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Name: Edmund D. Gibson

Institution: Oklahoma A & M College

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Title of Study: Industrial Arts Philosophies in the Small School Curriculum

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Scope of Study: This study deals with the industrial arts philosophies in the small school curriculum. Included in this report is an adequate history of the development of industrial arts education and an evolution of industrial arts objectives. Courses of study for woodworking and mechanical drawing are given along with the factors for determining the content of these courses. Final examinations were developed for these courses with emphasis on teacher-made objective type tests -- simple-recall, completion, multiple-choice, true-false, and matching; also, the evaluative criteria of a good test including validity, reliability, objectivity, administrability, scorability, and economy.

Findings and Conclusions: With the rapid growth and development of industrial arts, there is a need for the industrial arts teacher to adapt the curriculum to meet these changes. In meeting these changes, there should be a closer correlation of the student needs, community needs, and education in general. These needs are very important and are determining factors in developing the curriculum and courses of study for the situation with which the teacher is confronted. Since the testing program is a necessary part of the course of study, the instructor should be able to interpret test results in terms of motivation of students and as a means of evaluating teaching methods and materials.

ADVISOR'S APPROVAL C R Hall

INDUSTRIAL ARTS PHILOSOPHIES
IN THE SMALL SCHOOL CURRICULUM

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By

EDMUND D. GIBSON

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REPORT APPROVED:

C. R. Hill
Report Advisor and Acting Head,
School of Industrial Arts Education
and Engineering Shopwork

L. H. Bingham
Associate Professor,
School of Industrial Arts Education
and Engineering Shopwork

M. R. Lohmann
Dean, Oklahoma Institute of Technology

Robert MacVicar
Dean of the Graduate School

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E.D.G.

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CHAPTER I

INDUSTRIAL ARTS PHILOSOPHIES IN THE SMALL SCHOOL CURRICULUM

Since the latter part of the nineteenth century, industrial arts has rapidly expanded to encompass the entire United States. Industrial arts was probably first centered around the high school level. Today the elementary grades through the college level are included in the industrial arts program. The field of industrial arts has spread from interest in wood, metal and drawing to include a great number of interest areas of American industry. As a result of this rapid growth and expansion, there is a need for closer correlation of the objectives of industrial arts, the development of courses of study and curriculum construction.

Like many beginning teachers of industrial arts, this writer is confronted with the question "How do the objectives and philosophies of industrial arts affect the curriculum of the small school?" The writer has endeavored to apply recognized principles in seeking an answer to this question.

Needs for the Study. The need of incorporating the objectives of industrial arts into the development of courses of study and the improvement of teacher-made objective tests is a necessity with which the industrial arts teacher is confronted. It is the desire of the writer that the results

of this paper will help in the personal improvement as a teacher of industrial arts.

Method of Research. The study of books, periodicals and other literature found in the Oklahoma A. and M. College library was the principal source of information contained in this paper. Books written by recognized educators were used to gather the objectives and the history of industrial arts education.

Definitions of Significant Terms. To clarify the meaning of the significant terms used in this study, the following definitions are given:

> Industrial Arts is a phase of general education that concerns itself with the materials, processes and products of manufacture, and with the contribution of those engaged in industry. The learnings come through the pupil's experiences with tools and materials and through his study of resultant conditions of life. (18, page 15)

> Industrial Education. A generic term including all educational activities concerned with modern industry, its raw materials, products, machines, personnel and problems. It therefore includes both industrial arts, the general education forerunner of or introduction to vocational industrial education and the latter also. (10, page 7)

> Manual Training. Any form of constructive work that serves to develop the powers of the pupil through spontaneous and intelligent self-activity is called manual training. The power of observation is developed through exacting demands upon the senses; the reason, by constant necessity for thought before action; and the will, by the formation of habits, patience and careful application. (16, page 15)

> General Shop. Shops that are planned and equipped to teach two or more distinct types of shopwork

at the same time under one teacher are General Shops. (18, page 15)

Review of Similar Studies. An investigation of library sources was made to determine whether any similar studies of this type had been submitted. This investigation revealed that similar studies were not available; therefore, no studies have been used on the comparative basis.

Available Literature on this Subject. Numerous books and periodicals involving industrial arts objectives and courses of study were found and investigated by the writer. A listing of such material used in compiling this paper is found in the bibliography.

Predicted Views of the Results of this Investigation. The outcomes of this paper, as predicted by the writer, are as follows: (1) To establish the need of declaring definite objectives and applying them into the courses of study, (2) that the information will serve as a guide in constructing teacher-made objective tests, and (3) that this study will serve as an inspiration to the industrial arts teachers for better organized teaching practices.

A preliminary study of the history of industrial arts education and its development in general education is deemed necessary. This will help the reader to better understand and appreciate industrial arts as a definite part of general education.

CHAPTER II

A HISTORY OF INDUSTRIAL ARTS EDUCATION

Industrial arts has found its place in the field of general education. It is a vital part of our present educational system. A survey of the subject should be made to understand and appreciate its importance. The results of past experiences and experiments should be studied to provide a basis for present day beliefs and methods. This should be accomplished in order to provide better education.

Part A

Early History of Industrial Arts

The primitive men learned that there was an important advantage to being skilled with their hands. Their food, clothing, and shelter depended on man's ability to use his hands. It goes back to the time when father taught son all the crafts that he knew.

Primitive Development. Unconsciously the savage used a form of industrial arts or manual training in securing the necessities to build a hut for shelter and weapons to kill wild animals for food and clothing. Later primitive man developed or manufactured crude tools and implements from stone, wood, clay, bone and hides.

In primitive education the father was the teacher and the son was the student; the method was "learn-by-doing".

With the discovery of the control of fire, primitive man entered a new stage of development. Bennett stated the change as follows: "When man gained the power to control fire he passed into another state of civilization--from savagery to barbarism." (4, page 12) This was definitely a turning point in man's occupational aspects, a division of labor; men became smiths, carpenters, masons, miners, weavers and entered many other trades which were brought about by the control of fire.

Religious Teachings. Early education among the ancient Jews was primarily religion; therefore, under the leadership of the church. The young men were taught to work with their hands as well as to believe in Jehovah. Friese states:

> As far back as 2000 B.C. the Jews definitely recognized the social values of handwork. The youths went to school a half of each day to learn the laws. In their Talmund was the commission to all fathers to teach their sons a trade in the other half of the day. (10, page 3)

The Jewish law placed the duty of teaching the son a trade upon the parent. Rabbi Jehuda stated "He who does not teach his son a trade is much the same as if he taught him to be a thief." (15, page 156) They also believed if a boy became skillful in a manual trade that he would become a useful member of society.

The Bible mentions such crafts as carpentry, masonry, shipbuilding, metalworking, weaving, dying and pottery. Jesus Christ learned the carpentry trade from his father.

The monasteries were places of labor and worship. The day was completely divided into periods of labor, worship and reading. Quite different from any religious or educational motive, theirs was, of course, the economic motive. There was the necessity of providing food, clothing and shelter at a very low cost and at the same time being as independent as possible as far as outside supplies were concerned.

> A monastery, like a citadel always besieged, had within its enclosure gardens, a mill, a bakery and various workshops in order that no necessity of material life should occasion the monks to leave its walls. (4, page 18)

The monasteries carried out an extensive agricultural program, constructed bridges and roads, helped build and uphold social order as well as spiritual order.

With the increase of monks the need for more books or manuscripts, since reading was a daily occupation of the monks, rapidly increased. The monasteries met this great demand. The copying of manuscripts became a favored occupation with the monks. To produce a fine manuscript book was looked upon as a special service to Christianity.

The monasteries became an educational system--they became centers of intellectual life and, gradually, centers of instruction for boys. Soon boys were sent to monasteries merely for education and protection.

Apprenticeship. Apprenticeship began with father teaching his own son, and in many cases he added other boys whom

he treated as his own sons. The apprenticeship usually covered a seven year period. During this period the master was to give the apprentice sound moral, religious and social training. He was to teach the mysteries of his trade which included any arts or sciences involved in his craft. Of course, the method of training or instruction varied greatly with masters and trades. The master was to take only a number of boys that he could "keep, inform and teach".

The apprentice's compensation was in two forms: (1) instruction and (2) wages. This was arranged so the apprentice could earn while he learned the trade.

Guilds. The Guild system in France was about the oldest in Europe. The guilds were organized to prevent all other citizens from making or selling the articles in which the members of the guild dealt. Shops carrying on a particular trade such as baking, shoemaking, tailoring, bookbinding or the making of knives, candles, hats and such items were the main organizers of the guild system. In France the guilds were more powerful than in England since they had been supported and encouraged by Colgert, who believed that they kept up the standards of French products.

Martin Luther. Martin Luther was one of the early advocates of a state supported, comprehensive education for all children. He strongly opposed the early monastic and ecclesiastical schools, believing that such schools were

much like prisons. He believed that the young people should be free. He proposed to have the reform to come under the state. This school should be compulsory if necessary and should be open to every boy and girl, rich or poor. He believed in educational equality and education for life. Luther said, "My opinion is that we must send boys to school one or two hours a day and have them learn a trade at home for the rest of the time." (22, page 4)

John Amos Comenius. The first indication of industrial education apparently came during the Renaissance. Such men as More and Rabelais were dissatisfied with the existing political and social conditions of their age. This led to the development of imaginary states where individualism was emphasized. The educational systems of these states were industrial in nature. Agriculture was required in addition to a handicraft. The important motive in this was to give the student a sample of human experiences. Advocates of the sixteenth century of industrial education probably thought the goal was unlikely to be attained.

At the beginning of the seventeenth century a practical view of industrial education was seen. It was used as a method of reform, not a Utopian dream. The first to consider it in this form was Comenius, whose thinking is set forth in the following quotation by Anderson:

> His advocacy of industrial education in school is one of the most striking features of his Great Diactic, a work remarkable for the extent to which it anticipates in the seventeenth

> century the more important educational reforms of the nineteenth and twentieth centuries. He provides for industrial education in three of the four schools which constitute his complete system. (2, page 13)

Francke's Institution. August Herman Francke founded a school in the latter part of the seventeenth century with the primary purpose of providing religious education for the poor and neglected children. This school soon became the most important part of the institution. Out of the school developed an institution not only for the poor, but also a school for the well-to-do, a publishing house and a seminary for training teachers. Francke's pioneering in the industrial education field gave the students tools and school work, not as a part of the regular school work, but for their leisure hours. The curriculum of the institution consisted of mathematics, mechanics, natural sciences and handicrafts. Lathes were bought and installed for the students' use and a master of crafts was employed to give instruction and training on how to use them in woodturning.

Jean Jacques Rousseau. The writings of Jean Jacques Rousseau caused an upheaval in the educational thinking in the eighteenth century. Rousseau believed that experience is the best teacher and experiences should be as naturalistic as possible. He believed a person should discover ideas instead of relying on a master or teacher for information or demonstration.

