A SURVEY OF MAJOR EQUIPMENT IN HIGH SCHOOL SHOPS OF OKLAHOMA IN 1949

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

NATURE AND IMPORTANCE OF THE STUDY

While the absence of standardized courses of study and prescribed teaching methods in the field of industrial arts meets wide approval it is inconceivable that no minimum standard need be set. This reasoning may be applied to physical conditions of environment as well as to the practices which make up the routine of teaching. With this as a basis for beginning it is thought that in order to establish effectively a level from which to begin improvement it is first necessary to distinguish between the extremes of desirability. A practical set of recommendations could be made which would be in reach of the average school facility found to exist. At another level, the same guidance might be given with recognizable ideal conditions as a goal to be reached.

The Study Explained. The present study is primarily concerned with finding the kinds and quality of physical facilities provided for the teaching of industrial arts in Oklahoma High Schools. Analyses are to be attempted which will establish the extremes and averages of environmental physical conditions under which Oklahoma teachers must work in order to provide experiences in and information about the basic industries. Factors to be considered include cost, degree of obsolescence, condition of usefulness, comparability with that provided by industry for types of work or processes about which the equipment is used to teach, and the degree of correctness of conditions such as heating or isolation from other departments in the school.

It is expected that individual factual findings will provide bases

for the forming of worthwhile conclusions as will the tabulated summarization of analyzed material.

Definition of Terms Used. In order to write clearly about industrial arts or about any subject some medium is needed whereby there is a meeting of the mind of the writer and ultimate reader. A necessity to clear understanding is exactness and brevity in the use of language. While it is impossible in many instances to achieve exactness it is always helpful to have as points of reference meanings which are as clearly defined as it is possible to make them.

In order to express the meaning of the term "industrial arts" those individuals who have from time to time written about it have used different implications through a variety in the use of words. Several definitions are quoted here. Bonser defines industrial arts as the activities in the world of practical life. His definition is given here: "The Industrial Arts are the activities by which man changes or transforms the raw material of nature to make them more usable and satisfying in meeting his needs for material supplies" (3, page 1). As an adaptation of his definition to education Bonser defines industrial arts in these words:

> Industrial Arts is a study of the changes man makes in materials to increase their values to meet needs, of the appropriate usage of products made, and of the social advantages and problems resulting from the making of these changes and products. (3, page 2)

The term "industrial arts" has been popularized and generalized since about 1900, and has replaced the use of the terms "manual arts" and "manual training" except in isolated instances. As a part of education, industrial arts has become an identity. A definition by Hunt is quoted:

> Industrial Arts is the name applied to all forms of shopwork and industrial drawing taught in elementary schools, junior high

> schools, high schools, and possibly in colleges when the chief purpose is general education and not specifically vocational in nature. (9, page 2)

A definition proposed by the State Advisory Committee for Industrial Arts in Oklahoma Schools is quoted:

> Industrial Arts as a school subject, may be defined as a study of the processes, tools and machines by means of which the forces of nature are utilized and the raw materials of nature are changed by man to make them more valuable and pleasing. It includes an understanding of the native qualities of raw materials and of the natural forces, together with a knowledge of the methods and practices of utilizing and changing these materials and forces. It is also concerned with the social and economic problems incident to these changes. (State Advisory Committee for Industrial Arts in Oklahoma Schools.)

Other terms used in this study are enumerated and definitions by the writer are included here:

Shop. Any building or room where equipment is placed for use in teaching the activities and information related to that equipment. The equipment, machines or devices may be thought of as being a part of the shop.

Woodwork. The term "woodwork" shall be thought of as any taught activity in the handling and processing of wood for the purpose of making finished wooden projects.

Drafting. This term is mentioned in most textbooks or handbooks on drafting as the "universal language" of industry. For the use made of it in the present study it must be regarded as a taught activity in which the science, technique and need for such a "universal language" is emphasized.

