricity.
6. Watts equal volts times _____.
7. Volts equal _____ times _____.
8. _____is the rotary part of a motor.
9. A coil of wire wrapped around a piece of iron is called a _____.
10. A volt meter measures the _____ of a circuit.

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NINTH GRADE

1. SPECIFIC OBJECTIVES

    1. To give an understanding of the essential scientific facts necessary for the operation, care and upkeep of the common current consuming devices.

2. ABILITIES

    (a) Manipulative Abilities to be Acquired.

    1. To check circuit loads and use meters.
    2. To construct a small transformer.
    3. To build and repair small motors.
    4. To locate and correct simple troubles in motors and generators.

    (b) Informational Abilities to be Acquired.

    1. To become more familiar with the mechanical and electrical properties of insulators and conductors.
    2. To know the application of Ohm's Law to more complex circuits.
    3. To know the theory of magnetic induction as it concerns transformers and coils.
    4. To know the principles of motor and generator construction and operation and their controlling devices. (Direct Current).

3. SUGGESTED PROJECTS

    1. Electric Toaster
    2. Transformer for electric train
    3. Repair of household appliances
    4. Repair small motor driven appliances. Auto starters and generators.

REFERENCES.

1-2-3-4-5-6-7-8-11-12-13-14-17-18 (see bibliography)

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(4) SUGGESTIONS FOR PRE-TESTING AND TESTING

TRUE - FALSE

T F 1. Number eighteen copper wire will carry safely three amperes

T F 2. Conduit is a pipe in which electric wires are placed

T F 3. A fuse plug will carry twice its rated capacity

T F 4. A standard dry cell delivers six volts

T F 5. Thomas Edison is called the "Father of Electricity".

T F 6. An ameter registers the voltage of a circuit

T F 7. A horse power equals five hundred watts

T F 8. Like poles attract each other

T F 9. Fuses are used to protect electrical apparatus

T F 10. Conduit is used to protect electric wires

T F 11. A dry cell has two terminals

T F 12. It is unnecessary to insulate a low voltage conductor

T F 13. Loom is used to protect a wire when crossing over a water pipe

T F 14. A transformer is used to step up or step down the voltage of direct current

T F 15. An electromagnet has a north and a south pole

T F 16. Direct current will at times alternate

T F 17. Distilled water is a better conductor of electricity than un-stilled water

T F 18. Number fourteen wire is smaller than number ten wire

T F 19. All circuits must be properly fused

T F 20. A four way switch has four poles

T F 21. The "hot wire" is connected to the tongue of a socket

T F 22. The electrons in a permanent magnet are perfectly aligned

T F 23. Copper is the best commercial conductor of electricity

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9th Year (Cont.)

T F 24. All repairs should be corrected before a blown fuse is replaced

T F 25. In series circuits the voltage of each unit increases the total voltage

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(b) MULTIPLE CHOICE

1. Number 18 Copper Wire will safety carry 3 Amperes; 4 Amperes; 6 Amperes; 8 Amperes.
2. A watt-hour-meter measures Current; Resistance; Power; Voltages.
3. A horsepower equals approximately 550; 650; 750; 1000 Watts.
4. When a wire crosses a water pipe it is protected by Loom; Porcelain Tube; Tape; Wood.
5. Any magnet will pick up Lead; Gold; Brass; Iron.
6. Storage batteries are refilled with Acid; City Water; Distilled Water; Vinegar.
7. Number 14 wire is larger than No. 18; No. 10; No. 6; No. 12.
8. A four-way switch has 1; 2; 3; 4; poles.
9. A kilowatt is equal to 500; 1000; 1500; 2000 watts.
10. An Erector Motor has 2; 3; 5; 7 poles on the armature.

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(c) COMPLETION

1. Brushes on large motors are made of _____.
2. A horse power equals _____ watts.
3. A switch whose cover plate is even with the wall is a _____ switch.
4. The voltage across a parallel combination is the same as the voltage across _____ unit.
5. One hundred and ten volts will force _____ amperes through fifty-five ohms.
6. Like poles _____ each other.
7. The electrons flow from the _____ to the _____ in a rectifier tube.
8. The current flows out of the _____ pole of a dry cell.
9. A rheostat is a _____ regulator.
10. A storage battery produces _____ current.
11. Mica is a good _____.
12. The volt is the unit of measure of electrical _____.
13. Storage batteries are refilled with _____ water.
14. Direct current flows in _____ direction.
15. Copper is a _____ conductor.
16. A piece of _____ iron will not retain magnetism.
17. A _____ is a safety device.
18. A kilowatt equals _____ watts.
19. A standard dry cell delivers _____ volts.
20. A thousand feet of number ten copper wire has _____ ohms resistance.
21. An ameter is connected in _____ with the load.
22. An _____ flows in the primary winding of a transformer.

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23. A volt meter should be connected in _____ with the load.

24. A permanent magnet is made of _____ iron.

25. Four standard dry cells connected in parallel deliver _____ volts.

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TENTH GRADE

1. SPECIFIC OBJECTIVES

To give the boy a further insight into the technical branches of electricity that he may use it, more fully, without danger and with greater efficiency.

2. ABILITIES

(a) Manipulative Abilities to be acquired.

1. To apply all previous knowledge in more complicated construction, circuits, and repairs.
2. To install and correct troubles in 3 wire and 3 phase circuits.
3. To install and operate A.C. motors and their controls.
4. To construct equipment for the laboratory.

(b) Informational Abilities to be Acquired.

1. To know the theory of electromagnetic induction as applied to alternating current motors and generators.
2. To know the theory of 3 wire and 3 phase circuits.
3. To know the principles involved in telephone installations.
4. To know the various types of electric motor construction.

3. SUGGESTED PROJECTS

1. Installation of 3 wire circuit for lighting.
2. Install and operate D.C. and A.C. motors and controlling devices.
3. Build a motor generator set using an auto generator and a 1/4 H.P. A.C. motor.
4. Build and operate an electroplating outfit.
5. Build a rectifier for charging storage battery.
6. Build experimental transformers, lamp banks, test boards, electro-magnets, electric furnaces, etc. for use in the laboratory.

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(4) SUGGESTIONS FORPRE - TESTING AND TESTING

TRUE - FALSE

T. F 1. A direct current motor can run without brushes

T F 2. An overload cut-out is used as a relay

T F 3. A transformer delivers direct current

T F 4. A synchronous motor is a variable speed motor

T F 5. Direct current will flow through a condenser

T F 6. A direct current motor will not work on alternating current

T F 7. A dash pot has two adjustments

T F 8. A watt hour meter is used on house lighting circuits

T F 9. Three phase circuits may be connected in only one way

T F 10. A moving coil type of ameter is more accurate than the stationery type.

T F 11. A universal motor will run on either A.C. or D.C. current

T F 12. Rubber covered wire is used to rewind motors

T F 13. Large direct current generators have one brush for every pair of pole pieces

T F 14. A two pole synchronous motor runs at 3600 R.P.M.

T F 15. The third brush on a two pole generator regulates the output

T F 16. A small generator may be used as a motor

T F 17. Slip rings are used on direct current generators

T F 18. A dash pot controlled circuit breaker is an over load cut-out

T F 19. Three wire, hundred and ten volt circuits are the same as three phase circuits

T F 20. All motors have commutator bars

T F 21. A volt meter is used in parallel with the load

T F 22. The low potential side of all lighting circuits is grounded

T F 23. All lighting fixtures should be grounded

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T F 24. From the front view, the right hand terminal on all standard direct current meters is the positive terminal.

T F 25. Direct current is more extensively used for general purposes than is alternating current

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(b) MULTIPLE CHOICE

1. A small motor has 1; 2; 3; 4 brushes.
2. When a three phase motor fails to start but hums, it means an open circuit on 1; 2; 3; 4 lines.
3. The meter used on house lighting circuits is called Ammeter; Volt-meter; Watt-meter; Watt-hour meter.
4. The most efficient electrical apparatus is the Motor; Heater; Light; Transformer.
5. The usual voltage for residence lighting is 550; 220; 440; 110 volts.
6. The most commonly used fuses for residences are Cartridge; Plug; Open link; Open wire.
7. The most commonly used size of fuse for residences is 5; 10; 15; 20 amperes.
8. Most automobile generators have 2; 3; 4; 6 brushes.
9. The majority of alternating current systems have a frequency of 25; 33; 60; 133 cycles.
10. The majority of 5 H.P. Motors are 1; 2; 3; 4 phases.

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(c) COMPLETION

1. A mil-ampere is _____ part of an ampere.
2. An over load cut-out is used to _____ electrical apparatus.
3. A relay is a _____ switch.
4. The current flowing in the armature windings of a direct current generator is _____ current.
5. Magnetic lines of force are called _____.
6. The electrons are given off by the _____ of a two element tube.
7. Resistance to the movement of magnetic lines of force is called _____.
8. The direct current flows from the _____ to the _____ in a Tungar rectifier tube.
9. A horse power equals _____ watts.
10. A _____ measures the presence of small electrical currents.
11. The collectors of current on a direct current generator are called _____.
12. Lightening is a _____ form of electricity.
13. An automobile generator has _____ brushes.
14. Three phase circuits are wired up in _____.
15. The low potential wire should be connected to the _____ of a socket.
16. Slip rings are used on _____ motors.
17. Three wire; hundred and ten volt circuits have _____ hot wires.
18. Dynamic reproducers have _____ coils.
19. A device that changes alternating current to direct current is called a _____.
20. Like poles _____ each other.