Rousseau probably did more for the field of industrial education than any other man. His outspoken writings caused him to be driven from his home country. For a man who is credited with starting a revolution in France, he should be given some credit for starting a revolution in the minds of educators of his time. Rousseau felt that an education should be natural and general in nature and should consist of work of the hands and of the mind. Rousseau stated:

> Direct the attention of your pupil to the phenomena of nature and you will soon awaken his curiosity; but to keep that curiosity alive, you must be in no haste to satisfy it. Put questions to him adapted to his capacity, and leave him to resolve them. Let him take nothing on trust from his preceptor, but on his own comprehension and conviction; he should not learn, but invent, the sciences. If ever you substitute authority in the place of argument, he will reason no longer; he will be ever afterwards banded like a shuttlecock between the opinions of others. (4, page 79)

Rousseau values handwork as an aid to intellectual education. Construction makes demands on the intelligence. Rousseau said: "If, instead of making a child stick to his books, I employ him in a workshop, his hands work for the development of his mind. While he fancies himself a workman, he is becoming a philosopher." (2, page 49)

John Henry Pestalozzi. Students of the history of industrial arts have read that Pestalozzi has been called the "Father of Manual Training". Pestalozzi read writings by Rousseau and Comenius and was impressed by them. Pestalozzi

believed in these ideas so much that he established an experimental school in his home. This school and several others failed because of business management and economic reasons. Pestalozzi wrote to a friend concerning his experiences at Stanz as follows:

> I am more than ever convinced that as soon as we have educational establishments combined with workshops, and conducted on a truly psychological basis, a generation will necessarily be formed which, on the one hand, will show us by experience that our present studies do not require one-tenth part of the time or trouble we now give to them. (4, page 116)

One of Pestalozzi's beliefs was that the traditional school subjects could be taught if the students used real objects and did manual labor correctly. This method of instruction is being developed more fully today.

Fellenberg's Institution. This institution was founded by Philip Emanuel von Fellenberg at Hofwyl, Switzerland. The Fellenberg institute probably influenced manual training more than any other educational experiment of the early nineteenth century.

In this institution Fellenberg applied many of the principles of Pestalozzi, but his greatest contribution to education was a system of practical school administration and organization. Schools of the institute varied from the Academy Farm and Trade School, to a School for Girls and a School of Applied Sciences. His schools were designed for the poor as well as the rich. He believed that the two classes should be brought together and taught to appreciate and

respect each other and work together. The students were taught farm work until they were old enough to select a trade. When a student became twenty-one, he left the school prepared to meet the world.

Manual Training in Finland. The people of Finland were promised a new and complete elementary school system by the Russians in exchange for fighting power. The emperor of Russia appointed Uno Cygnaeus to reorganize the elementary school system of Finland. Cygnaeus had studied the ideas of Froebel and Pestalozzi and followed many of their ideas when he outlined his courses. Finland passed a law in 1866 making Sloyd compulsory for all boys in rural schools to take some form of handwork. These schools taught joinery, turning and basket making as manual training courses. Therefore, Finland was the first country to organize such work as a compulsory part of its school instruction.

The Swedish Sloyd System. Otto Salomon was making an attempt in the Scandinavian countries to give instruction in several different arts using a method which was later to be known as the Sloyd System. The outstanding characteristic of this system was the making of useful objects. The processes were to be analyzed and an educational method of presenting the material would then be formed. It had many desirable features which are stated concisely by Anderson:

> The distinctive features of the sloyd system are as follows: first, the emphasis laid upon the mental and physical development of the child rather than upon the mere acquisition of skill in the use of tools; second, the carefully arranged sequence of the exercises and the care taken to adapt them in other respects to the nature of the child; third, the restriction of the work of the pupil to the making of complete articles, valuable for their beauty; fourth, the importance attached to the knife as being the first fundamental tool; and fifth, insistence upon the trained teachers as instructors. (2, page 186)

The first sloyd work was done in the home. It was later begun in the schools. Children were taught skills, arts and discipline. In the beginning the sloyd system required specialists as teachers of sloyd. There was a great desire "to introduce Sloyd into elementary schools generally and experience proved that it would be better to have Sloyd taught by the ordinary teachers of the schools." (25, page 146)

Part B

Development of Industrial Arts in America

While studying the history of industrial arts, the European influence is evident on the early American schools. The two methods of instruction that were used in the early American schools were Sloyd and the Russian systems. Since America was composed of settlers from European countries, many of their practices from their mother countries were mingled to form a method of education in America. With many new ideas and practices, the outcome was an advanced general education.

The Manual Labor Institutes. The first record of shop instruction given in an institution in America was of the "Manual Labor" institutes that started about 1820. The inspiration for these schools was brought over from Fellenberg's academy. One of the first schools in America to introduce a manual labor system of the Fellenberg type was the Maine Wesleyan Seminary. This institution was a preparatory school or academy. The two courses of instruction offered were:

> One designed as preparatory for college and the other intended to give a thorough English education, at the same time furnishing those who are willing to labor with a knowledge of agriculture or one of the mechanic arts. (4, page 185)

The length of these courses was three years. The officials of this school proposed to unite manual labor and study in such a way as to make the students self-supporting and also to pay the operation cost of the school.

The Land Grant Act of 1862. Senator Justin S. Morrill introduced the land grant bill in 1857. This bill was to be of great benefit to the agricultural and industrial classes of society. The bill, after passing both houses, was vetoed by President Buchanan in 1859. The bill was introduced, passed once more and signed by President Lincoln in 1862.

The act granted to several states an amount of public land equal to thirty thousand acres per senator and representative in Congress. This land was to be sold to provide

colleges of agricultural and mechanical arts. The following quotation from the act states:

> The money derived from the sale of these lands was to be appropriated to the endowment, support and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life. (2, page 152)

The Influence and Adoption of the Russian System. In 1868, Della Vos and his associates devised the Russian system of workshop instruction. By the imperial decree of 1868 the School of Trades and Industries, in the city of Moscow, became known as the Imperial Technical School. Bennett gave this description of the school: "The purpose of the school was to train civil engineers, mechanical engineers, draftsmen, foremen, and chemists." (5, page 15) The length of the course of instruction was six years. The idea was to organize instruction shops separate from construction shops.

In an address before the New England Cotton Manufacturers' Association, Runkle, giving an excellent characterization of the system, said:

> Russia, for the first time, has built up a school for instruction--not construction, but instruction--in the use of tools. We think that they make this instruction just as systematic as our instruction in mathematics,

> chemistry, drawing, or any other subject. The instruction is given to classes. (2, page 159)

An exhibit was shown by the Imperial Technical School of Moscow, Russia, at the Centennial Exposition at Philadelphia in 1876. Dr. John Runkle, president of the Massachusetts Institute of Technology, and Professor Calvin Woodward, dean of the Polytechnic faculty of Washington University, saw this exhibit and were greatly impressed by it. Here was the solution to the problem of the distinction between mechanic arts and their application. Runkle wrote this about the Russian system in his 1877-78 annual report to the Board of Education of Massachusetts: "The method is not only educational, but it constitutes the only true and philosophical key to all industrial education." (5, page 321) This report led to the adoption of the Russian system of shopwork and to the establishment of a school in mechanic arts. Under this system, only boys under the age of fifteen could enter. The tuition charge was $150.00 per year.

Woodward gave the following observation of the Russian System:

> To Russia belongs the honor of having solved the problem of tool instruction. Others had admitted that practice in using tools and testing materials should go hand in hand with theory; but Russia first conceived and tested the idea of analyzing tool practice into its elements and teaching the elements abstractly to a class. In their hands, manual tool instruction has become a science. (5, page 322)

The Russian system, when put under the test of actual practice, revealed a defect. The emphasis on the use of tools for skills rather than making functional objects had little attraction for the American youth. School handwork was threatened with a serious decline.

Sloyd in America. Under the circumstances that existed under the Russian system, attention was turned to sloyd. Sloyd, as defined by Anderson, is "a system of hand training which gratified more fully the child's creative impulses and which seemed in other respects better adjusted to the nature of the child." (2, page 178)

The Swedish sloyd system was called to the attention of the American educators by Professor John M. Ordway, a former director of the School of Mechanic Arts in Boston. Ordway's description of the sloyd system was published in 1883 in the Annual Report of the Massachusetts Board of Education.

In 1888, the Sloyd Training School was established in Boston by Mrs. Quincy Shaw, under the direction of Gustaf Larsson, a former student under Otto Salomon. The institution was later taken over by the Boston school system.

With the development in Boston in 1890-91, it became necessary for teachers to acquire certificates to teach sloyd. The requirements for the certificates were as follows:

1. The satisfactory completion of twenty-five models (later increased to thirty-one).
2. Proof of ability to make and use working drawings

and of skill in the sharpening and use of tools.

3. Evidence of teaching ability.

4. A short essay on the theory and educational value of manual training written in class. (5, page 472)

During this time Boston was recognized a a great experimental center of educational handwork in America. The results of the Russian and Sloyd systems, along with the American needs, were brought out in the Massachusetts exhibit at the Columbian Exposition in Chicago in 1893. The methods of teaching manual arts in the elementary grades were greatly influenced by this exhibit.

Manual Training Movement. It should be remembered that manual training was taught in America before the introduction of the Russian and Sloyd systems. However, these systems were very influential upon the type of instruction given in handicrafts in America. In 1880, Washington University opened the St. Louis Manual Training School, under the direction of Dr. Calvin M. Woodward. Freise named Woodward the "Father of Manual Training." (10, page 13) Soon the St. Louis Manual Training School was well known and became the very inspiration for many similar schools. During the decade following 1883, manual training was introduced into the public high schools in more than fifty cities in the United States. This number had more than doubled by 1900.

Manual Arts Movement. In the early part of the twentieth century there was a change taking place in the emphasis placed on manual training and the point of view held toward it. This change was partly brought about by the teachings of John Dewey who expressed a new philosophy of education. The other part of the change was brought about by the psychological and social emphasis placed on hand work. Because of this change, the emphasis in manual training shifted from the mechanical aspect to the consideration of the arts and in allowing students to select and design their own projects. This was the beginning of the manual arts. Charles Bennett, who has promoted the expression "Manual Arts" since 1894, classifies such arts in these five groups: "grafic, mechanic, plastic, textile and bookmaking arts". (6, page 16)

The manual arts have been expanded and more fields of interest added. In 1894, Bennett referred to the movement of manual training as "Manual Arts". Later, Richards suggested that the term of "Industrial Arts" be used. (5, page 453) Definite purposes were organized and a new phase of education had evolved.

Part C

Current Viewpoints of Industrial Arts

As industrial arts gradually developed in America it became a part of general education. This was achieved

through the efforts of many leaders in the fields of industrial arts and general education. To appreciate the development and improvements in industrial arts, it is necessary to become familiar with its current viewpoints and objectives.