Electrical Work. The meaning shall extend in this area to include taught or guided experiences in most of the common appliances which

operate and are in existence because of the harnessing of electrical energy. Acquaintance will necessarily be made with a few of the devices, also, which are used in controlling electricity or electrical appliances and in installation of electrical circuits.

Ornamental Ironwork. This area of shopwork shall be interpreted as the teaching of iron work by several methods where special emphasis is placed on workmanship, appreciation, design, and originality rather than on speed of production. Activities shall be thought of as extending briefly into several largely separate types of iron or metal working. The activities to be included are those in forging, welding, machining and hand tooling, and will touch a few of the operations and tools used in pipe-fitting, plumbing, soldering, and the molding of metal.

Automobile Mechanics. Activities shall be included under this term which provide experiences in the use and care of the equipment and machines used in repairing and servicing automobiles.

Graphic Arts. For this study, work taught in the area of graphic arts shall include experiences with the major items of equipment and machines which are generally thought to be necessary in the teaching of printing operations.

General Metalwork. This area of shopwork shall include, generally, the teaching of basic operations in the metal industries where precision and accuracy is of value as well as are the principles of speed and efficiency in the performance of operations on parts of or on a completed project.

Arts and Crafts Work. This designation shall include taught

activities which will encompass hand skills and techniques of working with an avocational emphasis on projects in leather, wood decoration, etching, weaving, ceramics, plastics, book-binding, silk screen printing, and in lapidary work.

Definitions of the preceding terms are included and are intended to focus attention on the industrial arts subjects for which information about the equipment and machinery used in these areas has been obtained.

Scope of the Study. No discussion or distinction has been attempted as to types or classification of high schools, rather it is the intention to obtain an over-all picture, state-wide, of the conditions described in the explanatory paragraph of this chapter. Due to the rather detailed coverage of subject matter about which an attempt has been made to obtain first-hand information it was decided that a representative sampling would be afforded by limiting the survey to regular high schools in Oklahoma where shopwork or drafting were known to be taught. No special schools were included as it was felt that while conditions in those schools might be similar to those in regular tax-supported state and city schools they were not wholly representative.

Procedure of the Study and the Check-list Form. The comparison of factual information with minimum standards derived from the review of literature is the basis of this writing.

A Directory of Teachers and Administrators of Industrial Education in Oklahoma Secondary Schools, Colleges, and Universities, School Session, 1948-1949, was used as a mailing list. The Directory is compiled under the direction of Dr. DeWitt Hunt, Head, Department of Industrial Arts Education and Engineering Shopwork, Oklahoma Agricultural and Mechanical

College and distributed to industrial arts teachers in schools of the state. Detailed information for the directory was secured by Professor C. L. Hill and other members of the staff of the Department of Industrial Arts Education and Engineering Shopwork. A mimeograph form, the check-list, made up of lists of the desirable machines or major equipment for each of eight different areas of shopwork, accompanied by a letter of transmittal, was mailed directly to each of 296 selected high school shop or drawing teachers in Oklahoma. Information requested included the number of pieces of equipment and number of machines used in the shop. Itemized information requested included size, date of purchase, original unit cost, condition of usefulness, and the name of the manufacturer of the equipment. Space was provided and information asked for the name of shop or room, the size of the room, the date the room was built, ceiling height, subjects taught, location of the shop room in the main school building, and whether or not it was a separate building. A copy of the check-list form and of the letter of transmittal are included in Appendix (B) of this writing. Follow-up letters were mailed to those teachers who had not returned the completed check-list when it was decided that the response was lagging.

Need for the Study. It has been suggested in several writings about industrial arts in Oklahoma that research is needed in the various phases of information asked for in the present study. Singleterry recommended in 1934 that a needed area of research is in "design and construction of shops, buildings, and equipment necessary for an industrial arts program". (18, page 22).

A recommendation by Pope in a thesis written in 1938, states that "Another study could well establish the necessary equipment for industrial

arts classes by making a survey to determine what is now included in the shops". (15, page 59). These needs have been emphasized for Oklahoma.