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Tenth Year (Cont.)

21. The polarity of an electromagnet is determined by the use of _____ rule.

22. A motor generator set is used in most shops to produce _____ current.

23. A circuit of number fourteen rubber covered wire, in house wiring, will safely carry a load of _____ watts.

24. When the direction of the magnetic field and the direction of flow of current in the rotor windings of a direct current motor are known, the direction of motion can be determined by the use of _____ rule.

25. The phase angle between the primary current and the secondary current in a transformer is _____ degrees.

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(5) SUGGESTIVE CORRELATIONS

Grades Seven, Eight, Nine, and Ten.

ENGLISH

Correct sentence structure, spelling and pronunciation in all reports and tests, both written and oral.

MATHEMATICS

Emphasis on the importance of arithmetic may be made in the various grades as follows:

7th Estimating the materials and the cost of bell installations.

Figuring the cost of projects.

8th Applying Ohm's Law.

Estimating and making out bill of materials for jobs.

Figuring costs of operation for various appliances.

9th Estimating cost of repairs on appliances.

Application of Ohm's Law to more complicated circuits.

10th All of the above in greater detail and complication.

HISTORY AND GEOGRAPHY

Life history and contributions of men famous in electricity.

Generation of electricity by waterpower and its possibilities in the United States.

Location of sources of supply for the various substances used in the electrical industries.

SCIENCE

Electricity as a science.

Modern theories of electricity and matter.

How electricity contributes to science.

ART

Appreciation of beauty and symmetry in design.

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HYGIENE

Working conditions in the industry.

SAFETY

The most important factor next to ability and understanding.

Preventive measures.

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18. National Electric Code — 1928

19. Projects and new material may be obtained from current Manual Arts and scientific magazines.

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PATERN MAKING AND FOUNDRY PRACTICE

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CHAPTER XXII

Pattern Making and Foundry Practice for Grade Eleven

1. General Objective

The primary aim of the course in Pattern Making and Foundry Practice is to contribute to the general education of the student. Every home has a great many products of the pattern shop and foundry such as cooking utensils, stoves, furnaces, radiators, fixtures, etc.

The automobile is also largely a product of the pattern shop and foundry. Pattern Making and Foundry Practice form a valuable contribution to the metal working industry. These activities are of peculiar significance in the Cincinnati Public Schools because they represent the first steps in the metal working trades, which rank first in importance in this city. Therefore, in the study of Pattern Making and Foundry Practice the student comes into direct contact with one of the great basic industries of modern industrial development.

2. Specific Objectives.

a. To correlate with other phases of school work

b. To study the source and nature of industrial materials

c. To provide an opportunity for analytical judgment

d. To study problems related to industrial management, organization and production

e. To provide a basic technical training and experience in pattern making and foundry practice

f. To provide an opportunity for boys to undertake co-operative problems

g. To furnish a background for students desiring to enter the engineering profession.

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Note:-

METHOD OFTEACHING PATTERN MAKING AND FOUNDRY PRACTICE

The first few projects in pattern making and foundry work are exercises designed to provide the basic principles necessary for subsequent practical problems. The basis having been provided; individual projects of a varying nature are gvien to members of the class. These problems gradually increase in difficulty and incorporate new principles to be taught. As a means of teaching co-operation and permitting the work to move rapidly several boys may work on the same job. Thus a wide range of work may be carried on at the same time. Discussion of the various jobs constructed provides a fund of information and an understanding of methods of attacking problems. After the few formal exercises all work has a practical value and is used in some project furnished by the boys, or for use in the school shops.

3. Abilities
(a) Manipulative Abilities to be Acquired.

I. Woods

A. To recognize white pine, cherry, maple and mahogany
B. To select wood for a specific job
C. To construct a pattern so as to reduce to a minimum the effect of warping and shrinking of woods
D. To make out a stock list and get out lumber economically.

II. Glue

A. To prepare glue for use
B. To glue the various kinds of joints used in pattern making in hard or soft woods

III. Fillets

A. To determine kinds of fillets to use, measure their size and to insert in the corners of a pattern

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IV. Beeswax

A. To make fillets with the fillet gun
B. To fill nail-holes, etc.

V. Sandpaper

A. To sandpaper a surface true and smooth without destroying sharp corners.
B. To smooth round corners
C. To sand concave and convex surface and free from high or low spots

VI. Shellac

A. To mix shellac and apply it neatly and smoothly over a pattern

VII. Fastenings

A. To select the proper type of fastenings for a specific job
B. To select the proper length nails and screws to use
B. To bore the correct sizes of holes and insert screws
C. To drive and withdraw nails

VIII Rapping Plates

To locate and insert rapping plates in a pattern

IX Lead Figures and Letters

To tack or shellac lead letters and figures on a pattern

X Chalk

To chalk a joint of template in making a fit

XI Plaster of Paris

To mix and make plaster casts for matches, etc.

Operations and Processes

1. Designers Idea

To read and interpret blue prints and other drawings

II. Method of Molding

To determine the best method of molding after taking into consideration the number of castings wanted and the economy of production.

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III. Draft

To determine where and how much draft to use and apply to patterns

IV. Shrinkage of Metal

To determine what shrinkage to use and to apply it to patterns

V. Machinery

A. To allow a sufficient amount of finish on patterns, so that clean, smooth machined surfaces may be obtained on castings.

B. To supply lugs and projections on a pattern for the machinists' use.

VI. Sharpening of Tools

To grind and whet chisels, gouges, plane iron, spoke-shave bits and similar edge tools.

VIII. Laying out work

To construct from a drawing or casting an accurate layout of a pattern and provide the allowances for shrinkage and finish.

To lay out patterns and parts to be cut out on the various machines.

Construction

1. Factors Determining Method of Construction of Patterns

a. To plan the construction of patterns so as to overcome as much as possible the shrinkage and warping of lumber.

b. To make patterns that will stand foundry usage.

c. To take advantage of natural draft inmaking patterns.

II. Circular Patterns

a. To build a pattern of segments and turn it on the lathe.

b. To construct a job of lagging.

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III. Boxing

To use boxing constructions in making a pattern.

IV. Plate Work

To construct plate-like patterns so they will hold their shape, and shrinkage and warping will be reduced to a minimum.

V. Thin Patterns

To construct thin patterns which will hold their shape.

VI. Match Plates

To make duplicate patterns and mount them on a match plate.

VII. Metal Patterns

To make a master pattern and to finish the metal pattern.

VIII. Core Prints

To design and fasten core prints on a pattern for horizontal and vertical cores.

IX. Core Boxes

To design and construct parted and dump core boxes.

X. Partings

To determine the best method of parting a pattern and to provide regular or irregular partings for the molder.

XI. Constructional Joints

To apply and make the following joints used in pattern making:

1. Surface
2. Edge
3. Butt
4. Mitre
5. Dovetail
6. Pin Joints
7. Lap Joints
8. Housed
9. Tongue and Groove
10. Dado

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Tools

1. Laying Out Tools

a. To use the laying out tools and make a full sized accurate layout.

b. To lay out work that is cut out on the machines.

II. Testing Tools

To select and use the tools used in testing work.

III. Pounding Tools

To use the hammer and mallet.

IV. Cutting Tools

a. Paring chisels

To use paring chisels in cutting with the grain, across the grain, and with the end grain without tearing and breaking out the fibers of the wood.

b. Gouges

To select and use gouges in cutting concave and convex surfaces.

c. Planes

To adjust and use the jack, smoothing, and fore plane.

d. Router

To adjust and cut surfaces smooth and parallel to some higher plane.

e. Spoke Shave

To adjust and cut concave and conves surfaces true and smooth.

f. Rabbet Plane

To adjust and plane rabbets and similar depressions.

g. Core Box Plane

To adjust and use the core-box plane for cutting out concave

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semi-circular core boxes.

h. Tooth Plane

To use the trimmer for squaring, mitreing, and roughing off stock.

i. Shooting board

To use shooting board for jointing edges and applying draft to thin pieces.

V. Clamping Tools

To adjust and use the clamping tools.

VI. Turning tools

To use the turning tools in turning face plate and spindle work

VII. Woodworking Power Machines

a. To adjust and use the following power machines:

1. Band saw
2. Circular saw
3. Jointer
4. Thickness planer
5. Disc sander
6. Lathe
7. Tool grinder

b. To provide temporary guards when the permanent guards do not function.

c. To grease and oil above machines.

(B) Informational Abilities to be Acquired.

Materials

I. Woods

A. Kinds of Woods Suitable for Making Patterns:

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1. White pine
2. Cherry
3. Maple
4. Mahogany

B. Shrinkage and Warping as a Factor in the Construction of Patterns,

C. Common Defects Found in Woods

II. Glue

A. Kinds of Glue

1. Hide glue
2. Fish glue
3. Vegetable glue
4. Liquid glue

B. Manufacture of glue

C. Preparation for use

D. Application

III Fillets

A. Purpose of fillets and where used

B. Measurement of fillets

C. Kinds of fillets

1. Wood
2. Leather
3. Composition
4. Wax

D. Fastening of fillets

IV. Beeswax

A. How manufactured

B. Use in making small fillets

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C. Use for filling nail holes, etc.