Objectives of Industrial Arts. Each subject taught in a public school must have its own specific objectives. Objectives should be applied to the general contents of industrial arts, which includes the basic areas of woodworking, metalworking, drafting, graphic arts, ceramics, electricity, plastics and textiles. Newkirk states: "The industrial arts content is basically for purposes of general education and has the following eight objectives:

1. Self-expression through planning and building useful projects with tools and materials typical of modern industry.
2. Exploring aptitudes and interests in industrial work.
3. An understanding of industry, its workers and processes.
4. Reading and making working drawings for personal use.
5. Choosing wisely the industrial products that are needed for modern living.
6. Adjusting and making minor repairs on the industrial products used around the home and community.
7. Providing craft experiences suitable for hobby interests.
8. Giving social experiences that will develop understanding and ability to work effectively with others. (18, page 44)

It is the opinion of this writer that the objectives of industrial arts or any field of education would be incomplete without the Seven Cardinal Principles of Education. These are as follows:

1. Health
2. Command of fundamental processes
3. Worthy home membership
4. Vocation
5. Civic education
6. Worthy use of leisure
7. Ethical character (8, page 256)

It is important to understand the roles played by some of the leading educators in setting forth objectives and viewpoints in industrial arts.

John Dewey. In 1899 came John Dewey's School and Society placing industrial arts in the elementary school system as a very important part of the curriculum. His viewpoints would place industrial occupations as a method of teaching other subject matter. In discussing The University Elementary School, the laboratory school of the Department of Philosophy and Education, Professor Dewey said:

> A large part of the educational waste comes from the attempt to build a superstructure of knowledge without a solid foundation in the child's relation to his social environment. In the language of correlation, it is not science, or history, or geography that is the center, but the group of social activities growing out of the home relations. It is beginning with the motor rather than

> with the sensory side. . . . It is one of the great mistakes of education to make reading and writing constitute the bulk of the school work the first two years. The true way is to teach them incidentally as the outgrowth of the social activities at this time. (5, page 489)

Dewey's viewpoints in practice would serve as an instrument through which the school would be made a genuine form of active community life instead of a place set apart in which to learn a lesson. (5, page 452)

Charles R. Richards. Richards became known as a result of an editorial published in a 1904 magazine, The Manual Training Magazine, in which he suggested that the term "industrial arts" be used instead of or in reference to "manual training". This is a condensation of Richards' editorial, taken from William T. Bawden's book, Leaders in Industrial Education, which gives Richards' viewpoint as follows:

> As evidence of a change in our point of view, we are leaving behind the purely disciplinary thought of manual training. As long as constructive work represented an instrument to train the mental powers through the hand, manual training constituted a workable and fairly suggestive title; but now we realize that there is no such thing as a training of general powers through special exercises, and at the same time we are beginning to perceive the immense content meaning of our field. We are beginning to see that the scope of our work is nothing short of the elements of the industries fundamental to modern civilization. Instead of devoting our attention to miscellaneous and more or less meaningless projects, we seek in an orderly way to develop insight

> into the basic industries of our times, and knowledge of some of the steps through which these have reached their present form.
>
> Behind every other subject in the curriculum is a body of ideas of fundamental meaning and importance. The industrial arts stand for one of the most vital and important phases of modern civilization. We should discard the term manual training, as both inappropriate and misleading.
>
> In the hope of enlisting consideration and discussion the writer proposes the term, industrial arts, which indicates a definite field of subject matter. The word arts is inclusive of both the technical and esthetic elements, and the qualifying word points specifically and comprehensively to the field of our material. (3, pages 23-24)

Richards was professor of mechanical drawing and woodworking at Teachers' College, New York. While at Teachers' College, Richards included in the curriculum a course in design intended especially for teachers of manual training.

Frederick G. Bonser. In 1913, Bonser, professor of education at Teachers' College, Columbia University, contributed to the School Arts Magazine an article that extended the conception of industrial arts in the elementary school. In considering industrial arts as a school subject, Bonser tried to justify it on the same basis as other subjects. His viewpoint is illustrated by the following:

> From this standpoint, it will at once appear that primary emphasis will not be placed upon the production of industrial commodities, but rather upon intelligence and cultivated taste in their choice and use. In no single field will all of the children function as producers, but from every field worthy of study they will all function as consumers. The

> largest problems are those of developing an appreciative understanding of industry as it is at the present time, realizing its social problems and cultivating intelligent judgment and appreciation in the selection and use of industrial products. (5, page 454)

Bonser's idea of industrial arts was similar to that of Dewey's in that he believed the selection of industrial products was more essential than their production.

The General Shop Concept. The theory of the general shop was first conceived in 1925, but it was not until the early thirties that these shops were installed in the public schools. Newkirk formulated this definition for the general shop: "Shops that are planned and equipped to teach two or more distinct types of shopwork at the same time under one teacher are general shops." (18, page 15) An example of a general shop is one that is equipped to teach metalwork, woodwork, plastics, printing and drafting at the same time under one instructor.

The general shop is well adapted to the junior high school. A student at this age is becoming more conscious of the objects and materials that surround him. The pupil wants to learn about the objects which he comes in contact with in his daily life. A student of this age should try his skill in manipulating tools and materials. The experiences received in the general shop will enable the student to become qualified to better select commodities that he will use in the future.

Industrial Arts in General Education. Industrial arts as a school subject has been incorporated into the curricula of all types of schools--elementary, junior and senior high schools and institutions of higher learning. The following is a statement from an article written by Warner:

> It has had its greatest development, however, on the secondary school level. Here it has passed through two well-defined periods of growth, and it is now in the midst of a third. The first period was manual training where the emphasis was on hand skill, chiefly in woodworking. The second was manual arts where the emphasis, while still on skill, was extended to include the making of both useful and well-designed articles. The third is now on industrial arts, where the intent is to include all of the old that was good, and considerably more to meet the basic needs of everyone in an industrial civilization regardless of age, race, sex, intelligence or social status. (27, page 33)

As a school subject, industrial arts should justify itself on the same basis as other subjects in that it is an aid to general education. Industrial arts contributes to education as a whole, therefore, it is not a trade training program but a part of general education.

Part D

An Evolution of Industrial Arts Objectives

Education in a democracy has certain goals toward which it strives; industrial arts as a part of that education has specific aims whereby it attempts to contribute to the attaining of those goals. The fields of mechanical drawing, woodworking, or any of the other industrial arts areas have

Definite objectives whereby they expect to do their part in meeting the larger goals. Finally, each and every teacher in his daily work should have certain aims whereby he hopes to accomplish a small part of the larger objectives that have been set up for his specific subject, his general field, and all of education.

If this be true, then it is logical to expect that every industrial arts teacher will be able to show how his courses, his daily lessons and even his testing program help in attaining the objectives that have been set up for industrial arts and education in general. This is a real challenge to industrial arts teachers; in fact, it is a challenge that teachers of most subjects do not readily accept.

Much has been written about objectives pertaining to the field of applied and practical arts. In 1933, Voth and Hunter published a bulletin presenting a great number of references to objectives in industrial education. Since that time it would be only safe to assume that an equal or greater number of references would be available. Ericson, in his discussion of the objectives of industrial arts, makes a statement that presents a very good picture of the thinking that has been and is being done in the field of industrial arts aims and objectives:

> An analysis of available published material in this area would lead the reader to the

> conclusion that: (1) there is a concerted, broad, general acceptance of some repeated values of the industrial arts program; and (2) there is great diversity of individual thought and expression concerning emphasis and terminology used in expressing specific aims and outcomes for various courses and offerings. (8, page 247)

To fully understand and appreciate the present objectives of industrial arts, it is necessary to call attention to the objectives set forth by some of the recognized pioneers in the field. Although these objectives varied in wording, the basic results are similar. At this point the writer would like to present those objectives which seemed most appropriate for this paper.

Objectives of Sloyd. According to educators of today, the objectives for sloyd work seem to be very closely correlated with more recent listed objectives of industrial arts. As given by Otto Salomon in 1878, they are as follows:

1. To instill a taste for, and a love of, labor in general.
2. To instill respect for rough, honest, bodily labor.
3. To develop independence and self-reliance.
4. To train in habits of order, exactness, cleanliness and neatness.
5. To train the eye and sense of form.
6. To cultivate habits of attention, industry, perseverance and patience.
7. To promote the development of the physical powers.
8. To directly give dexterity in the use of tools.
9. To execute exact work. (6, pages 67-68)

Warner's Objectives. In 1928, Dr. William E. Warner developed statements of objectives for industrial arts as a school subject in junior high schools. He used the jury technique by which he submitted many claimed industrial arts aims to selected leaders in the field of industrial arts. These persons voted for their favored objectives. In this way, the combined opinions of experts in the field were derived. His statements are as quoted here:

1. Exploratory or finding values which relate to the detection, discovery or tryout of interest and aptitudes.

2. General guidance, both educational and vocational, gained through broad contacts and studies of industrial vocations.

3. Household mechanics or the development of handyman abilities about ability to do useful things.

4. Avocational opportunities for the development of hobbies, or a side-line interest.

5. Formation of desirable personal and social habits and insights which will influence conduct.

6. Consumers or utilizers knowledges and appreciations of the products of industry.

7. Development of a degree of skill with tools and in tool or machine processes commensurate with the ability of the pupil and incidental to the completion of a project or activity which should seem to have "educational" value.

8. Correlation or integration with other studies and interests both in and out of school.

9. Vocational purposes in the definite preparation for a future industrial vocation. Applicable to from 0 to 16 per cent of the average junior high school group where the occasional boy has to drop out of school. (28, page 44)

Friese's Objectives. Friese finds it most convenient and expressive to divide the aims in the junior high school into two groups, namely: (1) manipulative and (2) non-manipulative, as follows:

I. Manipulative Aims
   a. To provide opportunity to make and do things they like to make and do.
   b. To provide training in common skills everyone should possess.
   c. To provide trade exploratory or try-out experiences in typical trades, or assist in finding and testing interests and aptitudes.

II. Justifiable Non-Manipulative Aims
   a. To provide training in industrial art and industrial art appreciation (partially manipulative).
   b. To provide a natural medium for guidance, educational and vocational.
   c. To provide interesting technical information about the occupation or occupations represented in the school shop, and others closely allied.
   d. To provide studies in vocation economics closely related to everyday life.
   e. To provide organized training in reasoning and problem solving. (9, page 292)

Wilber's Objectives. Wilber's objectives are:

1. To explore industry and American industrial civilization in terms of its organization, raw materials, processes and operations, products and occupations.
2. To develop recreational and avocational activities in the area of constructive work.

3. To increase an appreciation for good craftsmanship and design, both in the products of modern industry and in artifacts from the material cultures of the past.