In order to outline completely the need which this thesis is purported to fill that specific need should be stated. In addition to those stated and recommended in previous studies of industrial arts in Oklahoma, conditions which exist in varying proportions from time to time, such as amount and types of facilities, the extent and manner of distribution in certain areas condition of existing facilities, and to a limited extent, the purpose for which use is made are recognizably important.

The need which is felt to be the motivation of this thesis is the lack of bases for establishing standards of equipment and facilities for use in Oklahoma school shops. A part of that need is the factual establishment of what is present in those shops. It is at this part that effort in this study is directed.

Delimitations. Research based on facts is limited as to the validity of the results obtainable from it. Isolated information might be valuable only when coordinated with other related knowledge in such a way as to present a true and whole picture. Cognizance is taken of the fact that constructive action which is motivated by findings is dependent upon the exercise of objectivity in the analysis of those findings. As has been mentioned in the preliminary explanation of this study the extreme and average condition will be inveterate but not as significant as the frequency distribution at either extreme. It is from those patterns of occurrence which are most distinct that most interpretation and generalization have been derived.

Review of Similar Studies. There have been few studies made of equipment used for shopwork. More attention has been given to conditions of housing, floor space, and similar environmental conditions such as lighting and size of classes. A Master's thesis entitled Provisions for Industrial Arts Equipment in Laboratory Schools, written by Orville E. Sink at Ohio State University has the following stated fourfold purpose:

> The first of these purposes is to learn and judge the present status of the provisions for housing industrial arts equipment in selected laboratory, training or demonstration schools.
>
> The second is to get from the teachers of industrial arts in these laboratory schools their judgement of the existing provisions in their respective shops and a statement of what they consider to be the optimum standard which ought to prevail.
>
> The third purpose is to establish principles of room planning and equipment selection which may be derived from existing and recommended situations revealed by the field study.
>
> The value of such a study lies in the practical application of findings and derived principles to a representative major university and a state teachers college engaged in the preparation of teachers of industrial arts. Therefore the fourth purpose is to apply such principles and findings to the planning and equipping of Industrial Arts Departments in Laboratory Schools at Ohio State University and Ball State Teachers College. (Sink 19, page 1).

Not all of the purposes described by Sink are coincidental to those in the present study. Provisions for housing equipment, statements of teachers as to the existing provisions in their respective shops, and situations involving factors which influence room planning are parallel to the problem of this research. Sink's study was limited to 22 laboratory schools distributed over 14 states. An account of the concluding summary in his thesis is as follows: (19, page 92)

> Eighty per cent of the teacher training institutions have some form of a laboratory school.
>
> Eighty-eight per cent of these have industrial arts in their program of study.
>
> Eighty-five per cent of the industrial arts work is given through the medium of a general shop.
>
> The schools offer a total of twenty-one different units of work in their general shop programs.

Those units most frequently found are bench woodwork, electrical work, sheet metal work, mechanical drawing, machine shop, forge work, woodturning, printing, wood finishing, auto mechanics and concrete construction.

Thirteen different kinds of unit shops were found in the laboratory schools studied. Those most frequently found are bench woodwork shops, drawing rooms, print shops, electrical shops and sheet metal shops.

Most of the shops are fairly well equipped. Much of the equipment is old.

A larger variety of equipment could have been purchased for the same amount of money, had smaller machines been purchased.

Nearly every general shop is equipped with machines formerly purchased for use in a unit shop.

Size of shops is more than adequate and exceeds fifty square feet per pupil in most cases.

More than half of the shops are located in the basement. One-fourth have concrete floors. Artificial lighting was bad in most cases. Window area in most cases did not exceed fifteen to eighteen per cent of the floor area as compared with a twenty-five or thirty per cent minimum area which is recommended by most teachers.