D. Use for carving

V. Sandpaper

A. The manufacture of sandpaper

B. Grading of sandpaper

C. Use of sandpaper

VI. Shellac

A. Source of shellac

B. Manufacture of shellac

C. Uses of shellac

D. Meaning of red, black, and orange shellac on patterns

E. Application of shellac

VII. Fastenings

A. Kinds of fastenings

1. Brads

2. Nails

3. Screws

4. Corrugated fasteners

B. Use of the different fastenings

1. How and when used

2. Length of gauge of screws, nails, and brads

3. Driving and withdrawing of nails and brads

4. Insertion of screws

VIII. Rapping Plates

A. Purpose of rapping plates

B. Kinds of rapping plates

C. Location of rapping plates

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1. For balancing of patterns
2. For protection of patterns

D. Rapping plates inserted.

IX. Lead Figures and Letters

A. Purpose

B. Fastening

1. Shellacing
2. Tacking

X. Chalk

A. Purpose of colored chalk

B. Application of chalk to parts and templates to secure a fit.

XI. Plaster of Paris

A. Uses of Plaster of Paris in pattern making

B. Making of casts

Operations and Processes

I. Designers Idea

A. Interpretation of drawings

1. Meaning of the different kinds of lines
2. Meaning of letters and symbols

II. Method of Molding

A. Selection of the best method of molding a pattern

B. Method of molding in determining construction

C. As a factor in cost of production

D. As a factor in obtaining cleancastings

III. Draft

A. Purpose of draft

B. Where draft is applied

C. Amount of allowance

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IV. Shrinkage of Metal

A. Cause of shrinkage

B. Consideration of shrinkage in making a pattern

C. Amount of shrinkage allowance for

1. Brass
2. Gray iron
3. Steel
4. Aluminum

V. Machining

A. How indicated on the drawing

B. Amount of allowance for obtaining clean smooth surfaces on castings when machined

C. Providing lugs or projections for convenience in machining

VI. Sharpening of tools

A. Grinding of edge tool

1. Angle for grinding
2. Cautions in grinding
3. Use of oil stone and slip stone
4. Stropping and buffing
5. Testing for sharpness

VII. Laying out work

A. Use of dividers, marking gauge, combination square, bevel, trammel points andother laying out tools.

B. Making of full sized layouts for

1. Construction of patterns
2. Determining finish and shrinkage
3. Facilitating assembling

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C. Laying out work for cutting out on machines

D. Character of lines necessary for accurate work

Construction

I. Factors determining the methods of construction of patterns

A. Tendency of wood to shrink and warp

B. The building of strong patterns

C. Lightening of patterns

D. One or few casting required

E. Permanent or standard patterns

F. Natural draft

II. Circular patterns

A. Use of Segments

1. On ring patterns and similar jobs

2. Method of determining number of rows and number of segments to circle

3. Allowance for turning and fitting

4. Getting out segments

B. Use of lagging

1. Kinds of jobs adapted

2. Number of staves used and finding of angles for joints

3. Getting out staves.

III. Boxing

A. Kinds of jobs adapted

B. Different methods of boxing

IV. Plate work

A. Kinds of jobs adapted

B. Methods of construction

C. Use of open and unglued joints

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V. Thin patterns
   A. Methods of construction
   B. Use of Battens
VI. Match Plates
   A. When used
      1. Use on thin or frail work
      2. Use on production jobs
   B. Mounting of patterns on match plates
   C. Provision for runners and gates
VII. Metal patterns
   A. When used
      1. Used on thin or frail work
      2. Use on production jobs
   B. Making of master patterns
   C. Kinds of metal used
      1. Gray iron
      2. Brass
      3. Lead alloy
      4. Aluminum
   D. Finishing of metal patterns
VIII. Core prints
   A. Purpose of core prints
   B. Kinds of prints
      1. For horizontal cores
      2. For vertical cores
   C. Length of prints to provide balance and prevent tilting and crushing
   D. Taper allowance

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IX. Core boxes

A. purpose of core boxes

B. Kinds of core boxes

1. Parted boxes

2. Dump boxes

3. Half boxes for symmetrical cores

4. Skeleton boxes

5. Assembled cores

C. Construction

1. One piece boxes

2. 2. Several piece boxes

3. Boxes with loose pieces

X. Partings

A. Factors that determine where partings will occur

B. Regular partings

C. Irregular partings

D. Use of follow boards to facilitate molding and support patterns

E. Loose pieces in eliminating partings

XI. Constructional joints

A. factors governing kinds of joints used in pattern making

B. Use of the following joints

1. Surface

2. Edge

3. Butt

4. Mitre

5. Dovetail

6. Pin joints

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7. Top joints
8. Housed
9. Tongue and Groove
10. Dado

Tools

I. Laying Out Tools

1. Bevel
2. Combination square
3. Dividers
4. Shrinkage rule
5. Beam compass
6. Framing square
7. Knife
8. Straight edge

b. Selection of the proper tools, their care, adjustment and the procedure in accomplishing the following laying out operations:

1. Erecting perpendiculars
2. Laying out angles
3. Transference of angles
4. Bisecting angles
5. Gauging lines
6. Laying out circles and radii
7. Transference of measurements
8. Locating centers on cylinders

II. Testing tools

a. Tools used

1. Combination square

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2. Framing square

3. Straight edge

4. Calipers

5. Shrinkage rule

b. Selection of the proper tools, their care, adjustment, and the procedure in accomplishing the following tests:

1. Testing for a true surface

2. Testing for squareness

3. Testing for draft

4. Testing diameters

5. Testing between points

III Pounding tools

1. Hammer

2. Mallet

Use and care of the pounding tools in accomplishing the following:

1. Driving nails

2. Withdrawing nails

3. Driving chisels and gouges

4. Inserting centers in lathe work

IV. Cutting tools

A. Paring Chisels

Uses of the paring chisels in accomplishing the following:

1. Cutting with the grain

2. Cutting across the grain

3. Cutting end grain

4. Cutting at an angle with the grain

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B. Gouges

1. Kinds of Gouges
   a. Inside ground gouges
   b. Outside ground gouges
2. Radii of gouges
   a. Method of testing for the radius
3. Uses of gouges
   a. For cutting out concave surfaces
   b. For roughing off stock

C. Planes

1. Smoothing, jack, and fore plane.
   a. Use, adjustment and care
2. Router
   a. Use in cutting surfaces of depressions smooth and parallel to some higher surface
3. Spokeshave
   a. Use in smoothing concave and convex surfaces
   b. Care and adjustment
4. Rabbet plane
   a. Use in planing rabbets and similar depressions
   b. Care and adjustment
5. Core box plane
   a. Use in cutting out concave semi-circles
   b. Care and adjustment
6. Tooth plane
   a. Use on bench and lathe work
   b. Care and adjustment

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7. Trimmer
   a. Uses of the trimmer for accomplishing the following:
      1. Squaring ends of stock
      2. Mitreing
      3. Roughing off stock
   b. Care and adjustment.
8. Shooting board
   a. Uses of the shooting board for the following:
      1. Jointing edges of thin pieces
      2. Planing draft on thin pieces

V. Clamping Tools
   A. Kinds of clamping tools
      1. Hand screws
      2. Cabinet clamps
      3. Pinch dogs
      4. Wedges
   B. Uses of clamping tools
      1. Uses
      2. Care and adjustment
      3. Cautions to be observed

VI Turning Tools
   A. Kinds used in pattern making
      1. Gouges
      2. Square end chisel
      3. Diamond point
      4. Round nose
      5. Parting tool

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B. Uses of the turning tools

1. Purpose and use of each tool
2. Cautions to be observed

C. Care of turning tools

1. Grinding and sharpening
2. Cautions to be observed

WOODWORKING POWER MACHINES

A. Machines used in pattern making

1. Band saw
2. Circular saw
3. Jointer
4. Thickness planer
5. Disc sander
6. Lathe
7. Grinder
8. Motors
9. Saw filing machine

B. Uses of power machines

1. Purpose and use of each machine
2. Cautions to be observed in operating
3. Making of temporary guards
4. Making of jigs for machines
5. Setting and adjusting of machines

C. Care of machines

1. Oiling and greasing of bearings
2. Sharpening
3. Adjusting

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FOUNDRY PRACTICE

(a) Manipulative Abilities to be Acquired.

Materials

I. Metals

To identify gray iron

II. Sands

To identify molding, fire, and free sands

III. Fire clay

To identify fire clay and prepare lining mixtures daubing mixtures and clay washes

IV. Facings

To identify materials used in facings and to select and apply facings to mold

V. Parting materials

To identify and select parting materials for specific jobs.

VI. Core binders

To identify and select the binders used in specific core sand mixtures.

VII. Blackenings

To identify materials used, mix, and test blackenings, and apply them to molds and cares.

VIII. Chaplets

To select and use chaplets in holding cores in place

IX. Core rods

To select and set rods in cores

X. Fuels

A. to light core oven and regulate the temperature

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b. To build a fire in a crucible or ladle for pre-heating.

XI. Furnace, Cupola and Ladle Linings

a. To recognize fire brick and fire clay

b. To mix fire clay for linings and daubing.