4. To increase consumer knowledges to a point where students can select, buy, use and maintain the products of industry intelligently.

5. To provide information about, and--in so far as possible-- experiences in, the basic processes of many industries, in order that students may be more competent to choose a future vocation.

6. To encourage creative expression in terms of industrial materials.

7. To develop desirable social relationships, such as cooperation, tolerance, leadership and fellowship and tact.

8. To develop a certain amount of skill in a number of basic industrial processes. (29, pages 42-43)

Objectives of Oklahoma Policies Bulletin Committee. The members of the Oklahoma Policies Bulletin Committee were leaders and teachers of the industrial arts field in Oklahoma. The objectives previously stated in this paper, along with many more objectives, were considered in forming the objectives best representing industrial arts in Oklahoma. The Committee agreed upon the following objectives:

1. Industrial Arts is complementary to other school subjects and provides opportunities to apply knowledge learned in other subjects.

2. Develops an appreciation of applied knowledge and skills.

3. Provides a knowledge of industrial drawing, the language of industry, and methods of

expressing ideas by means of drawings.

4. Contributes to later vocational efficiency.

5. Stimulates students' knowledge and appreciation of good design.

6. Instills a satisfaction in personal creative achievements.

7. Develops the ability to analyze a job into its processes and organize them into correct procedures.

8. Contributes to consumer knowledge and induces an appreciation of the value of industrial materials and the need for their conservation.

9. Trains in industrial and home safety (including fire prevention).

10. Acquaint students with industrial information and induce a recognition of the standards of industrial attainment.

11. Develops avocational interest.

12. Trains individuals to be more resourceful in dealing with the material problems of life.

13. Stimulates correct attitudes toward an orderly shop and home and their environment.

14. Aids in making vocational choices.

15. Develops qualities of leadership.

16. Develops cooperative attitudes toward work habits.

17. Develops an appreciation of the dignity and importance of the occupation of one's neighbor. (21, pages 23-24)

Some teachers have a tendency to make a declaration of objectives and aims but ignore them in the teaching process.

However, the teacher who has stated objectives will be more likely to lead his students toward a definite goal than the teacher who neglects to establish definite standards. In many cases, seriously formulated objectives will readily indicate procedures for their attainment.

An attempt has been made in this chapter to relate the history and development of industrial arts education and to establish that industrial arts is an important part of our general education. An evolution of industrial arts objectives has been made in order that the objectives and philosophies of our past and present leaders may strengthen constructive thinking in organizing courses to meet our needs.

CHAPTER III

PROPOSED COURSES OF STUDY

"How am I to choose the proper subject matter for my classes?" "How am I to know what projects my students should make?" "What lessons should I teach?" These are the familiar problems with which the beginning teacher of industrial arts is confronted.

The answer to these familiar questions lies in the selection of lessons, demonstrations, class activities and an adequate testing program which will promote the desired objectives.

There is one primary purpose of all subject matter. That purpose is to achieve the objectives of the particular course in question. Subject matter should be chosen or rejected solely on the basis of whether or not it contributes toward meeting the specific objectives which the teacher has in mind for the particular group of students.

In addition to the general objectives of industrial arts, there are basic factors which should be considered in determining what is to be taught. The following factors may be found in the bulletin Industrial Arts in Oklahoma:

1. Age range of the students
2. Background and abilities of the students
3. Grade level of students

4. Length of class periods
5. Duration of course
6. Facilities of the school
7. Personality and ability of the teacher (21, page 94)

Part A

A Proposed Course of Study for Woodworking

The proposed course of study for beginning woodworking included in this paper is designed for the junior high school or the small rural high school. The units for this study are listed in the break down form under the five headings of: objectives, introduction, presentation, application and outcome. These small teaching units may be planned separately for class presentation, thus enabling the teacher to use an endless variety of techniques and aids to keep the subject lively.

BEGINNING WOODWORK COURSE

Objectives	Introduction	Presentation
1. To know how to use working drawings	a. Relationship to industry b. Occupational possibilities c. Methods of reproducing or blueprinting	a. Need for working drawings b. Use of job sheets c. Reading sketches d. Plan of procedure
2. To know how to read and measure with common measuring tools	a. Historic sketch of measures b. Standards of Measurement Bureau c. Every day use of measurements	a. Common types of measuring instruments used in shop b. Divisions of measures c. Use of illustrations, drawings, etc.
3. To know how to use lay-out tools	a. Ability of forefathers to secure a degree of accuracy b. Opportunities for lay-out men in industry c. Importance of accuracy in industry	a. Explain or demonstrate order or procedure b. Use of job sheets, etc. c. Use of lay-out tools (1) Use of steel square and try square (2) Measuring tools d. Emphasize the need for accuracy
4. To know how to properly use hand planes (common)	a. History of planes b. Importance in care of selecting c. Manufacture of planes	a. Different kinds of hand planes b. How to assemble and adjust c. How to hold and safely manipulate

BEGINNING WOODWORK COURSE (continued)

Application	Outcomes
1. Use working drawings of projects	Ability to read and interpret working drawings
2. Use common measuring instruments in constructing shop projects	Ability to read a rule correctly and to measure with a reasonable degree of accuracy
3. Use lay-out tools in making projects	Ability to use lay-out tools properly and safely
4. Use the planes in planing stock for project	Ability to use planes safely and properly

Objectives	Introduction	Presentation
5. To know how to use hand saws	a. What were saws first made of b. Saws used in industry	a. Kinds of hand saws b. When to use c. Selecting a saw for the job
6. To learn and be able to apply procedure for squaring stock	a. Importance of squareness in home repairs b. Furniture factories	a. Step by step procedure b. Use of tools needed c. Necessity of accuracy d. Significant terms
7. To develop an ability to lay out and transfer designs	a. Design in industry b. Occupational possibilities c. Duplication of many wood items	a. Laying out curves and dividing spaces with dividers b. Review lay-out tools c. Laying out duplicate parts d. Accuracy in laying out and transferring designs
8. To know how to use chisels	a. Early chisels, materials made of b. Use of chisels in home repairs	a. How to select proper chisels for job b. How chisels are driven c. How to manipulate for different types of work d. Types of chisels e. Names of the parts

Application	Outcomes
5. Use the saws to cut stock for projects	Ability to select and use saws properly
6. Apply procedures of squaring stock in constructing project	Ability to square a piece of stock
7. Apply laying out and transferring designs to use on project	Ability to lay out and transfer design with highest degree of accuracy
8. Use chisels where needed in constructing project	Ability to safely and properly use chisels

Objectives	Introduction	Presentation
9. How to use boring tools	a. Historical sketch of boring tools b. Types and kinds of boring tools used in industry	a. How bits and drills are specified b. How and when to use different types c. Necessary part names of braces and bits d. How to place bit in brace e. Vertical and horizontal boring f. Boring without splitting
10. How to sharpen edge tools	a. Sharp tools cut better b. Sharp tools versus dull tools c. Safety	a. How to operate grinder b. How to hold and keep proper angle c. Honing d. How to hold guages and slip stone e. How to sharpen scrapers
11. To know some of the kinds of wood suitable for the school shop	a. How lumber is purchased b. Where grown c. Forest conservation	a. How to recognize woods b. Open and closed grains c. Usefulness as building materials d. Specifications of woods e. Processes of preparing lumber

Application	Outcomes
9. Use of the brace and bits where specified in project	Ability to select and use boring tools correctly
10. Sharpen edge tools	Ability to sharpen edge tools properly
11. Use of some of the various woods in constructing project	Knowledge of some of the woods used in woodworking and also their adaptability to industry

Objectives	Introduction	Presentation
12. Obtain a knowledge of how to order lumber	a. Storage of lumber b. How lumber is shipped c. Occupational possibilities	a. Explain significant terms in ordering lumber b. How to order lumber c. How lumber is sold d. How to use a price list e. Names and specifications
13. How to properly apply shop mathematics	a. Use in industry b. Use in everyday life c. Dependability on mathematics	a. Board measure b. Fractions c. Measurements d. Bills of materials e. Cost sheets f. Geometrical figures and calculations
14. To know how to construct the more common joints in woodworking	a. Purpose of joints b. Examples of use c. Suitability	a. Purpose b. Where and why used c. Importance of accuracy d. Joints of good construction e. Details of form
15. To know how to glue wood together	a. How glue is manufactured b. Sources of glue c. Commercial glues	a. The use of hand screw clamps b. Types of glue and their preparation c. Types of joints
16. How to drive, draw and set nails	a. Value of nails in pioneer days b. First nails or pegs c. Joints instead of nails	a. Selecting the claw hammer and its use b. Types of nails c. How made d. How sold e. The nail set

Application	Outcomes
12. Make bill of materials and stock lists for projects, using correct trade names	Ability to make orders for lumber correctly
13. Shop mathematics applicable to project	Ability to use shop mathematics efficiently Develop habits in procedure
14. Use common joints as specified in construction of project	Ability to construct some of the common joints used in woodwork
15. Use glue where specified in project	Ability to glue wood together properly
16. To use nails if specified in project	An ability to drive, draw and set nails and also to purchase nails

Objectives	Introduction	Presentation
17. How to fasten with screws	a. Historical sketch b. Wood screws c. Materials in screws	a. The types and uses of screws b. How made c. How sold d. How to fasten with a screw
18. How to use the scraping tools	a. Manufacture of tools b. Materials made of c. Relation to industry	a. How to select scraper b. How to use and select files and rasps c. How to sharpen d. Safety in use of files and rasps
19. To know how to sand wood surfaces	a. Furniture repairs b. Source of materials c. Occupational possibilities	a. Types of sandpaper b. How used c. How made and sold
20. To learn to apply stains	a. Manufacture of stains b. Colors and design	a. Types of stains b. Selecting proper stain c. Application of stains
21. To learn how to apply shellac	a. History of shellac b. Source of shellac c. Why use shellac	a. Kinds of shellac b. Origin of shellac c. Cleaning and caring for shellac brushes
22. How to apply varnish	a. Furniture finishing as an occupation b. Methods in industry c. Use in the home	a. Selecting good brush b. Selecting good varnish c. Importance of finish room d. Caring for brush and varnish

Application	Outcomes
17. Select and fasten with screws if specified in project	An ability to select and fasten with screws
18. Use scraping tools where required on project	Ability to use and care for scraping tools properly
19. To sand project in preparation for finish	An ability to buy, select and use sandpaper correctly
20. Apply stain to project if needed	Ability to select and properly use stains common to woodwork
21. Apply shellac as steps in finishing project	Knowledge of shellac and its application
22. Apply varnish as steps in finishing project	Knowledge of varnish, its use and application

This course of study is a tentative outline and should be flexible enough to meet situations and problems as they arise. Also, it should be adaptable to the immediate needs of the student, the school, the community and education in general.