A list of principles evolved by Sink (19, page 82) were subjected to evaluation by a jury of twenty-four specialists in the field of industrial arts either as supervisors in large city systems, industrial arts teachers in laboratory schools, or as men in industrial arts departments in universities teachers colleges, and normal schools. The list as evolved by Sink was given the following order of rank by the jury:

1. Artificial lighting.
2. Safety first.
3. Location of machines.
4. Work procedure.
5. Health problems.
6. Based on objectives.
7. Relations of units of work in a general shop.
8. Work aisles.
9. Aisles of travel.
10. General appearance.
11. Location of general purpose equipment
12. Special features.

(19, page 82)

Those principles thought to govern the selection of equipment are as follows:

1. Objectives as guides.
2. Urgency of need.

3. Equipment balance.
4. Budget control of equipment selection.
5. Experience as a guide.
6. Space available.
7. Danger to pupil.
8. Size of equipment
9. Cost of installation.
10. Durability.
11. Cost of operation.

One additional principle relative to the selection of major pieces of equipment was suggested by the jury that guards be used on machines where at all feasible. (Sink 19, page 83).

Sink suggests that there is need for research in the problems of shop arrangement, of the equipment in a shop to derive bases for minimum standards of selection, cost, use, and arrangement, and in the administration of industrial arts supplies. (19, page 84).

The Sink thesis is a masterful treatment of a much needed study in industrial arts. Exhaustive techniques were utilized to validate findings. Due to the year in which the study was made, 1929, not all of the conditions found to prevail at that time are applicable now. The derived principles of room and equipment selection are especially good. Some of Sink's conclusions are slightly subjective as are his recommendations which seem to be rather meagre when reviewed in the light of that is in all other respects a highly competent research.

Three other theses written at Oklahoma Agricultural and Mechanical College contain data on shopwork or drafting equipment. One of these, a study by Searle Singleterry, in 1934, (18) included the approximate cost of shop equipment. Another by Henry Cliff Winkle, in 1946, (25), lists the value of shop and drafting equipment in both junior and senior high schools in Oklahoma. Granville Bennett Strunk conducted a survey of industrial arts in New Mexico in 1941. Information on shops and equipment comprised a part of the data for his study. The questionaire technique for obtaining information was used in all of the studies reviewed.

Similar Studies Not Reviewed. As has been emphasized in the Review of Similar Studies, few research efforts have been made about existing facilities in school shops. The most nearly identical, the Sink study, reached only teacher training institutions and existing conditions of housing and shop equipment was a part of the research effort.

The following is a bibliographical list of theses or dissertations which were not available for review:

Cline, William F., A Survey to Determine the Needs for Industrial Education in Wood County, West Virginia, Master's, 1937, Ohio University, 73 pages.

Klehm, Walter Allen, A Method of Determining Equipment Requirements in Industrial Arts Courses Based Upon Teaching Objectives, Doctor's Degree Dissertation, 1937, Ohio State University, 180 pages.

Tearney, Orville A., Physical Equipment and Courses of Study in Woodworking in the Junior High School, Master's, 1931, Colorado State Teachers College, 78 pages.

Witt, Edward H., Physical Aspects of Industrial Arts Departments, 1933, University of Minnesota, 63 pages.

Schedule of Writings in this Thesis. It was at first intended to divide into chapters each type of information asked for in the survey. Patterns of information and the utilization of super-abundance of factual details made some condensation necessary. Some revised planning resulted in the present described schedule of writings.

Chapter I, of course, is introductory and attempts to explain the method of research used as well as to justify the study. Chapter II, is a brief, historical account of the early development of manual education as a part of the evolution of industrial arts into its present concept, and a brief commentary on the history and status of the program in Oklahoma. Chapter III, contains descriptive information and commentary about the information requested in the survey relative to subjects taught, size

construction, and location of rooms or buildings and the types of heating utilized.

Chapters IV and V include itemized information and discussion of paragraph length for each item of machinery or equipment listed, respectively, for woodwork and drafting. Chapter VI contains informational data and discussion of paragraph length for machines and equipment which were reported for the shopwork areas of electrical work, ornamental ironwork, automobile mechanics, graphic arts, general metalwork, and arts and crafts. In Chapter VII validation of findings and results of the study are attempted by interpretative analysis and recommendations.