XII. Crucibles

To clean out and care for crucibles

Tools

I. Flasks

a. To build flasks and bottom and molding boards.

b. To alter flasks and adjust pins

II. Shovel

To use shovel in handling sand and other materials and to keep in good condition

III. Riddles

To use automatic and hand riddles in riddling sand

IV. Rammer

To use rammer in ramming sand

V. Finishing Tools

To identify, select, and use finishing tools

VI. Clamps and weights

To select clamps and weights for specific jobs

VII. Gaggers, soldiers and nails.

To select gaggers, soldiers and nails for retaining sand.

VIII. Core plates

To use core plates in making cores

IX. Core Oven

To operate core oven and bake cores

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X. Furnaces and cupolas

To assist in operating a furnace or cupola

XI. Foundry ladles

To line, care for and handle a ladle

Operations

I. Cutting and tempering of sand

A. To temper, cut, and test sand for use in making a mold.

B. To mix and test sands used in making cores.

II Selection of Flasks

To select flasks for specific patterns

III Placing of Patterns on Molding Board

To place patterns on a molding board so that there will be adequate sand wall allowance, so the pattern will mold well, and so there will be sufficient space for sprues, gates, and risers.

IV. Ramming of Sand

To ram molds and cores and test for hardness

V. Re-enforcing of sand

To use gaggers, nails, and soldiers in re-enforcing sand

VI. Setting of Sprues

To select and set sprues

VII. Venting

To use vent rods and risers in venting a mold

VIII. Drawing of patterns

To swab, rap, and draw, patterns and core boxes

IX. Cutting Gates

To select the method and cut gates

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X. Patching of molds

To patch molds

XI. Finishing of Molds

A. To clean out, blacken, and slick molds

B. To set cores

C. To check, close, and clamp or weight molds

XII. Handling of Metal

A. To prepare charges of gray iron for the cupola or furnace

B. To catch molten metal in a ladle and pour molds

XIII. Finishing of castings

To break off sprues and risers, snag, and tumble castings.

XIV. Operation of Furnace and Cupola

A. To clean out, daub the lining, and check a furnace or cupola.

B. To charge metal and fuel and assist in the operation of the furnace or cupola.

(b) Informational Abilities to be Acquired.

Materials

I. Metals

A. Metals that are commonly used in the foundry:

1. Iron
2. Brass
3. Steel
4. Aluminum

B. Where obtained and how prepared for foundry use:

1. Mining
2. Smelting

C. Characteristics of the metals used in the Foundry

1. Chemical properties.
2. Physical properties
3. Sampling

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d. Melting of Metals

1. Melting temperatures
2. Preparation of charges
3. Mixing of iron
4. Effect of re-melting iron
5. Pouring temperatures
6. Problems in castings

II. Sands

a. Kinds used in the foundry

1. Molding sands
2. Fire sands
3. Free sands

b. Source of sands

1. Where found
2. Formation of sands
3. Mining of sands

c. Composition of sands

1. Chemical elements
2. Fhysical characteristics
3. Grades of sands

d. Care and preparation of sands

1. Tempering and cutting of molding sands
2. Testing of molding sand
3. Daubing mixtures

III. Fire Clay

a. A source of fire clay

1. Where found
2. Formation of fire clay
3. Mining of fire clay

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b. Composition of fire clay

1. Chemical elements

2. Physical characteristics

c. Preparation of fire clay for use

1. Fire clay lining mixtures

2. Daubing mixtures

3. Clay washes

IV. Facings

a. Purpose of facings and how accomplished:

1. Filling in the bores between the grains of sand

2. Forming film of gas between the sand and the molten metal

b. Kinds of facing materials

1. Graphite

2. Charcoal

3. Sea coal

c. Manufacture and mining of facings

1. Where found

2. How manufactured

3. Facing mixtures

V. Parting materials

a. Kinds of parting materials

1. Sands

2. Charcoal dust

3. Commercial parting compounds

VI. Core binders

a. Purpose of core binders

b. Kinds of core binders

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1. Flour
2. Rosin
3. Linseed oil
4. Molasses
5. Commercial Core oils
6. Glue

VII. Blackenings

a. Purpose of blackenings and how accomplished

b. Materials used in blackenings

1. Plumbago
2. Clay
3. Soapstone
4. Molasses
6. Glue

c. Mixing of blackenings

1. Combination of materials
2. Testing
3. Application

VIII. Chaplets

a. Purpose of chaplets

b. Kinds of chaplets

c. Setting of chaplets

IX. Core Rods

a. Purpose of core rods

b. Methods of roding cores

X. Fuels

A. Coke

1. Source and manufacture

b. Analysis of foundry coke to determine:

1. Carbon content
2. Sulphur content

c. Use of coke in melting metals

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XI. Furnace, Cupola and Ladle Linings

A. Purpose of linings

b. Kinds of linings

1. Fire brick

2. Composition linings

XII. Crucibles

a. Composition and manufacture

b. Care of crucibles

TOOLS

Flasks

a. Kinds of flasks

1. Snap flasks

2. Floor flasks

b. Manufacture and Maintenance of Flasks

1. Construction

2. Baring of the cope

3. Adjustment of pins

4. Molding and bottom boards

c. Selection of flasks

1. Amount of thickness of the sand walls; placing of several patterns in one flask and other factors affecting the dimensions of flasks.

II. Shovels

a. Kinds suitable for foundry work

b. Use and care of the shovel

III. Riddles

a. Purpose of riddles

b. Kinds of riddles

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1. Hand riddles
2. Automatic riddles

c. Use and care of Riddles

IV. Rammers

a. Purpose of rammers

b. Kinds of rammers

1. Bench
2. Floor
3. Pneumatic

c. Use and care of rammers

V. Finishing Tools

a. Purpose of finishing tools

b. Kinds of finishing tools

1. Trowels
2. Slicks
3. Lifters
4. Corner slicks
5. Swabs
6. Vent rods
7. Draw screws and draw spikes
8. Bellows
9. Blow cans

c. Use and care of the finishing tools

VI. Clamps and weights

a. Purpose of clamps and weights

b. Kinds of clamps and weights

c. Fastening of clamps

d. Estimating of weights to hold down cope

VII. Gaggers and soldiers

a. Purpose of gaggers and soldiers

b. Setting of gaggers and soldiers

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VIII. Core Plates

a. Kind of core plates

b. Use of core plates

IX. Core Oven

a. Kinds of core ovens

b. Operations of core ovens

X. Furnaces and Cupolas

a. Kind of furnaces and cupolas

b. Functions of the different parts

c. Operation of furnaces and cupolas

XI. Foundry Ladles

a. Kinds of Ladles

b. Lining of Ladles

c. Use and Care of Ladles

Operations

I. Cutting and Tempering of Sand

a. Tempering of Sand

1. Moisture content necessary in sand

2. Methods of tempering

3. Tests for moisture content

4. Effect of too much moisture

b. Cutting of sand

1. Methods used in cutting sand:

Hand methods and automatic devices

2. Tests for properly cut sand

II. Selection of flasks

a. Consideration of the following factors:

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1. Amount of sand necessary between the molding board and the pattern
2. Amount of sand necessary above pattern in the cope
3. Molding several patterns in one flask

III. Placing of Patterns on the Molding Board

a. Consideration of the following factors:

1. Amount of sand necessary between the patterns and the flask
2. Sand walls between patterns
3. Allowances for sprues and gates
4. Position of gates

IV. Ramming of sands

a. Tucking of sand around patterns
b. Ramming of drag of the mold
c. Ramming of cope of the mold
d. Ramming for light and heavy work
e. Care in ramming near patterns
f. Tests for hardness

V. Re-enforcing of sand

a. Devices used

1. Gaggers
2. Soldiers
3. Nails

b. Choice for re-enforcements for:

1. Bodies of sand projecting from the cope
2. Thin and narrow sections of sand
3. Green sand cores

c. Setting of re-enforcements

1. Clay washing
2. Cautions to be observed

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VI. Sprues

a. Kinds of sprues

1. Molded sprues

2. Cut sprues

b. Selection of sprues

1. For large, medium, and small work.

c. Position of sprue in relation to the pattern.