This course of study can be adapted to any of the state adopted textbooks, however, this writer prefers Units in Hand Woodworking, by Douglass and Roberts, published by the McCormick-Mathers Publishing Company.

Selecting Projects. To the industrial arts teacher a project is a vehicle through which instructional content is presented and other industrial arts objectives attained. To most students it is the one reason he enrolled in the course; he wants to make some worth-while project.

It is the responsibility of the teacher to select, or permit the student to select, a project which is appropriate. However, important determining factors should be considered to ascertain a project's appropriateness. Wilber states these factors as follows:

1. It should contribute to the attainment of at least one major objective.
2. It should have student interest.
3. It should be within the student's ability.
4. It should present a challenge.
5. It should be well designed.

6. The student should be able to complete it in a reasonable length of time.

7. It should be economical of material.

8. It should illustrate some industrial or craft process which is new to the learner.

9. It should allow students to cooperate and work together on a common problem. (29, page 153)

The following projects are only suggested projects for the junior high school student in beginning woodwork.

Book ends	Magazine holder
File box	Wall shelf
Small table	Silverware tray
Lamp stand	Shoe shine box
Table lamp	End tables
Book rack	Card tables

The writer recommends that a basic project be assigned at the beginning of the semester. This enables the teacher to control the development of basic tool skills and procedures. The selection of this project is left to the discretion of the teacher.

Part B

A Proposed Course of Study for Mechanical Drawing

Drawing should be considered a communication subject, like reading and writing. Drawing was used as a means of communication before the alphabet was developed and served as a basis for it.

In keeping with the overall objectives of industrial arts, mechanical drawing must have direct relation to the problems of living.

The proposed course of study included in this paper is designed as an introductory course in mechanical drawing. It is intended to meet the needs of the junior high or small high school. The units for this study are listed in the break down form under the four headings of teaching units, introduction, application, and presentation. This break down will enable the teacher to develop lesson plans or instructor's guide sheets from the proposed teaching units. The declaration of objectives as established by the American Vocational Association have served as a guide in developing these teaching units. Those objectives are as follows:

1. To become better acquainted with the basic principles of design and how to apply them.
2. Learn to read and interpret sketches and working drawings.
3. Learn to interpret the symbols used in common types of drawings.
4. Develop a certain amount of skill in the basic fundamentals of drawing.
5. Learn to recognize and practice good drawing techniques.
6. Increase consumer knowledge.
7. Obtain experiences in, and information about, the various types of drawings used in industry, in order that a more intelligent choice of a vocation may be made. (1, pages 46-47)

The book used in developing the following course of study in mechanical drawing is Mechanical Drawing by Thomas E. French and Carl L. Svenson. This book is also the writer's preference as a textbook for this course of study.

This book was used in the careful study in the selection of problems, suitable for the proposed course of study, which the writer feels will attribute to the attainment of the course objectives.

COURSE OF STUDY IN MECHANICAL DRAWING 1a

Teaching Units	Introduction
1. Language of Drawing	A sound motion picture on the language of drawing to stimulate the interest of the students
2. The Theory of Shape Description	The three-dimensional picture of the eye Properly drawn lines describe more accurately and more clearly than a photograph or a written description
3. Sketching - Isometric to Orthographic	Early man's use of sketching or drawings as a means of conveying ideas
4. Use and Care of Drawing Instruments, supplies, Scale and Other Measuring Devices	Discuss materials and industries involved in the manufacture of the working equipment
5. Lettering, Alphabet of Lines, and Symbols	Historical sketch of lettering Field for lettering Standards of the symbolic language
6. Graphic Solutions	Relations of oral and graphic interpretations Graphic solutions related to other academic subjects
7. Problems in Shape and Size Description	Discuss common means of conveying size and shape description

COURSE OF STUDY IN MECHANICAL DRAWING 1a (continued)

Application			Presentation
Reference Page	Problem Number	Page	
1. 1-2			Orientation of the language of drawing
2. 33-42			Describing objects by views The relations of views The theory of relations of views
3. 51-55	Fig. 5.7	56	Purpose and use of sketches
	Fig. 5.8	57	Freehand sketching
	Fig. 5.9	58	Types of sketches
	Fig. 5.10	59	
4. 4-19	Fig. 16.1-16.11	200-202	The selection, use and care of the basic drawing instruments and materials
5. 20-31	44-50	282	Styles of lettering and numerals
102-110	Fig. 9.8	110	Lettering devices and guides Size and spacing of letters The alphabet lines
6. 200-209	12,16,18,20	280	Common symbols
200-209-	23-26	280	Demonstrate the construction
200-209	10	277	and application of geometric
200-209	28	280	figures
7. 40-50	61-64	286	Review the theory of size
40-50	79-82	289	and shape description
40-50	87-90	290	Principles of size and
40-50	101-104	292	shape description
40-50	110	293	Conveying ideas by means of size and shape description

COURSE OF STUDY IN MECHANICAL DRAWING 1b

Teaching Units	Introduction
8. Purpose and Use of Section Half Full Revolved	Means of showing interior construction of objects Show models of objects that demonstrate cut-away sectional views.
9. Auxiliary View	Auxiliary views are supplemental views taken from a different direction to aid the regular views in showing more clearly the real shape of the object.
10. Revolutions	Common machines that involve the principles of revolution
11. Developments and Intersections	Discuss common examples of development and intersections. Relation to occupational fields
12. Pictorial Drawing Isometric Oblique Cabinet Perspective	Use of pictorial drawings in industry Occupational possibilities

COURSE OF STUDY IN MECHANICAL DRAWING 1b (continued)

	Application			Presentation
	Reference Page	Problem Number	Page	
8.	60-69	151	307	Types of sectional views; half-sections, broken-out sections, revolved sections and full sections Symbols used in sectioning; crosshatching, broken lines, reference letters, etc.
9.	70-76 70-76 70-76	156-157 160-162 173-175	314 314 320	Principles of auxiliary views When are auxiliary views used Types of auxiliary views; right, left, front and rear
10.	77-79 77-79 77-79	177 179 184	323 323 323	The rule of revolutions Vertical axis of revolution Revolutions about a horizontal axis Practical revolved views Successive revolutions
11.	217-227 217-227 229-236 217-236	439 451 472-473 488	394 395 400 404	Developments and intersections of: cylinders, prisms, pyramids and cones Cylinders and prisms, cylinders and cones and of planes and curved surfaces Development of measure Seams and laps
12.	148-157 148-157 158-160 160 160 161-165	327-331 356-357 371-373 287 293 376-383	372 379 386-387 353 356 388	The pictorial views and their principles of application: isometric, oblique cabinet, perspective drawing

Mechanical Drawing Ia has been designed to introduce the basic principles and essentials of drawing. Mechanical Drawing Ib is a continuation of Mechanical Drawing Ia. Through this course the student will become familiar with the different types of drawing used in the industrial world. Whether or not the student desires to pursue further drawing, he will have an enriched knowledge of mechanical drawing that is needed in life today.

Industrial arts is an essential part of every modern school program. Industrial arts is something more than "making things or projects". If the natural interest of boys and girls is to be directed into the most profitable experiences, content must be carefully selected and organized. Objectives must be established and the testing program will be directly related to the course objectives which have been set up.

CHAPTER IV

TESTS AND OBJECTIVES OF TESTING

The need of definite objectives in the mind of the instructor before a course is begun has been stressed previously. With these definite objectives established and the course of study developed, there is a need for a testing program. This program will serve as an instrument for the purpose of determining whether the students are, in actual practice, realizing those objectives.

This section of the paper is intended to emphasize the teacher-made objective type tests which are most commonly used by the instructors of industrial arts.

Part A

Test Objectives

The writer found several sets of test objectives listed in different books. Due to the scope of this paper, only those pertinent to this field were chosen.

Michaels and Karnes give their interpretation of test objectives under eleven different statements as follows:

1. The development of effective methods of thinking.
2. The circulation of useful work habits and study skills.
3. The inculcation of social habits.
4. The acquisition of a wide range of significant interests.

5. The development of increased appreciation of music, art, literature and other aesthetic experiences.

6. The development of social sensitivity.

7. The development of better personal social adjustment.

8. The acquisition of important information.

9. The development of physical health.

10. The development of a consistent philosophy of life.

11. The development of useful manipulative skills. (17, page 93)

Newkirk and Greene present their objectives in the following statement:

> Industrial arts teachers need reliable measuring instruments in order to give more adequate educational guidance, to evaluate personality traits, to motivate learning, to study the effectiveness of teaching material and methods, and to measure pupil progress more accurately through the establishment of more definite standards of performance and through the diagnosis of pupil difficulties. (19, page 1)

Test objectives as suggested by Hjerstedt are stated as follows:

1. To give an accurate measure of that trait which it is designed to measure.

2. To make possible a diagnosis of individual weakness and strength of pupils, of the adaptability of the subject matter and of the appropriateness of the method used.

3. To stimulate proper study and habits of study.

4. To stimulate and guide proper methods of teaching.

5. To grade the schools fairly and accurately.

6. To measure the progress of pupils in their studies.

7. To measure the ability of the teacher.

8. To find a practical method of supervising study and teaching how to study.

9. Different schools can be rated more accurately by using the new method of testing.

10. To eliminate irresponsible rating, which may work serious injustice to the children.

11. To measure progress of class and individual pupils.

12. To compare classes with each other and with the standard or norm.

13. To classify pupils on the basis of ability.

14. To determine the relative merits of two methods of teaching the same subject.

15. To set up different and better grades of attainment for teachers and pupils alike.

16. To discover individual abilities and interests. (14, page 422)

Definition of Testing Terms. To facilitate the study of testing in industrial arts, certain significant terms may need to be clarified and defined. Quoted from the writings of recognized specialists in the field of test and measurements and industrial arts, these definitions are given:

> Evaluate is to test, measure and appraise the whole child by the use of tests and a wide variety of non-test techniques and devices. (13, page 617)

> Evaluation is the process of ascertaining or judging the value or amount of something by careful appraisal. (11, page 156)
>
> Test. Generally speaking, a test is a measuring instrument used for the evaluation of a knowledge, quality or ability. (20, page 12)
>
> A test is any type of instrument for measuring any mental ability. (12, page 383)
>
> To measure means to determine the magnitude of a property in terms of a suitable unit. 'Anything that exists at all exists in some quantity and anything that exists in some quantity is capable of being measured'. (17, page 19)
>
> Objectivity. By objectivity in a measuring instrument is meant the degree to which equally competent users get the same results. (24, page 88)

With these test objectives in mind the teacher will be better equipped to develop tests that will serve as a measuring instrument. However, the characteristics of a good test will require additional consideration by the teacher.

Part B

The Criteria of a Good Test

The problem of giving tests and grading examination papers confronts the teacher of industrial arts, as well as other teachers. The teacher needs to determine what to measure and then secure a test that will measure what it is supposed to measure. A good test should possess the following characteristics: validity, reliability, objectivity, administrability, scorability and economy. 2.