The slightly different methods of approach used in the various chapters of this thesis prompted the writer to make this effort at clarification. The small number of schools reporting equipment for the six areas in Chapter VI as compared to the large number reported for woodwork and drafting seemed to justify the method of tabulation and ranking which were eventually used.

CHAPTER II

THE HISTORICAL DEVELOPMENT OF INDUSTRIAL ARTS

The present program and concept of industrial arts owes its beginning to the discovery of the method in tool instruction as advocated by Victor Della-Vos of the Russian Imperial Technical School of Moscow in 1868 (Bonser 4, page 468). Credit for the development and establishment of shopwork instruction in eastern United States is due Professor John D. Runkle of the Massachusetts Institute of Technology. Professor Runkle, after attending the Centennial Exposition in Philadelphia, had decided that shopwork instruction had general education values. Parallel to this the St. Louis Manual Training School was established by C. M. Woodward in 1879 (Ibid., page 469). The former instance of development was in an engineering school and the latter in a private pre-engineering high school.

The development of industrial arts or manual training as it was at first called was for a time influenced by two schools of thinking. The Russian system of perfecting the technique of processes differed from the theory of Otto Saloman that the real value of teaching a child in the use of materials was in the "formative education" of faculties rather than a means of technical education. Saloman's theory placed emphasis upon the making of useful articles. In this practice, wood was the chief material for expression.

The Manual Training School. The manual training idea underwent rapid development during the decade from 1890 to 1900 as evidenced by educational publications of that period. An editorial by Froebel, written for the Educational Review, is quoted by Bonser and Mossman. It is as follows:

> Efficient schemes of manual training suitable for elementary schools will doubtless be evolved in time, if, indeed they have not evolved already; but the manual training high school, as attested by its magnificent results in preparing its students for every department of active life, but the affection and admiration of those who have gone through its curriculum, and by the popular support it enjoys, may already be regarded as a permanent feature of the American educational system. (4, page 472).

The success of the manual training high school not only stimulated the establishment of other manual training type schools, but also gave impetus to the adoption of shopwork, mostly woodworking and drawing, in general high schools.

Manual Training in General Public Schools. Manual training was first offered in a public general high school at Peru, Illinois in January, 1884 under Superintendent Joseph Carter who furnished the workshop at his own expense. Three years after the work started the aims in manual training were stated thus:

1. To inculcate a correct knowledge of the use and care of woodworking tools.
2. To implant the habit of carefulness in accomplishing work.
3. To develop the power to plan work.
4. To teach quickness of perception; to train the judgement; to render the memory exact and reliable.
5. To turn the pent-up energies of the boy into channels of usefulness. (Bennett 2, page 389).

During the years 1883 to 1900 manual training was introduced into public high schools in more than a hundred cities in the United States. (Ibid., page 397).

The introduction of manual training into public elementary schools constituted the beginning of a period of experimentation with types of instruction which later developed into a pattern similar to our present total program of industrial arts. Classes for both boys and girls were the subject of experimentation. Much of the endeavor at the elementary level was privately supported. Gradually, however, public support was

given to the teaching of shopwork as a part of the work of the regular school. Much of the work taught was thought of as arts and crafts in the areas of needlework, clay modeling, and of woodworking. Most projects were a follow-up or an application of study in drawing.

By harmonizing some of the principles of the Russian System with those of the Swedish Sloyd which was introduced in the Boston area of this country by Gustaf Larsson an American System of manual training had been produced which was pedagogically sound and practical (Ibid., page 434). The inclusion of mechanical drawing, a median procedure between class and individual instruction, and the following of a progressive order in exercises were eventually emphasized by Larrson. Thoughtful teachers now had the problem of developing practices which would be in harmony with American needs and ideals and which would incorporate the best features of both the Swedish and Russian methods of instruction.