VII. Venting of molds and cores.

a. Purpose of venting

b. Systems of venting

1. Proper selection of sands

2. Use of vent rods and risers

3. Use of cinder beds

4. Use of wax tapers for cores

VIII. Drawing of patterns

a. Swabbing of patterns

1. Kinds of swabs used

2. Methods of swabbing

b. Rapping of patterns

1. Tools used

2. Amount of rapping necessary

c. Drawing of patterns

1. Tools used

2. Balancing of the pattern

3. Elimination of suction

4. Getting a clean draw

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IX. Cutting of Gates

a. Where to cut gates

1. Surfaces easily ground or to be machined

2. Hidden parts of casting

b. Kinds of gates

1. For brass, aluminum and gray iron

2. Cutting of common gates

3. Cutting of skim gates

X. Patching of molds

a. Use of the hands in patching

b. Use of the finishing tools

c. Cautions in swabbing

XI. Finishing of molds

a. Slicking of surfaces

1. Use of the trowel, spoon, etc.

b. Blackening of molds

1. Dusting and brushing on surfaces

2. Printing back

c. Setting of cores

1. Trimming cores to fit

2. Setting into place and checking

3. Patching around cores

d. Closing of molds

1. Clasing and checking

e. Clamping of molds

1. Selection of clamps

2. Use of clamping bar and wedges

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XII. Handling of Metal

a. Catching of metal in ladles from cupola or furnace

b. Cautions to be observed in handling molten metal

1. Proper equipment

2. Carrying of metal

3. Avoidance of water

4. Spilling of metal

c. Pouring

1. Skimming of metal

2. Necessity of keeping a steady streem of metal flowing into the mold

3. Pouring of light and heavy work

4. Disposal of left-over metal

d. Mixing of charges

1. Meaning of the term "Cupola Mixture"

2. Elements affecting gray iron:

Carbon, silicon, sulphur, phosphorus, manganese

3. Scrap metal in charges

4. Weighing out of charges

XIII. Operation of furnaces and cupolas

a. Furnaces

1. Cleaning out of crucibles after a heat

2. Daubing furnace lining and checking

3. Pre-heating of crucibles

4. Lighting fire and putting on the blast

5. Charging metal

6. Testing for pouring temperature

7. Taking off metal

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b. Cupola

1. Cleaning away refuse from previous heat
2. Chipping of slag from lining, daubing and patching
3. Fastening of bottom doors and building the bottom
4. Kindling the fire
5. Charging of metal
6. Forming of the tap hole
7. Putting on the blast
8. Tapping of metal
9. Dropping the bottom

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(4) SUGGESTIVE PROJECTS

1. Woodworking vise
2. Concrete tamper
3. Small drill press
4. Small lathe
5. Book ends
6. Door stops
7. Door knocker
8. Flag standard
9. Gear blanks
10. Surface plate
11. Proof press
12. Seat brackets
13. Furnace shaker
14. Grate bars
15. Soldering furnace
16. Vise stand
17. Small anvil
18. Jack
19. Bending jigs
20. Small emery grinder
21. Motor base
22. Dollies
23. Drill press vise
24. Drill press table
25. Circular saw fence
26. Guard brackets
27. Water cup for grinder
28. Lathe rests
29. Core plates
30. Lathe rest holder
31. Pig mold
32. Babbit metal mold
33. Face plates
34. Lamp bases
35. Small disc sander
36. Hearth plate for forge
37. Furnace door liner
38. Small punch press
39. Printing press brake
40. Dowel boring jig
41. Andirons
42. Name plates
43. Stove lids
44. Foot accelerator for auto

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(5) SUGGESTIONS FOR CORRELATION

PATTERNMAKING

1.- Pattern Making

A.- English
- 1 - Enterpreting
  - a. text
  - b. notes
  - c. specifications
  - d. tables
- 2 - Correct spelling and pronunciation of
  - a. tools
  - b. materials
  - c. operations
  - d. processes
  - e. technical terms
- 3 - Topical composition
  - a. oral and written
  - b. class discussion
  - c. specifications

B. - Mathematics
- 1 - Measures
  - a. linear
  - b. square
  - c. cubic
  - d. board
  - e. circular
  - f. weight
  - g. liquid
  - h. temperature
- 2 - calculations
  - a. add, subtract, multiply, divide whole numbers and fractions
  - b. convert decimals to common fractions and vice versa
  - c. obtain circumference or diameter of circles
  - d. transfer linear and circular measurements
  - e. read protractor to one-half degrees
  - f. calculate thickness of cut per revolution of planer handle
- 3 - Geometry
  - a. erect perpendiculars at any point on or at end of a straight line
  - b. Bisect any straight line
  - c. Divide straight line into any number of equal parts
  - d. Lay off angles from 0 to 360 degrees
  - e. bisect angles
  - f. obtain hypotenuse of right triangles
  - g. divide circles into any number of equal parts
  - h. find centers from which circles are struck
  - i. obtain approximate length of arcs

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j. recognize straight, flat, square surfaces

C. - Geography
1. Sources and production of materials
a. lumber
b. shellac
c. wax
d. nails and screws
e. fillets
2. Nature of localities peculiar as pattern centers
a. as to trade
b. as to other manufactures
c. as to transportation
d. as to foundries
e. as to metal mining regions

D. - Drawing
1. Understand the following terms and symbols:
a. full line
b. dotted line
c. dash lin and dot line
d. broken line
e. cross-hatchings
f. F.; F.A.O.; F.F.; G.F.
g. - core
h. scale
i. section
2. Interpret every line and note on the following kind of drawings:
a. sketches
b. layouts
c. working drawings (detail)
3. Make required
a. sketches
b. layouts

E. - Science
1. - Strains
a. contraction and expansion
b. tension
c. tortion
d. compression
e. shear
f. centrifugal force
2. - Chemistry
a. suspension
b. decomposition
c. evaporation
3. - Botany
a. structure of wood
1. knots
2. heartwood
3. sapwood
4. grain
b. annular rings of growth
1. as guide to warping

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2. as guide to working wood

4. - Mechanics
   a. nature of wood working tool steels and temper
   b. cutting edges and clearances
   c. friction and how oil reduces it
   d. care of machine, minor repairs and adjustments
   e. machine shop practice as affected by pattern maker

E. - Art
   1. - Designs
      a. proportion
      b. geometrical
      c. reliefs
   2. - Carving
      a. wood
      b. wax

G. - Hygiene
   a. germs are invisible; they cause infection
      1. sterilize instruments before extracting splinters
   b. attend to all injuries promptly
   c. avoid heavy lifts
   d. have proper light
   e. have proper ventilation
   f. pounding chisel handle with palm of hand is dangerous
   g. collect dust properly

H. - Safety
   a. avoidance of slippery or littered floors
   b. have ample room about machines and benches
   c. keep all machines properly adjusted, sharp, and all moving parts well guarded
   d. keep out of plane in which saws, heads, and discs of high speed machines revolve
   e. leaning on, or storing material on machines may cause injuries to someone
   f. keep attention concentrated on work while using machines
   g. avoid forcing machines
   h. avoid loose clothing or ties when using or oiling machines
   i. wear goggles when grinding
   j. never run short pieces thru jointer or planer
   k. before sawing cylindrical pieces on the band saw, rig properly for it
   l. use notched stick to push material past the rip saw
   m. properly adjust speed of the lathe
   n. properly secure lathe work
   o. be sure lathe rest is tight
   p. keep all tools from projecting beyond or falling off bench
   q. projecting nails or screws are dangerous

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II. Foundry

A. - English
1 - interpreting text and tables
2 - correct spelling and pronunciation of
a. tools
b. materials
c. operations
d. processes
e. technical terms
3 - Topical composition
a. oral and written
b. class discussion

B. Mathematics
1 - Measures
a. linear
b. square
c. cubic
d. dry
e. weights
f. liquid
g. temperature
2 - Calculations
a. percentage and ratio
b. convert inches to feet or yards; linear; square and cubic
c. convert cubical contents to gallons or pounds weight
d. pressure in molds
e. weight of iron sections, plates and chains
f. weight of castings from patterns
g. specific gravity
3 - Mensuration
a. area of squares and rectangles
b. area of triangles
c. area of circles
d. convex surface of cylinders

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(4)

PATTERN MAKING AND FOUNDRY COURSE
RELATED INFORMATION

II. - Foundry

B. - Mathematics
3. - Mensuration (concluded)
e. convex surface of spheres
f. contents of rectangular solid
g. contents of cylinder
h. contents of sphere

C. - Science
1. - Strains
a. contraction and expansion
b. tension
c. compression
d. pressure
2. - Chemistry
a. alloys of metals
b. compounds
c. suspension
d. carbons

C. - 3 - Geology
a. sands
1 - structure
b. metals
1 - impurities
4 - Physics
a. structure of metals
b. gas expansion
c. specific gravity of metals
d. fusion of sand particles
e. cohesion
f. equilibrium
5 - Mechanics
a. working properties of various metals
b. care and minor repairs on foundry equipment

D. - Geography
1 - Sources and production of materials
a. sand
b. iron
c. steel
d. tin
e. coke
f. graphite
g. fire clay
h. flour
i. rosin
j. molasses
k. lumber
2 - Type of localities peculiar to foundry centers
a. as to transportation
b. as to commerce

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c. as to other manufactures
d. as to proximity of coke and metals

E - Drawing

1. Understand the following terms and symbols
   a. full lines
   b. dotted lines
   c. dot and dash lines
   d. core
   e. F.; F.A.O.; F.F.; G.F.

F - Art

1. Finish and color of metals

G - Hygiene

1 - a. germs are invisible; they cause infection
      1 - sterilize instruments and bandages
   b. attend all injuries promptly
   c. avoid heavy lifts
   d. have proper light
   e. have proper ventilation
   f. collect dust and fumes properly
   g. clean oil is good first aid in case of burns

H - Safety

   a. avoidance of slippery or littered floors and gangways
   b. have ample room to work in
   c. keep attention concentrated on work while handling hot metal
   d. wear goggles and leggings when handling hot metal

HI. Safety

   e. wear goggles when cleaning castings
   f. projecting screws and nails are dangerous
   g. at all times keep water away from molten metal
   h. stand to one side when catching molten metal
   i. co-operate with helper

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(A) SUGGESTIONS FOR PRE-TESTING AND TESTING

PATTERNMAKING

TRUE - FALSE

T F 1. A good rule to follow in applying draft is to allow as much draft up to 1/4" per ft. in height as will not interfere with the design.