The industrial arts teacher should understand these characteristics to effectively select, construct and use test suitable for the testing situation at hand. The interpretation of a good test as given by Micheels and Karnes is stated here:

1. A good test must actually measure what it is supposed to measure (validity).
2. It must do this accurately and consistently (reliability).
3. It must be fair to the students (objectivity).
4. It must pick out the good students from the poor (discrimination).
5. It must be long enough to do the job (comprehensiveness).
6. It must be easy to use (ease of administering and scoring). (17, page 104)

All these factors should be present in a good test. They are interdependent. They affect each other.

Validity. Ross states, "By validity is meant the degree to which the test or other measuring instrument measures what it claims to measure. In a word, 'validity' means 'truthfulness'." Validity is the most important characteristic of a good test. Unless a test is valid it serves no useful purpose. Validity of a test may be determined statistically by comparing the scores yielded by a standardized test that has already been validated and a test in the same subject matter and grade level. If the scores of the

two tests correspond, the test of unknown validity is said to be valid because of the agreement of its scores with those yielded by the valid test.

Reliability. A test is reliable if it measures consistently what it is designed to measure. When a test is given two times within a short period of time and the resulting scores are practically the same, the test is said to have reliability. Reliability is synonymous with consistency.

The reliability of a test can generally be increased either by careful selection of the test items or by a more adequate sample of the subject matter to be tested.

Concerning the reliability of tests, Louis V. Newkirk and Harry A. Greene state: "The reliability of a test may be thought of as the consistency with which it performs." (20, page 24)

Objectivity. An objective test is one so constructed that the personal judgment of the one scoring the test cannot influence the grading or the final score. Objectivity in a test helps eliminate personal opinion, bias or judgment of the person who scores it. Equally important to the test being objective in giving and scoring is the fact that each item should lend itself to only one interpretation. Only one answer can be given, there should be no questions that are partly right and partly wrong.

Regarding the objectivity of tests, Newkirk explains:

> A test is highly objective when the personal bias has been excluded in scoring the answers. The less writing the pupil has to do, the more objective the test. Complete objectivity is obtained where the pupil simply underlines one response out of a number presented; checks or writes "true" or "false"; inserts the number of the correct response; and the like. (18, page 173)

Administrability. Ease of administration should be evaluated from the standpoint of the student as well as the teacher. Group tests are generally more easily given than individual tests. All instructions for taking the test should be simple, direct, clear and should appear on the test itself. In most cases, the teacher should supplement the written instructions by oral instructions. The type of response called for should be illustrated clearly on the test by sample questions.

F. Theodore Struck states in his book:

> "Ease of administration", broadly interpreted, includes the ease with which the test is prepared, given and interpreted. Some tests, like "multiple choice", are relatively difficult to prepare but easy to give and score. Others, like the essay type are easy to prepare and hard to score. (29, page 434)

Scorability. The response of a test should be easy to score. Among the various methods employed to aid in scoring tests are the use of prepared keys, the use of separate answer sheets to be scored by hand, and the use of separate answer sheets to be scored by a machine.

Henry Daniel Rinsland asserts:

> The very heart of an objective test is the method of scoring. Often the only difference between a subjective and an objective test is the method of scoring. Perfect objectivity exists when many people can score the same test and get exactly the same number of points. A key of answers, which must contain all possible correct answers, must also specify what is counted and how much. (23, page 269)

Economy. Economy, although not one of the major factors of a good test, needs to be considered. All cheap tests are not economical forms of testing, neither are costly instruments and methods necessarily the best.

Costs of testing can be kept low without reducing the effectiveness of the testing and measuring program. By means of the mimeograph or other reproduction methods, the teacher can prepare informal objective tests. The use of scoring keys saves time, thus resulting in financial saving. Therefore, a sufficiency or deficiency of funds need not be the sole determining factor for an effective testing program.

The writer has attempted to familiarize the reader with some of the essential characteristics of a good test. A good test should be valid, reliable, objective in nature, easy to administer and score and economical to use.

Part C

Types of Objective Tests

An objective test is an examination in which every response is either correct or incorrect. A properly constructed objective test is not influenced by subjective opinion or personal judgment in its scoring.

Theodore Struck defines an objective test as follows:

> An objective test is one which is free from personal judgment in scoring. It is a test so devised that the same score will be given by any competent examiner or by the same examiner at any time. (26, page 426)

Securing Objectivity. Objectivity, the quality in a test contributing directly to validity and reliability, may be secured in several ways. First, the directions need to be briefly and completely stated with a sample illustration indicating the type response needed. Second, the questions should not be debatable in any way. Third, the phrasing of the questions should be clear and certain with no opportunity for wrong interpretation by the student or different examiners.

Types of Objective Tests. The types of objective tests most commonly prepared and used are:

1. Recall types
   a. Simple-recall questions
   b. Completion exercises

2. Recognition types
   a. True-false
   b. Multiple-choice
   c. Matching exercises

The type of objective tests to be used depends upon the measurement needs in the classroom and shop for the particular circumstance. The different types of objective tests should be studied carefully by the instructor so that he can readily select the type most suitable to the information being tested.

Recall Exercises. In the simple recall type of test the response must be recalled by the pupil from his past experience. The simple recall test and the completion test are the most common forms. The simple recall item is usually considered as requiring the student to supply a missing word, figure or date. The word may come at the end of the statement, may be an answer to a direct question, or it may be associated with another word or phrase. The answers are not given or suggested but must be recalled. There is practically no difference between the simple recall and the sentence completion. The sentence completion requires a key word or words which make the statements complete, meaningful and true. The simple recall does not require the completion of a sentence.

SIMPLE RECALL SAMPLE

Your name_____ Date_____ Score___

Directions: Answer each of the following questions by writing the correct answer in the blank space at the left. The first question is answered as an example.

(George Washington) 0. Who was the first president of the United States?

_____ 1. What is the natural color of shellac?

_____ 2. From what wood are dowels made?

COMPLETION SAMPLE

Your Name_____ Date_____ Score____

Directions: Each of the blank spaces in the following statements indicates the place of an omitted word. Complete the meaning of each statement by writing the correct word in the corresponding numbered blank at the left. The first item is answered as an example.

(George Washington) 0. The first president of the United States was _____.

_____ 1. When pounding with a mallet it is necessary that a ____ chisel should be used.

_____ 2. The hammer used for driving and pulling nails is called a _____hammer.

Recognition Exercises. Recognition exercises are those in which the student chooses the correct or best response from two or more possibliities that are listed. True-false, multiple-choice and matching items are examples of the recognition type.

The true-false test is probably the best known and the most widely used alternate response type test. Fundamentally the true-false item consists of a declaratory statement that is definitely either true or false. The student decides which of the two possible choices is the correct one and places his answer accordingly.

TRUE-FALSE SAMPLE

Your name_____ Date_____ Score____

Directions: Some of the following statements are true and some are false. If the statement is true place a plus sign in the blank space at the left. If the statement is false place a zero in the space. The first item is answered as an example.

0 0. Thomas Jefferson was the first president of the United States.

_____ 1. Filing a saw will prevent it from binding.

_____ 2. The plane iron is ground at approximately 25 degrees.

A multiple-choice item consists of a question or incomplete statement followed by several possible answers. The student indicates the correct response by underlining or checking the answer or by placing the number of the correct response in accordance with the directions given.

MULTIPLE-CHOICE SAMPLE

Your name_____ Date_____Score____

Directions: Each of the questions or incomplete statements listed below is followed by several words, phrases or series of numbers. From these, you are to choose the one which answers the question or completes the statement

correctly. Place the letter of that word or phrase (A, B, C, D) in the numbered blank space at the left of the item. The first item is answered as an example to follow.

C 0. The first president of the United States was (A) Jefferson (B) Adams (C) Washington (D) Franklin.

_____ 1. The plane that does not have a plane iron cap is the (A) circular (B) jack (C) block (D) jointer, plane.

_____ 2. Which of the following saws has the finest teeth? (A) crosscut (B) dovetail (C) turning (D) backsaw

Matching, as the name implies, is the alternate response type requiring the matching of two or more sets of material in accordance with given directions. The common matching item consists of two columns of words or phrases. The student is required to match each item in one list with the item in the other list to which it is most closely related.

MATCHING SAMPLE

Your name_____ Date_____ Score_____

Directions: The two columns below contain related words and phrases pertaining to mechanical drawing. Select the word in the right hand column that is most closely related to the descriptive phrase in the left hand column and place the identifying letter in the blank space provided. The first item is answered as an example.

B	0.	The first president of the United States	A. Dewey B. Washington C. Franklin

_____1.	An irregular curve	A.	Lettering
_____2.	A measure for laying off distance	B.	Scale
		C.	Arc
_____3.	Denotes a type of drafting pencil	D.	Protractor
_____4.	Single stroke Gothic	E.	French curve
_____5.	Instrument for measuring angles	F.	4-H

The test objectives, criteria of a good test, and types of objective tests have been set forth and stressed in this chapter. The writer has carefully considered and has attempted to incorporate these principles in developing the following tests in woodworking and mechanical drawing.

FINAL TEST

WOODWORKING

Your Name_____ Date_____ Score____

TRUE-FALSE

Directions: Some of the following statements are true and some are false. If the statement is true, place a plus sign in the blank space at the left. If the statement is false, place a zero in the space. The first item is answered as an example.

__0__ 0. Jefferson was the first president of the United States.

_____ 1. As a rule softwoods are lighter than hardwoods.

_____ 2. Quarter-sawed lumber warps less than plain sawed lumber.

_____ 3. Hardwoods are sawed into standard widths and lengths.

_____ 4. Plywood is stronger than plain wood of equal thickness.

_____ 5. Open grain wood does not require a filler.

_____ 6. The tongue of the framing square is longer than the blade.

_____ 7. A 12 point saw cuts smoother than the 8 point saw.

_____ 8. Filing a saw will prevent it from binding.

_____ 9. The coping saw teeth point in the direction of the handle.

_____ 10. For accurate measurement place the rule on its edge.

_____ 11. The plane iron is ground to an angle of approximately 25-30 degrees.

_____ 12. The jointer plane and the jack plane are the same.

_____13. The best broad surface is selected as the working face.

_____14. It is best to bore a hole entirely through from one side with an auger bit.

_____15. Use the try square to test long boards for wind.

_____16. A chamfer and a bevel are the same.

_____17. Gimlet bits are designed to drill holes for screws.

_____18. The expansive bit has an adjustable cutter which makes it possible to bore holes of various sizes.

_____19. The round head screw should be countersunk.

_____20. The number 7 screw is larger than the number 8.

_____21. Screws have more holding power than nails.

_____22. It is possible to tighten a screw too tight.

_____23. The oval head screw is not used in fastening hinges to wood.

_____24. An 8-D nail is three inches long.

_____25. Nails have more holding power when driven in at an angle.

_____26. A nail set is used to set a common nail below the surface of a board.

_____27. Joints are usually used in furniture for ornamental purposes.

_____28. The butt joint is the most simple type of joint to construct.

_____29. The miter joint is commonly used in constructing picture frames.

_____30. The dovetail joint is very good for drawer construction.

_____31. The tenon should be cut before the mortise.

_____32. Number 1 sandpaper is coarser than number 0.

_____33. Stain will easily penetrate glue that has been left on the wood surface.

_____34. Stick shellac can be obtained in only one color.

_____35. Oily rags should be kept in a metal container.

_____36. Shellac is often used as a sealer.

_____37. All woods require a filler.

_____38. A synthetic type of varnish is alkyd.

_____39. Two coats of lacquer or varnish are usually sufficient.

_____40. Rottenstone is a type of rubbing compound.

MULTIPLE-CHOICE

Directions: Each of the questions or incomplete statements listed below is followed by several words, phrases or series of numbers. From these, you are to choose the one which answers the question or completes the statement correctly. Place the letter of that word or phrase (A, B, C, D) in the numbered blank space at the left of the item. The first item is answered as an example.