As soon as the teaching of manual training had graduated from a purely disciplinary function other applications and implications began to appear. It was suggested that the eventual scope of the work was to touch all of the elements of the fundamental industries. The name "industrial arts" was first applied to manual training as a counter-irritant to the excessive formality of tool instruction methods.

The Development of "Industrial Arts". Stombaugh states that James P. Haney was among the first to differ with the advocates of regimented course organization. In a quote from Haney, The Relation of the Manual Arts to the Curriculum, the following condition of orderly course arrangement is described:

> Skill is cultivated and discipline maintained, but there is lacking the incentive to that freedom in thought, to that self

> reliance in action and individuality in expression which is necessary to the child who is to be trained to be an active forceful man. (Stombaugh 23, page 125, quoted from Haney)

The foregoing criticism is suggestive of the tendencies which were instrumental in causing a developmental departure of school shopwork from its early design. More enlargement is offered by Stombaugh in the following discussion (23, page 162). From the original purpose of the Boston Whittling School which was to give wholesome and enjoyable work of a type suitable to normal pupil interests a shift of emphasis was motivated during the period influenced by the Russian System. This system concentrated efforts toward the development of tool skills and a knowledge of industrial processes to train pupils for manual occupations. The Sloyd System capitalized on leisure-time interests through a mastery of tool processes. Stimulation of design appreciation and promotion of interest in art as well as to encourage creative expression was the purpose underlying the arts and crafts movement. Knowledge of trade processes and methods of manufacturing was again proposed during the industrial education movement. An explanation of the evolution and purpose of industrial arts is aptly summarized by Stombaugh and is quoted:

> With the development of industrial arts there is a recurrence of emphasis upon the developmental growth of pupils and their possible future avocational interests, with some stress upon skill and a knowledge of industrial processes. (23, page 162)

According to Stombaugh, class methods of instruction, courses of study made up of a graded sequence of required exercises typical of tool processes in basic trades, and the use of a teacher-selected abstract exercise, characterized the Russian System of shopwork teaching. Similarly in the Sloyd System the pupil had no choice in selection of a problem. Some choice of problem selection was given to pupils in the arts and crafts movement after certain specified courses had been completed.

While the nature of shopwork under the industrial education movement required close organization and closely supervised selection of projects more freedom is allowed in industrial arts. Pupils are allowed free choice of problems on which to work. These problems in turn determine what sequence of processes and information are needed. Problems are selected from suggested lists or are under the guidance of the teacher.

A summary of the findings reported by Stombaugh (23, pages 164-172) is given in the following account. Class sizes have fluctuated since the pioneering period of shopwork, but have tended to remain at twenty to twenty-four during recent years.

Time allotments have varied since the inception of the early manual training high schools, between three hours a day, given at that time to shopwork and drawing, and 90 to 300 minutes a week, the time presently given to shopwork.

Shopwork activities have increased from a limited form of bench woodworking to include over 69 different shop activity courses. Problems of production work by classes have been omitted in only one system, the Sloyd.

Findings in this study (Stombaugh) indicate the following trends:

1. Decreasing teacher dictation.
2. Increasing pupil choice of problem and subject matter.
3. More opportunity for pupil experimentation.
4. Fewer abstract exercises.
5. Less pupil exploitation on production work.
6. Revolutionary emphasis toward individual instruction.
7. Expansion and refinement of instructional devices.
8. A much closer bond with the academic subjects of study.

Maris M. Proffitt, in a United States Office of Education publication entitled Trends in Industrial Arts, described the general situation which existed in 1940 as it influenced industrial arts. The outstanding trends at that time were broadly summarized by Proffitt and are listed:

1. A strong trend toward an alignment with the objectives and principles obtained in general education.
2. A trend toward a broadened program of activities.
3. A trend toward a general shop form of organization.
4. A trend toward increasing enrollments.
5. A trend toward increasing the qualifications of teachers.
6. A trend toward improved physical facilities.
7. A trend toward extending pupil experiences beyond the class period and the four walls of the shop.
8. A trend toward a keener realization of the value of industrial arts for girls (16, pages 2-17).