T F 2. The manner in which a pattern is to be drawn from the mold is not an important factor to consider in making a pattern

T F 3. The usual allowance for finish or maching on medium sized gray iron castings is 1/16"

T F 4. Some metals shrink more than others when cooling

T F 5. Shrinking and swelling of lumber is one of the chief factors to consider in determing the construction of patterns

T F 6. Patterns from which many castings are to be made are usually made of metal

T F 7. Metal patterns are called master patterns

T F 8. Double shrinkage is used on metals that shrink a great deal

T F 9. Much of the shaping of patterns must be done with sandpaper

T F 10. Sharp internal corners on a casting have a weakening effect

T F 11. A flat back pattern is molded entirely in the drag

T F 12. When a pattern is withdrawn from the mold leaving a core as part of the mold it is called a green sand core

T F 13. Green sand cores are very often used for horizontal internal cavities

T F 14. Core prints are necessary on a pattern where green sand cores are used

T F 15. Two types of core boxes are dump boxes and parted boxes

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T F 16. A core print should be of sufficient length to support and balance the dry sand core

T F 17. It is impossible for the molder to insert cores improperly in the mold when there are core prints on the patterns.

T F 18. On some cores half boxes will be sufficient

T F 19. Irregular partings are always established by the molder

T F 20. Match plates are wooden boards or metal plates on which patterns are mounted

T F 21. Some patterns are framed and left with unglued or open joints

T F 22. Ring patterns are usually made of segments

T F 23. Sweep work is the making of molds in pits

T F 24. F.A.O. on a drawing means for aluminum only

T F 25. Iron shrinks more than aluminum

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(b) MULTIPLE CHOICE - PATTERNMAKING

1. Cast iron shrinks 1/16"; 1/8"; 3/16"; 1/2"; 5/16" per ft. when it solidifies and cools.
2. The usual allowance for machining medium castings is 1/32"; 1/16"; 1/8"; 3/8"; 1/2".
3. Ring patterns are built of segments to Make patterns smoother; To have equal shrinkage of wood and make pattern stronger; to make pattern easy to turn; to save material.
4. Core boxes are Boxes for storing baker sand cores; the frame work of hollow patterns; Boxes in which dry sand cores are made; Compartments in the core oven.
5. Patterns are made hollow like a box to Save time; To make pattern stronger; To make pattern lighter and save material; To make pattern easy to alter.
6. Core prints are Projections on a pattern to locate and hold baked sand cores when molded; A drawing of cores; A box for making cores.
7. Battens are used in Holding Thin plate-like patterns in shape; Holding loose pieces on patterns; Sweeping a mold.
8. On large plate work joints are left open to Save material; Because it is not necessary that they be closed; To save time; Provide for the expansion and contraction of wood.
9. Patterns are often parted to Make the work of the pattern-maker easier; to Eliminate excessive shrinkage; Strengthen pattern; To facilitate molding.
10. The best all around wood for making patterns is Cedar; Basswood; Poplar; White pine, Gum.
11. Fillets are for the purpose of Hiding defects in the pattern; To make shellacing easier; To make the casting clean easier;

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12. Templates are used for Holding work in the lathe; Testing corresponding shapes; A temporary guard on the circular saw; Glueing up stock.

13. Layouts in pattern making are Scaled drawing or blueprints; The arrangement of the shop; A full sized accurate drawing made on a board; Directions for making patterns.

14. Follow boards are Guides used to aid in sawing along a line; To aid in the construction of a pattern; To establish a molders parting; Boards on which cores are made.

15. A good rule to follow in allowing draft is Give the pattern as little as possible; Allow 1/32" per foot; Give as much as possible up to 1/4"; Allow 1/2" per foot.

16. A router is used for Roughing off material in a lathe; Testing semi-circular core boxes; Laying off large radii; Cutting recesses where one surface is parallel to another surface.

17. Half round core boxes can be tested with A square; A marking gauge; Calipers; Trammel points.

18. The proper angle to grind chisels for pattern work is 45°; 10°; 20° to 25°; 35° to 40°.

19. For making 500, 3" x 3" unfinished cylinder castings the best method of procedure is to Make many patterns; Mount a set of patterns on a match plate; Make long cylinders to be cut into lengths after casting.

20. Cope core prints should be tapered; very little; generously; none at all; 1/8" per foot.

21. Cylindrical prints for horizontally set cores should be tapered 1/8" per foot; Generously; Very little; Not at all.

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22. Loose pieces are used on a pattern; so the mold may be easily patched, because patterns always mold better when made in several pieces, because time and material is saved in the pattern shop; so that a part may be drawn and lifted from the mold.
23. Rapping and draw plates should be fitted in; One casting job; Standard patterns; Match boards; Cylindrical patterns.
24. Holes marked "drill" on the drawing should be Disregarded; Drilled by the pattern maker; Cored; Filled with wax.
25. Most metal patterns are made of gray iron; Steel; Aluminum; Brass.

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(c) COMPLETION TEST

PATTERN MAKING

1. The best wood for general pattern work is _____.
2. A _____ is made by the pattern maker to establish an irregular parting in the mold.
3. For accurate work a _____ line is the only kind of line to use.
4. A master pattern, for an aluminum pattern, to be used in making gray iron castings should have _____ per foot shrinkage.
5. The solvent used for shellac is _____.
6. Leather fillets are fastened in a pattern with _____ or _____.
7. Fillets are used in a pattern to give the casting added _____.
8. A core box for a core 1" x 2-1/2" x 6" would be parted _____.
9. A _____ is used for locating the center of cylinders.
10. A half round core box may be tested by using a _____.
11. When the shape of a pattern is such that no draft allowance is necessary it is said to have _____.
12. Cope core prints should have considerable _____ to prevent crushing the sand and to straighten the core.
13. A _____ pattern is usually made for a cylinder that is molded in a horizontal position.
14. A core that fits over the top of the mold at the parting is called a _____ core.
15. Circular patterns in which the length is considerably greater than the diameter are usually made of _____.
16. To hold thin plate like patterns in shape _____ are used.
17. Thin pieces of wood or metal cut to some desired shape and used

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for testing the corresponding shapes of various pattern parts which can not be laid out on surfaces are called _____.

18. On gray iron patterns black indicates _____, red indicates _____, and orange or natural color of shellac indicates _____.

19. Lead figures and letters are used on the patterns for the purpose of _____.

20. A very keen edge may be put on tools after they come from the oil stone by using the _____ or _____.

21. Four constructional joints used in pattern making are _____, _____ _____ _____.

22. When face plate work is turned on both sides it is necessary to _____ it.

23. Large kettles, flywheels, pulleys, etc., are very often made without patterns, this type of work is called _____.

24. Patterns in which the outline is partially furnished and then filled in with clay to complete the shape are called _____ patterns.

25. Dowel pins are put in the _____ side of parted patterns.

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SUGGESTIONS FOR PRE - TESTING AND TESTING

FOUNDRY PRACTICE

TRUE - FALSE

T F 1. A good molding sand should not be refractory

T F 2. Molding sand for gray iron work contains from 80% to 90% silica and from 6% to 10% clay

T F 3. New sand is the best for molding

T F 4. Foundry facing is the term given to materials applied to or mixed with the sand which comes in contact with the melted metal

T F 5. Graphite and charcoal are used as foundry facings

T F 6. Parting sands should contain about 8% bond

T F 7. In flasks, the part between the cope and drag is called the cheek

T F 8. The cheapest and quickest method of making the general run of castings is by green sand molding

T F 9. Crossbars are put in the cope for the purpose of strengthening the flask

T F 10. Pneumatic rammers are used in some commercial foundries

T F 11. When clamping a mold the clamps should be hammered on tightly

T F 12. Chaplets are used as a support for projections of green sand from the cope

T F 13. Risers are for the purpose of telling when the mold is filled

T F 14. Two of the causes of blow holes are hard ramming and lack of venting

T F 15. Cold shuts mean that two streams of metal chill and do not fuse when meeting

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T F 16. Swells are caused by the unequal shrinkage of the casting

T F 17. Sand matches are used for the purpose of establishing a parting in the mold

T F 18. Many of the larger molds are made in pits in the floor

T F 19. The largest iron ore mining district is found in Pennsylvania

T F 20. Gaggers are used in the cope to help retain the same

T F 21. In core making the principal material used is a refractory sand.

T F 22. Clay is one of the chief bonds used in making baked sand cores

T F 23. The strength of a core depends entirely on the length of time it is baked

T F 24. Coke and cinders are used on the inside of large cores to make them vent better

T F 25. The openings used to convey the blast from the wind box into the cupola are called tuyeres

T F 26. Air is blows into the cupola to keep the shell cool

T F 27. Fire brick is used for lining cupolas and furnaces

T F 28. Ladles are painted with graphite and oil to prevent the metal from burning through

T F 29. A pyrometer is used for the purpose of testing the temperature of metal.