__C__ 0. The first president of the United States was (A) Jefferson (B) Adams (C) Washington (D) Lewis.

____1. The moisture content of wood used for cabinet making should be approximately (A) 2% (B) 8% (C) 16% (D) 24%.

____2. In what order should the dimensions of stock in a material bill be listed: (A) Length, width, thickness (B) Thickness, width, length (C) Width, thickness, length (D) None of these.

____3. Which of the following saws has the finest teeth? (A) Dovetail (B) Crosscut (C) Turning (D) Backsaw

____4. Which of the following planes does not have a cap iron? (A) Jack (B) Circular (C) Block (D) Smooth

____5. Which of the following planes is best to use in removing the waste of dadoes? (A) Bullnose (B) Block (C) Modeling (D) Router

_____ 6. Which of these tools is best for checking the angle of chamfers and bevels? (A) Marking guage (B) Foot square (C) Try square (D) T bevel

_____ 7. The part of the brace into which the tang of the bit fits is the (A) ratchet (B) chuck (C) socket (D) none of these.

_____ 8. Which of these abbreviations pertain to screws? (A) F. H. B. (B) F & S (C) S2S (D) R & H

_____ 9. Which of the following nails has the largest head? (A) Finish (B) Casing (C) Common (D) Box

_____10. A joint commonly used in making a stepladder is the (A) cross lap (B) dado (C) butt (D) none of these.

_____11. A glue that should be applied while hot is (A) animal glue (B) casein (C) fish (D) none of these.

_____12. The cheeks of a tenon should be cut with which of the following saws? (A) Rip (B) Crosscut (C) Back-saw (D) Compass

_____13. Which of the following is the finest size of sand-paper? (A) No. 2 (B) No. 1 (C) No. 2-0 (D) No. 4-0

_____14. Which of the following glues is waterproof? (A) Casein (B) Fish (C) Animal (D) None of these

_____15. Angle irons are usually made at an angle of (A) 180 degrees (B) 90 degrees (C) 60 degrees (D) 45 degrees.

_____16. Which of the following stains is easiest to apply? (A) Oil (B) Water (C) Spirit (D) None of these

_____17. An example of open grain wood is (A) gum (B) birch (C) mahogany (D) maple.

_____18. Linseed oil is made from (A) flax seed (B) cotton seed (C) crude oil (D) none of these.

_____19. An ingredient of varnish remover is (A) benzine (B) turpentine (C) linseed oil (D) none of these.

_____20. Which is best to use for removing a lacquer finish? (A) Lye water (B) Lacquer thinner (C) Varnish remover (D) None of these

MATCHING

Directions: The two columns below contain related words and phrases pertaining to woodworking. Select the word in the right hand column that is most closely related to the descriptive phrase in the left hand column and place the identifying letter in the blank space provided. The first item is answered as an example.

B	0.	The first president of the United States	A. Dewey B. Washington C. Franklin
_____	1.	A grade of lumber	A. Kerf
_____	2.	Term involving plywood	B. Denatured
_____	3.	Unit of measure by which lumber is sold	C. F. A. S.
_____	4.	Closet linings	D. S2S
_____	5.	Tool handle material	E. Redwood
_____	6.	Imitation for walnut	F. Red gum
_____	7.	Applies to screws	G. Bd. Ft.
_____	8.	Plane	H. 4-0
_____	9.	3 pound cut	I. Putty
_____	10.	Alcohol	J. GlS
_____	11.	Designates nail sizes	K. Penny
_____	12.	Brushes	L. Silex
_____	13.	Cut made by a saw	M. Cu. Ft.
_____	14.	A material used in paste filler	N. Cedar
_____	15.	A fine grade of sandpaper	O. Bristles
			P. Hickory
			Q. F.H.B.
			R. 1-0
			S. Shellac
			T. Throat

COMPLETION

Directions: Each of the blank spaces in the following statements indicates the place of an omitted word. Complete the meaning of each statement by writing the correct word in the corresponding numbered blank at the left. The first item is answered as an example.

(George Washington) 0. The first president of the United States was _____.

_____ 1. A chamber artificially heated and used for drying large quantities of lumber is called a _____.

_____ 2. The number 10 stamped on the heel of the saw indicates the number of _____ per inch.

_____ 3. The part of the plane that clamps the plane iron in place is called the _____.

_____ 4. Dowels are made of _____ wood.

_____ 5. The three methods of cutting veneers are sawing, slicing and _____.

_____ 6. The number on the tang of an auger bit indicates its diameter in ____.

_____ 7. The formula for figuring board feet is _____.

_____ 8. The bit that may be adjusted to bore various sized holes is called a _____ bit.

_____ 9. How many diameters of screws are there?

_____ 10. Screws are packed in boxes containing _____.

_____ 11. Lag screws are driven in place with a _____.

_____ 12. When pounding with a mallet it is necessary that a _____chisel should be used.

_____13. Small finish nails 1/2 inch in length are called _____.

_____14. The tool used as a guide for marking the shoulders of a tenon is the _____.

_____15. Vises, braces and clamps are classified as _____ tools.

_____16. What is the name of the flat steel scraper that does not have a frame?

_____17. The stain that raises the grain of wood most is _____ stain.

_____18. Brushes which have been used in shellac should be cleaned with ___.

_____19. Lacquer brushes should be cleaned with _____.

_____20. Paint and varnish brushes should be cleaned with _____.

KEY

FINAL TEST
WOODWORKING

True-false	Multiple-choice	Matching	Completion
1. ✓	1. B	1. C	1. kiln
2. ✓	2. B	2. J	2. points
3. O	3. A	3. G	3. cap iron
4. ✓	4. C	4. N	4. birch
5. O	5. D	5. P	5. rotary
6. O	6. D	6. F	6. sixteenths
7. ✓	7. B	7. Q	7. $\frac{T \times W \times L}{144 \text{ (or } 12)}$
8. O	8. A	8. T	8. expansive
9. ✓	9. D	9. S	9. 31
10. ✓	10. B	10. B	10. one gross
11. ✓	11. A	11. K	11. wrench
12. O	12. C	12. O	12. socket
13. ✓	13. D	13. A	13. brads
14. O	14. A	14. L	14. marking guage
15. O	15. D	15. H	15. holding
16. O	16. A		16. hand scraper
17. ✓	17. C		17. water
18. ✓	18. A		18. alcohol
19. O	19. D		19. lacquer thinner
20. O	20. B		20. turpentine
21. ✓			
22. ✓			
23. O			
24. O			
25. ✓			
26. O			
27. O			
28. ✓			
29. ✓			
30. ✓			
31. O			
32. ✓			
33. O			
34. O			
35. ✓			
36. ✓			
37. O			
38. ✓			
39. ✓			
40. ✓			

FINAL TEST

MECHANICAL DRAWING

Your name_____ Date_____ Score___

TRUE-FALSE

Directions: Some of the following statements are true and some are false. If the statement is true, place a plus sign in the blank space at the left. If the statement is false, place a zero in the space. The first item is answered as an example.

__0__ 0. Thomas Jefferson was the first president of the United States.

____1. Mechanical drawing is the universal language of industry.

____2. A ruler is the same as a scale.

____3. A 3H pencil is harder than a 5H pencil.

____4. Drawing paper is cut perfectly square.

____5. The dividers are used to transfer distances.

____6. The bottom edge of the T square is never used to draw horizontal lines.

____7. A drawing board does not need to be square.

____8. All lettering should be as wide as they are high.

____9. Hidden lines are made of short and long dashes.

___10. The center lines and dimension lines may properly be drawn with a 2H pencil.

___11. Extension lines should not touch the view.

___12. Dimensions are placed on the view wherever convenient.

___13. Dimension lines may cross.

___14. The views describe the shape of the object.

___15. A working drawing need not be fully dimensioned.

___16. The size of the object is described by its dimensions.

___17. Parallel lines are lines that are at right angles to each other.

___18. An isometric drawing shows only one face of the object.

___19. Horizontal lines are sketched from left to right.

___20. When a circle is drawn in isometric, it appears as an ellipse.

___21. Orthographic drawings have only two views.

___22. A freehand drawing should be reasonably accurate.

___23. Orthographic projection is used to describe the shape of an object.

___24. In freehand drawing the views may be placed in any convenient position.

___25. The top view is placed above the front view.

___26. A line tangent to a circle has two points in common.

___27. To bisect means to divide into two equal parts.

___28. The diameter of a circle is one-half the radius.

___29. A regular hexagon has two diameters.

___30. Auxiliary views aid regular views in showing more clearly the shape of the object.

___31. The real length of the edge is unimportant in development.

___32. The intersection of a cone and a cylinder may be found by passing planes parallel to the horizontal plane.

___33. Cutting planes are used to solve intersections.

___34. The pattern of a cone is developed in the same manner as the pyramid.

___35. Cabinet drawings are easier made than isometric drawings.

____36. Isometric drawings are made with the aid of a 45 degree triangle.

____37. A perspective drawing shows an object as viewed from one point, the eye of the observer.

____38. The auxiliary view is extremely important in the making of the development.

____39. A cylinder is usually divided into 12 parts for developing.

____40. The scale, 3 inches equals 1 foot, means that the object is drawn one third the whole.

MULTIPLE-CHOICE

Directions: Each of the questions or incomplete statements listed below is followed by several words, phrases, or a series of numbers. From these, you are to choose the one which answers the question or completes the statement correctly. Place the letter of that word or phrase (A, B, C, D) in the numbered blank space at the left of the item. The first item is answered as an example.