In a partial enlargement of the list of developments in industrial arts by Proffitt is quoted:

> In general the trends in industrial arts are in step with modern principles of education. They reveal adherence to the principles of the experience curriculum. They show that the organization of shopwork takes into consideration individual differences that are significant as to learning ability. ---- They show attempts to broaden instruction to include opportunities for the acquisition of knowledge about the materials and tools with which they work, the products and services of industry, the power that drives the machine in our industrial age, and the part played by industry in the determination of social patterns (16, page 20).

Purpose and Aims of Industrial Arts. According to Bonser, the purpose of industrial arts teaching is to capitalize on the impulses or forms of impulses to expression or action which find satisfaction in the several phases of the study of industrial arts. Bonser states that there are at least four of these forms of impulse. They are stated here:

1. The impulse to manipulative activity, resulting in the handling of materials and tools, and, in time, the using of these in constructive and investigating activities.
2. The impulse to investigate, expressing itself in inquiries about constructive methods, kinds and sources of materials, uses of material and products, the operation and explanation of devices and principles of machines and constructions, and the relationships of practical activities to human purposes.
3. The art or aesthetic impulse, which finds satisfaction in the enjoyment of beauty in form and color as observed in materials and products, and in creative production by the designing and constructing of new products.
4. The social impulse, leading one to observe what others are doing, to attempt to share with others their activities, and to secure from others their approval and cooperation in furthering one's own activities (4, page 33).

Bonser goes on to say that the activities stimulated by the four forms of impulses must include the designing and planning aspects of the work in order to represent the real expression of thought or a thinking process by which ideas are clarified and enlarged (4, page 47). This means that the questions of what, why, and how must be answered if the work has value or meaning.

At a higher level of specificity the Report of the Iowa State Department of Public Instruction by Jesse M. Parker lists eight definite objectives or aims which are desirable in the development of an effective industrial arts program. These are quoted here:

> 1. To provide an opportunity for students to develop desirable interests, attitudes, habits, and character traits through participation in cooperative work.
> 2. To provide an opportunity for students to develop an appreciation for good workmanship, design, and value of industrial materials and products.
> 3. To provide an opportunity for students to learn to plan and construct things of value and beauty involving the use of the more common hand tools, machines and materials.
> 4. To provide an opportunity for students to acquire the necessary information for the intelligent selection, care, and use of the common products of industry.
> 5. To provide an opportunity for students to gain an intelligent insight of a technological nature through which they may be able to consider and plan their direction for living and working in a democracy.
> 6. To provide an opportunity for students to develop desirable recreational and avocational activities in the field of craftsmanship.
> 7. To provide an opportunity for students to become familiar with and interested in maintenance and improvement in the home and farm.
> 8. To provide an opportunity for students to develop a body of information and training, which will aid them in avoiding accidents to themselves and in preventing accidents to others. (14, page 17).

These are objectives for the teaching of industrial arts and are functional only to the extent that they are specific.

A set of objectives included in Bulletin No. 12, 2nd Edition, 1948, by the Florida State Department of Education is designed to provide the following outcomes:

1. Experimental development on a vertical basis--the improvement of skills and techniques. the increase of learnings.
2. Terminal training--specific building upon general foundations for the student who will go no farther.
3. Pre-vocational training--preliminary to job-holding or to further definitely vocational preparation.
4. Pre-professional training--manipulative experience for professional fields that require a high degree of coordinated manipulative ability.
5. Technical training--background for specific further technical education.
6. Avocational development--outlet for and means of expression of creative desires.
7. Socio-economic perception--industrial awareness and consumer knowledge.
8. Curricular integration--a clear understanding of and working usage of relationships of school content.
9. Character formation--the firm foundation and following of high spiritual and ethical habits, desires and qualities--an emphasis on being (21, page 53).