T F 30. Sulphur is one of the most desirable elements in cast iron

T F 31. Phosphorus makes metal run more fluid

T F 32. Manganese weakens cast iron

T F 33. There are many kinds of pig iron and it is necessary to mix them together to get desirable qualities in castings

T F 34. Remelting makes scrap iron softer

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MULTIPLE CHOICE

FOUNDRY PRACTICE

1. Molding sand is composed of about 90% Clay; Metallic Oxides; Magnesia; Silica; Lime.
2. When molding sand becomes weak New sand is added; It is discarded; Fire clay is added; Facing sand is added.
3. Venting of molds is for the purpose of Colling the casting quickly; To dry the mold; Allowing gases and steam to escape; Allowing metal to flow freely.
4. A facing is for the purpose of Making the castings stronger; Enabling the surface of the mold to withstand the flow of metal; Making the sand peel easily and give clean castings; Drying the surface of the mold.
5. Sea coal facing is a mixture of Graphite and Charcoal Dust; Charcoal dust and fireclay; Ground bituminous coal and molding sand; Rosin; Flour and sharp sand.
6. Gates for gray iron molds are usually cut Wide and deep; Narrow and deep; Wide and shallow.
7. Sulphur is one of the most desirable elements in cast iron; Immaterial; The most undesirable element; A hardener.
8. A blow hole is caused by Trapped air and gas in the mold; Poor grade of sand; Fast pouring; not skimming the metal.
9. A chaplet is A tool used for cutting gates; To support sand in the cope; A metal support for holding cores in place; A rod used for re-enforcing cores.
10. A cold shut is A piece of metal placedin the mold to shill the casting; the junction wheretwo streams of metal run together and do not

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fuse; Iron that has frozen in the ladle; A spongy place in a casting.

11. A bod is A bar or mandrel used as the center on which is built a core; the portion of the lining of a cupola immediately surrounding the tap hole; A bar used to tighten clamps on a flask; A lump of clay which is inserted in the tap hole of a cupola.

12. Sweep refers to A piece of wood or iron revolved about a center to form the surface of a mold; The finishing of a mold; Striking off a true surface for the top of an open mold; A Cylindrical core.

13. A good parting material is Flour; Powdered rosin; Lake sand; Fire Clay; Graphite.

14. Too much moisture in the sand will cause The mold to blow; The casting to become hard; A warped casting; A soft casting.

15. Crucibles are made of Fire Clay; German Clay and Graphite, Clay and cinders.

16. Match plates are used in the foundry on One casting jobs; On all work; On production job; Cylindrical work only.

17. In order to make smooth castings, dry sand cores are Rammed very hard; Coated with glutrin; Blackened with a graphite paint; Made of fire clay.

18. Malleable castings are made by Using a mixture of brass and iron; Annealing castings made of a certain mixture of iron; Heating and dipping in oil; Using an iron high in silicon.

19. Gray iron melts at about 3000; 1800; 2200; 1300 degrees.

20. Tempering sand means Mixing new sand with old sand; Breaking up all the lumps; Adding a facing sand; Adding water.

21. The fuel most commonly used in iron foundries for melting iron is Gas; Coal; Electricity; Coke.

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22. The method of charging a cupola is Charge all the coke and then all the iron; Charge all the iron and then all the coke; Charge alternate layers of coke and iron.

23. Combined carbon in gray iron makes it: Softer, Harder; More fluid; malleable.

24. Formers are used for Shaping a mold; Cutting gates; Forming a sprue; drying irregular shaped cores.

25. A lifter is A type of Crane; A type of Draw Screw; A tool for removing loose sand and slicking a mold.

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COMPLETION (FOUNDRY PRACTICE)

1. Four common defects found in castings are _____, _____, _____, _____.
2. Foundry ladles are lined with _____.
3. Molding sand contains from ____% to ____% silica and from ____% to _____% clay.
4. Linseed oil, flour, and rosin are used as _____ in the foundry.
5. Four finishing tools used in the foundry are _____, _____, _____, _____.
6. Five elements that greatly affect the physical properties of gray iron castings are _____, _____, _____, _____, _____.
7. The element in gray iron that foundrymen attempt to reduce to a minimum because of its bad effect on castings is _____.
8. Brass is called an _____, the base of which is _____.
9. _____ molding is the cheapest form of making castings.
10. A mineral form of carbon used in the foundry is _____.
11. A free sand has no _____.
12. To give some cores support and to keep them from floating _____ are used.
13. Clay is the element that gives the sand _____.
14. Sand and slag in a casting are always found on the _____ side of the casting.
15. Two methods of allowing for the escape of gases in a mold is by _____ and use of A_____.
16. A sand match is used to establish a _____.

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17. A mold in which the surfaces are baked to a shallow depth is called a _____ mold.

18. _____ and _____ are used to help retain sand in the cope.

19. Long thin cores are _____ so they can be handled without breaking.

20. The four main branches of foundry work are _____, _____, _____, _____.

21. For protection, when pouring molds, a molder wears _____ and _____.

22. Two methods of cleaning castings in the foundry are by _____ and _____.

23. Crooked cores which cannot be vented with a rod are vented with _____.

24. A frame of wood or metal which is slipped over a snap flask mold after the flask is removed is called a _____ and is for the purpose of keeping the metal from _____.

25. The _____ ladle is used for pouring large castings.

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A P P E N D I C E S

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Appendix A

Cincinnati, Ohio,
October 24, 1928.

Dear Sirs:-

I am attempting to make a study of the present status of the manual activities (manual training, industrial arts, and manual arts) as conducted in the various states throughout the nation. In consequence, I desire to solicit your support and co-operation in this study.

Will you kindly fill in the attached sheet and oblige?

Thanking you for any information and assistance you may be able to give me relative to these questions, I am,

Respectfully,

H. A. Sotzin

HAS:JM

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1. State Department of Public Schools. . . . . .
(Name of State)

2. Do you designate a particular state officer to supervise and direct the manual activities, connected with your general or liberal educational courses (this does not refer to Smith-Highes or any other work, of a specific occupational nature)?

Answer Yes. . . . . .No. . . . .

3. If so, what is his title?. . . . . .

4. If not, who directs or supervises this work?. . . . . .

5. Do you publish a state course of study?. . . . . .

Answer Yes. . . . . .No. . . . .

6. If so, will you kindly forward me a copy and oblige?

Answer Yes. . . . . .No. . . . .

7. List a number of cities in your state (approximately 12) who have or might have a printed or typed course of study in the field of industrial arts, I.E. manual training.

NOTE: If the answer to a question is yes, place a check mark to the right; if the answer to the question is no, place a check mark to the right.

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APPENDIX B

Cincinnati, Ohio,
November 30, 1928.

Superintendent of City Schools

Dear Sir:

Your state department of public instruction has suggested your school system as a possible source for obtaining a course of study in the field of industrial arts. Hence, if you have a printed, typed or mineographed course in this field, will you kindly forward me a copy and oblige?

Thanking you for any material that you may be able to furnish me, I am,

Respectfully,

H. A. Sotzin

EML

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APPENDIX C

Cincinnati, Ohio,
November 15, 1928

Dear Sir:

A group of eighty Industrial Arts Teachers in this city are working on a new Industrial Arts program of study for the city schools. This group is desirous of acquainting itself with information from every available source, relative to their problem, and in consequence solicit your assistance.

Hence, will you briefly point out for us what in your estimation are some of the major defects of our present Industrial Arts program, and oblige?

I am,

Respectfully yours,

H. A. Sotzin

EML

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APPENDIX D

The Industrial Arts teachers (i.e. Manual Training) of Cincinnati are reexaming their course of study and solicit your assistance in this task. It will be greatly appreciated if you will fill out the attached questionnaire and oblige.

INDUSTRIAL ARTS QUESTIONNAIRE FOR HIGH SCHOOL SENIORS

1. Below you will find listed a number of grades; ranging from the fourth to the twelfth inclusive. UNDERSCORE all of the grades in which you have had INDUSTRIAL ARTS WORK, (i.e. Manual Training).

2. UNDERSCORE ONCE the INDUSTRIAL ARTS courses that you have taken. Underscore TWICE those that you have taken in the high school. In the latter, include grades nine to twelve inclusive.

BENCH WOODWORK. . . WOOD TURNING. . . WOOD PATTERNMAKING. . .

CABINET MAKING . . . MACHINE SHOP . . . FORGE SHOP . . .

ELECTRICAL SHOP . . . SHEETMETAL . . . PRINT SHOP . . . ART

METAL SHOP . . . FOUNDRY . . . FREEHAND DRAWING . . . SKETCHING

. . . . . MECHANICAL DRAWING . . . . ARCHITECTURAL DRAWING . . .

Add any others not listed.

3. If you elected shop and drawing course in the senior high school, what were your reasons for this choice of subject matter? UNDERSCORE

TO EARN EASY CREDITS. I LIKE MECHANICAL WORK. I BELIEVE I HAVE MECHANICAL APTITUDE. TO TRY AND DISCOVER WHETHER OR NOT I POSSESSED MECHANICAL ABILITY. MY PARENTS WANTED ME TO TAKE THE WORK. TO PERMIT ME TO MAKE THINGS THAT I WANTED. TO PERMIT ME TO MAKE THINGS THAT WERE DESIRED FOR THE HOME. I LIKE THE FREEDOM OF THE SHOP. I LIKED THE TEACHER. MY CHUMS RECOMMENDED IT. I INTEND TO TAKE AN ENGINEERING COURSE. I HOPE TO FIND EMPLOYMENT IN A MECHANICAL OCCUPATION. Add any other reasons that you may have.

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4. If you did not elect shop and drawing courses during your senior high school course, what were your reasons? UNDERSCORE

I DISLIKE THE WORK. I DID POORLY IN SHOP WORK IN THE GRADES. MY FAMILY OPPOSED IT. I DISLIKE TO SOIL MY HANDS AND FACE. I BELIEVE IT IS OF LITTLE OR NO VALUE FOR THE OCCUPATION I HOPE TO ENTER. MY CHUMS DID NOT SELECT IT. THE COLLEGES GIVE TOO LITTLE ENTRANCE CREDIT FOR THIS WORK. Add any other reasons.