__C__ 0. The first president of the United States was (A) Adams (B) Jefferson (C) Washington (D) Lewis.

_____1. Every working drawing must have (A) three views (B) neat figures (C) dimensions (D) ink.

_____2. One of the necessary factors in a drawing is (A) accuracy (B) exceptional speed (C) an advanced knowledge of machines (D) none of these.

_____3. Isometric drawing is (A) an example of orthographic drawing (B) simple method of perspective drawing (C) a necessary part of working drawings (D) necessary in freehand sketches.

_____4. Angles are measured in (A) inches (B) feet (C) degrees (D) meters.

_____5. The 5H pencil is (A) medium (B) hard (C) soft (D) very hard.

_____6. The border line is usually a (A) heavy dark line (B) medium line (C) light line (D) very light line.

_____ 7. A line consisting of short dashes represents (A) the center line (B) an invisible edge (C) a visible edge (D) dimension line.

_____ 8. An angle that has been trisected is divided into (A) 2 (B) 3 (C) 4 (D) 6 equal parts.

_____ 9. A straight line that touches a circle in one point only is a (A) diameter (B) chord (C) arc (D) tangent.

_____10. An ellipse has a (A) major and minor axis (B) major axis only (C) minor axis only (D) neither.

_____11. Used as a guide for drawing horizontal lines (A) triangle (B) architect's scale (C) T square (D) none of these.

_____12. The pattern of the cone is developed in the same manner as a (A) pyramid (B) cylinder (C) rectangular prism (D) none of these.

_____13. In developing a cylinder it is usually divided into (A) 4 (B) 8 (C) 12 (D) 16 parts.

_____14. Cabinet drawings are used to illustrate (A) sheet metals (B) furniture (C) house structure (D) none of these.

_____15. Cabinet drawing is (A) the same as isometric (B) a simple method of pictorial drawing (C) a method developed by industry (D) none of these.

_____16. The view that describes the length and width of an object is the (A) left end (B) right end (C) front (D) top.

_____17. Who is responsible for the accuracy and tolerances stated on all drawings? (A) Machinist (B) Engineer (C) Draftsman (D) None of these

_____18. The type of view most commonly used to describe the slanting surface is the (A) isometric (B) sectional (C) auxiliary (D) none of these.

_____19. Developments and intersections are most common in (A) sheet metal (B) woodworking (C) electricity (D) none of these.

___20. Which of the following is not found in the title block of drawing? (A) date (B) name of object (C) name of draftsman (D) cost of materials.

MATCHING

Directions: The two columns below contain related words and phrases pertaining to mechanical drawing. Select the word in the right hand column that is most closely related to the descriptive phrase in the left hand column and place the identifying letter in the blank space provided. The first item is answered as an example.

B 0.	The first president of the United States	A. Dewey B. Washington C. Franklin
____1.	One who draws, sketches, plans or designs	A. Lettering
____2.	A device used as a guide for drawing vertical and inclined lines	B. Arc C. Triangle
____3.	A soft rubber eraser used for cleaning purposes	D. Csk E. Octagon
____4.	Used to aid in drawing irregular curves	F. Draftsman
____5.	A measure for laying off distance	G. Pentagon H. French curve
____6.	Any part of the circumference of a circle	I. Compass
____7.	Single stroke Gothic	J. C. Hrd.
____8.	A figure having six equal sides	K. Isometric
____9.	A figure having five equal sides	L. Hexagon
___10.	Any figure having four sides	M. Scale
___11.	A type of pictorial drawing	N. Art gum
___12.	American (National) Standard	O. Am. St'd.
___13.	Finish all over	P. Quadrilateral

___14.	Countersink	Q.	F. A. O.
___15.	Case-harden	R.	Ruby red eraser

COMPLETION

Directions: Each of the blank spaces in the following statements indicates the place of an omitted word. Complete the meaning of each statement by writing the correct word in the corresponding numbered blank at the left. The first item is answered as an example.

(George Washington) 0. The first president of the United States was _____.

_____1. The top view of an object is drawn on the _____ plane.

_____2. The side view of an object is drawn on the _____ plane.

_____3. When parallel projectors are drawn perpendicular to a plane of projection, the result is ____ projection.

_____4. General notes and dimensions are _____ inches high.

_____5. The distance (space) between the object and a dimension line on a drawing should be about ___ inches.

_____6. Vertical lines are drawn by using the ____ and the _____ together.

_____7. Light parallel lines used to assist in lettering are called ____ lines.

_____8. The height and length of an object are found in the _____ view.

_____9. Each triangle used in drafting contains a _____ degree angle.

_____10. A surface to be machined is indicated by a _____.

_____11. There are _____ principal planes of projection.

_____12. The part of an angle where the two sides meet is the _____.

_____13. When a cylinder is developed it becomes a _____.

_____14. In making a full section view, _____ of the object is cut away or removed to obtain such a view.

_____15. In making a half section view, _____ of the object is cut away or removed to obtain such a view.

_____16. The two classes of working drawings are _____ and ____ drawings.

_____17. The view used to describe the true shape of the slanting surface is an _____ view.

_____18. Whenever surfaces come together, there is a line common to both called the line of _____.

_____19. A type of pictorial drawing that is very much like the isometric drawing, in method and rules, is the _____ drawing.

_____20. Vanishing points are necessary in _____ drawings.

These tests have been developed as final tests for the courses of study which were presented in Chapter III. These tests were designed to meet the needs of this teacher and may or may not be useful for other teaching situations. The tests may be divided and used as unit tests, as well as final examinations.

KEY

FINAL TEST
MECHANICAL DRAWING

True-false	Multiple-choice	Matching	Completion
1. ✓	1. C	1. F	1. horizontal
2. O	2. A	2. C	2. profile
3. O	3. B	3. N	3. orthographic
4. O	4. C	4. H	4. 1/8
5. ✓	5. D	5. M	5. 1/4
6. ✓	6. A	6. B	6. T square triangle
7. ✓	7. B	7. A	7. guide
8. O	8. B	8. L	8. front
9. O	9. D	9. G	9. 90
10. O	10. A	10. E	10. f
11. ✓	11. C	11. K	11. 3
12. O	12. A	12. O	12. vertex
13. O	13. C	13. Q	13. rectangle
14. ✓	14. B	14. D	14. 1/2
15. O	15. B	15. J	15. 1/4
16. ✓	16. D		16. detail assembly
17. O	17. C		17. auxiliary
18. O	18. C		18. intersection
19. ✓	19. A		19. oblique
20. ✓	20. D		20. perspective
21. O			
22. ✓			
23. ✓			
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CHAPTER V

SUMMARY AND RECOMMENDATIONS

This study was undertaken to determine the value of or how the objectives and philosophies of industrial arts affect the curriculum of the small school. The writer has attempted to apply the objectives, philosophies and important principles in industrial arts in developing the courses of study given in this paper.

Summary. The valuable developments in the history of educational handwork need to be preserved and applied. Since their livelihood depended on it, primitive men learned that there was an important advantage to being skilled with their hands. The Jews, in their religious teachings, advocated that the father must teach his son a trade. Many leaders such as Luther, Rousseau, Pestalozzi, made important contributions which helped in the development of the present field of industrial arts. Swedish sloyd was planned largely for cultural education. Its influence in America was in the direction of the recognition of child instincts and capacities, and methods of utilizing them in educational handwork. The Russian system of tool instruction, which influenced American educational handwork in organization and administration, was vocational in character and purpose. Manual training was originally much like the Russian

system of exercises and models, but was directed into the field of general education. It claimed values in formal discipline, including transfer of training as one of its chief educational values. Manual arts added the idea of the pupil designing of problems, which fit into what came to be known as the "educational project". Manual arts brought an extension of subject matter, so a larger number of trades and crafts were presented. As manual arts developed in America, it became a part of general education known as industrial arts.

Aims and philosophies, in the form of listed or stated objectives, as given by recognized leaders in the field of industrial arts serve as a helpful and satisfactory basis of declaring specific course objectives. In many cases a study of such objectives will determine the methods or means for reaching the desired goals. With this in mind, an evolution of industrial arts objectives was given.

In developing the course of study, in addition to the general objectives, factors such as: age range of students, background, grade level, time, facilities, and personality and ability of the teacher, were considered. Considering these and other factors, courses of study for woodworking and mechanical drawing were developed. The units for these courses of study were listed under the

headings of: objectives, introduction, presentation, application, and outcomes. These units were so listed for the purpose of simplicity in adaptability for class presentation. The suggested projects and textbooks were selected, by the writer, with a specific need in mind, therefore, they may or may not meet the needs of other teaching situations.

The objectives to be accomplished are a determining factor in what type of measurement the teacher can best use efficiently in the classroom situation. Since the objective type tests are most commonly used, the teacher should be prepared to develop such tests that are valid, reliable, objective in nature, easy to score and administer, economical, and usable.

The most common types of objective tests are simple-recall, completion, multiple-choice, true-false, and matching. Proposed final examinations for woodworking and mechanical drawing, made up of these types of objective tests, were given. Through the use of these objective tests, a teacher may cover a wide sample of information, and also provide a diagnosis of the situation.

Recommendations. The recommendations given here are based upon the knowledge and experience gained while making this study and as a teacher of industrial arts. These recommendations are those of one individual and should be considered as such.

It is recommended that each and every teacher establish definite goals and strive toward their achievement. This may be attained through effective organization of course content.

It is further recommended that there be a closer correlation of the objectives, the courses of study, and the testing program. The writer suggests that more emphasis be placed on courses designed to improve curriculum and course construction and adequate testing programs.

In making this study the writer has found related problems which could serve as a basis for future studies. Some of the most pertinent problems evolving from this study are: (1) How the curriculum is affected by the community needs, (2) A survey of the testing programs used by industrial teachers in Oklahoma, and (3) A survey of testing materials made available to the industrial arts teachers.

This study has resulted in many questions pertaining to developing courses and testing being answered. It is the desire of the writer that this paper will prove helpful to other industrial arts students and teachers and also serve as basis for further studies.

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VITA

Edmund Duvon Gibson

Candidate for the degree of

Master of Science

Report: INDUSTRIAL ARTS PHILOSOPHIES IN THE SMALL SCHOOL CURRICULUM

Major: Industrial Arts Education

Biographical:

Personal Data: Born February 19, 1933, at Witts Springs, Arkansas, the son of Earl C. and Verbie Gibson.

Education: Attended grade school in Witts Springs, Arkansas, and Blackgum, Oklahoma; graduated from Vian High School in Vian, Oklahoma, in 1950; received the Bachelor of Science degree from Northeastern State College, Tahlequah, Oklahoma, with a major in Industrial Arts, in May, 1954; completed requirements for the Master of Science degree in August, 1956. A member of the following professional education groups: Iota Lambda Sigma, Student Industrial Arts Association, and Oklahoma Education Association.

Experience: Industrial Arts teacher in the Mound Valley High School, Hominy, Oklahoma, from 1954-1956.

TYPIST: Nita Butcher