5. Have you made an occupational choice? Check. Yes... No....

6. If your answer to Question 5 is Yes; did the industrial arts work, that you have had either in the grades, junior high school or senior high school, aid you in making this choice? Check Yes... No...

7. Are you planning to go to college? Check. Yes... No...

8. If you were entering high school again, would you select the (Check)

SAME AMOUNT OF INDUSTRIAL ARTS WORK..... A LESS AMOUNT.....

A LARGER AMOUNT. . . . . .

9. Have the experiences that you have had in the industrial arts courses made you a more intelligent buyer and consumer of industrial and manufactures products? Check Yes. . . . No. . . .

10. Do you make the minor repairs and adjustments about the home, automobile, furniture, etc? Check Yes. . . . No. . . .

11. List some articles that you made in the school shop, which in your opinion afforded the broadest experiences and the most satisfaction.

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12. List some of the things that you disliked about the shop and drawing courses.

A. Shop Courses

B. Drawing Courses

13. List any suggestions that you believe will improve our INDUSTRIAL ARTS WORK.

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APPENDIX E

The Industrial Arts Teachers (i.e. Manual Training) of Cincinnati are re-examining their course of study and solicit your assistance in this task. It will be greatly appreciated if you will fill out the attached questionnaire and oblige.

QUESTIONNAIRE FOR SENIOR COLLEGE STUDENTS

1. Below you will find listed a number of school grades; ranging from the fourth to the twelfth inclusive. UNDERSCORE all of the grades in which you have had INDUSTRIAL ARTS WORK. (i.e. Manual Training).

   4th - 5th - 6th - 7th - 8th - 9th - 10th - 11th - 12th

2. Underscore ONCE the INDUSTRIAL ARTS COURSES that you have taken; TWICE those that you believe have benefitted you most.

   BENCH WOODWORK... WOOD TURNING. . . WOOD PATTERNMAKING . . .

   CABINET MAKING. . . MACHINE SHOP . . . FORGE SHOP . . . ELECTRICAL

   SHOP . . . . SHEET METAL SHOP . . . PRINT SHOP . . . ART METAL

   SHOP . . . FOUNDRY . . . FREE HAND DRAWING . . . SKETCHING . . .

   MECHANICAL DRAWING . . . . . ARCHITECTURAL DRAWING . . .

   Add any others not listed.

3. Did you take more INDUSTRIAL ARTS work than the minimum school requirement?
   Check Yes . . . No. . .

4. If your answer to question 3 is YES, list the courses that you chose.

5. If your answer to question 3 if NO. list your reasons.

6. Did the Industrial Arts work that you had either in the grades, junior or senior high school, influence your choice of an occupation?
   Check Yes . . . No. . .

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7. Have the experiences that you have had in the Industrial Arts course made you a more intelligent buyer and consumer of industrial and manufactures products?
   Check Yes . . . No. . .

8. Have the abilities that you acquired in the school shops and drawing rooms equipped you to make minor repairs about the home, automobile, etc?
   Check Yes . . . No. . .

9. If you had an opportunuty to take your secondary school work over again would you take (check)

   THE SAME AMOUNT OF INDUSTRIAL ARTS. . . . A LESS AMOUNT . . .

   A LARGER AMOUNT. . . .

10. List some of the articles that you made in the school -shop, which in your opinion afforded the broadest experiences and the most satisfaction

11. List some of the things that you disliked about the shop and drawing courses.

    A. Shop Courses B. Drawing Courses

12. List any SUGGESTIONS that you believe will improve our Industrial Arts work

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APPENDIX F

The Industrial Arts teachers (i.e. Manual Training) of Cincinnati are re-examining their course of study and solicit your assistance in this task. It will be greatly appreciated if you will fill out the attached questionnaire and oblige.

INDUSTRIAL ARTS QUESTIONNAIRE

1. What is your occupation?. . . . . (fill in here)

2. Check below the approximate number of years that you have taken Industrial Arts work (i.e. Manual Training).

   1 yr. . . . . 2 yrs. . . . 3 yrs. . . . 4 yrs. . . . 5yrs. . . .

   6 yrs. . . . 7 yrs. . . . 8 yrs. . . .

3. Below you will find listed a number of shop and drawing courses that are usually offered in our public schools. Underscore ONCE those courses that you have taken and TWICE those that have proven most useful since you have left school.

   WOODWORK . . . WOOD TURNING . . . WOOD PATTERNMAKING . . .

   CABINET MAKING . . . MACHINE SHOP . . . FORGE SHOP . . . ELECTRICAL

   SHOP . . . SHEET METAL SHOP . . . PRINT SHOP . . . ART METAL SHOP

   . . . FOUNDRY . . . FREE HAND DRAWING . . . SKETCHING . . . MECHANICAL

   DRAWING . . . ARCHITECTURAL DRAWING . . .

   Add any others not listed.

4. Did the Industrial Arts work that you took during your school career influence your choice of occupation?
   Check Yes . . . No . . .

5. Have the experiences that you have had in the industrial arts courses made you a more intelligent buyer and consumer of manufactured and industrial products?
   Check Yes . . . No . . .

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6. Have the mechanical processes that you learned in the school shop enabled you to save money, by making your own repairs and alterations about the home, its equipment, the automobile, etc?
Check Yes . . . No . . .

7. If you had an opportunity to take your school work over again would you take (check)

THE SAME AMOUNT OF INDUSTRIAL ARTS . . . . . A LESS AMOUNT . . .

A GREATER AMOUNT . . . .

8. List some of the reasons why you liked the shop and drawing courses.

9. List some of the things that you did not like about the shop and drawing courses.

10. List any suggestions that you believe would improve this type of school work

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APPENDIX G

UNIVERSITY OF CINCINNATI
College of Education

Dear Sir:

The Industrial Arts teachers (i.e. Manual Training teachers) of Cincinnati are re-examining their course of study and solicit your assistance in this task.

One of the major problems is,to discover whether the experience acquiredin the school shop function, when the pupil enters occupational life.

Industrial Arts education is considered, in this city, a part of the pupil's general education and not specific occupational or trade training.

It will be greatly appreciated if you will fill out the attached questionnaire and oblige.

Respectfully,

H. A. Sotzin

.c.c. . . . . .
(name of firm)

What product or products do you manufacture?. . . . . .

. . . . . .

---

1. Does your firm employ apprentices? Answer. Check Yes No

2. Does your firm have any educational requirements necessary for employment? Answer, Check Yes No.

3. In giving employment to boys does your firm give preference to high school graduates over eighth grade graduates and those who have not completed the eighth grade? Answer, Check Yes No.

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4. If you do not require high school graduation as a prerequisite for employment do you prefer boys, who have had 'exploratory' shop experiences, in our school shops? The purpose of 'exploratory courses' is, to acquaint the boy with some of the basic industrial processes through actual participation in them; enhance his general intelligence and to foster a respect for industry and the workers engaged in industry.
Answer Check Yes No.

5. Do you approve of shop work being given in our public schools for general educational purposes?
Answer. Check Yes No.

6. Do you believe that our schools can furnish valuable training of a general industrial nature?
Answer. Check Yes No.

7. Do you prefer to employ boys who have had Industrial Arts work?
Answer. Check Yes No.

8. Do you find that boys who have had Industrial Arts work possess a better grasp of industry and industrial processes than boys who have not had this work?
Answer. Check. Yes No.

9. Do you find boys who have had Industrial Arts work superior to the non-industrial arts pupils in any of the following traits?
(a) Are they more industrious? Ans. Check, Yes No
(b) Do they use better judgment? Ans. Check Yes No
(c) Are they more accurate? Ans. Check. Yes No
(d) Are they more dependable? Ans. Check, Yes No
(e) Do they display greater initiative? Ans. Check Yes No

10. The more common activities found in our school shops are the following:

Bench woodwork; cabinet-making; wood-turning; wood patternmaking; machine shop; foundry; forge; electrical shop; sheetmetal; printing; mechanical drawing; architectural drawing; sketching; etc.

Underscore the above - ONCE those that you consider most valuable for the boy who will enter industry. TWICE those that would be particularly valuable for boys who would enter your employment.

11. In addition to specific manipulative qualifications, which of the following factors do you consider of importance for success in your firm?

Underscore

Speed; Accuracy; Neatness; Effort; Originality; Health; Honesty; Initiative; Personal habits.

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12. What kind of training do you prefer boys to have had before entering your organization?
Check

a. General academic with manual experiences_____
b. General academic without manual experiences_____
c. General academic with specific occupational training_____

13. Do you prefer to furnish the entire industrial training for your employees?
Ans. Check Yes No

14. What is your annual labor turnover? Check:

Small_____ Medium_____ Large_____ Very large_____

15. What are the causes for most of your labor turnover?. . . . . .

. . . . . .

16. What qualities, traits, training, etc; do boys lack whom you employ?

. . . . . .

. . . . . .

17. What qualities, traits, training, etc., do boys lack who seek employment with your firm but who are not hired?. . . . . .

. . . . . .

18. List any suggestions that you have, which may be of assistance to us in better adapting our work to the needs of pupils, for entrance upon occupational life.

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