Not so new but still applicable are the statements of aims or objectives as proposed by Warner. Some of these are broader than the desirable outcomes listed by the Florida State Department and are explained somewhat by the following quotation:

> With the criticism of manual training came a more careful statement of objectives, so that during the last twenty years it has become a favorite topic. Students and teachers alike are concerned about industrial arts objectives because policies and programs of industrial arts education are controlled by them. ---- An extensive preliminary study of objectives was made to discover what ones had been used during the past fifty years. Particular attention was given to books, courses of study, periodicals, government bulletins, and the annual reports of the National Education Association. Finally, a group of fifteen specific notions or central purposes were chosen by the writer which seemed to represent fairly all of the points of view expressed by the sources, whether they might be considered acceptable or not. (Warner 26, pages 33-34).

The fifteen objectives are proposed by Warner to include the following concepts and are in turn quoted:

a. Exploration.
b. Educational guidance.
c. Vocational guidance.
d. Consumer knowledges and appreciations.
e. Household mechanics.
f. Social habits and attitudes.
g. "Pre-vocational" purposes.

h. Avocational purposes.
i. A degree of skill.
j. The seven cardinal principles.
k. Mechanical intelligence.
l. Correlation with other subjects.
m. Developing the "faculties".
n. Coordinating the hand and eye.
o. Vocational training. (26, page 34)

The Warner objectives were subjected to ratings by a selected jury, who spoke forcefully and decisively both favorably and unfavorably, for such of the objectives as would represent their points of view. Those in the list which were most generally ranked as desirable for high school industrial arts are as follows:

1. General guidance.
2. Further exploratory and avocational opportunities.
3. Vocational preparation for a specific industrial vocation.
4. Consumers' or utilizers' knowledges and appreciations of the products of industry.
5. Formation of desirable personal and social habits.
6. Development of a degree of skill with tool or machine processes commensurate with the ability of the pupil and incidental to completion of a project or activity which seems to have "educational" value. (Warner 26, page 44)

Snedden, who disapproved of the aforementioned aims and in general saw no justification for industrial arts courses for any pupils above fifteen years of age makes a pointed and discerning observation. His quoted statement is as follows:

> Manual training got its start in public acceptance, shop rooms, equipment, and special teachers by pretending---innocently enough, of course, through its partisans---that it was vocational preparation for the above-mentioned trades. (20, page 11)

The trades in question are those of carpentry, machine shop practice, the electric trades, printing, and sheet metal work. The most apparent characteristic of the various opinion and belief which are quoted is an implied recognition that there is no single arbitrary direction to follow in the teaching of industrial arts. A true situation has perhaps been most accurately described by Dr. John L. Fierer in the last of a series

of talks given at the Fifth Annual Oklahoma Industrial Arts Clinic, 1949. His summation was to the effect that there is much confusion in industrial arts, as to just what it is, as to where the emphasis lies, whether it is on an artistic bent or on the industrial. Fierer elaborated that this manner of thinking is healthful to industrial arts teaching in the proportion that it is constructive. This writer feels that some coordination is needed in the field of industrial arts, not so much with reference to objective aims and purposes, but to facilitate uniform practices which will result in standards which can be recognized in the communities where it is taught.

Industrial Arts in Oklahoma. Little is known of all of the development of industrial arts in Oklahoma. Some attempt has been made to establish a brief chronology of the origin of this type of work in the various schools of the state. Information has been collected on the teachers' colleges and from Oklahoma City which affords a place for beginning a historical account.

The First Manual Training Shop. A resume of the teaching experiences of H. F. Rusch, written by Mr. Rusch, is quoted and discussed by Dr. DeWitt Hunt in an unpublished paper entitled, Industrial Arts In Oklahoma, Past Present and Future. Excerpts from Mr. Rusch's account as they are given by Dr. Hunt are quoted:

> The first manual training shop organized in the State of Oklahoma was at Jones Male Academy, four miles out from Harthshorne (Indian Territory) in the fall, September, 1903, for the Choctaw and Chickasaw Nations, a division of the five civilized tribes. —
>
> Oklahoma City added manual training to its high school curriculum in the fall of 1904 in the basement of the high school building. Mr. Funk, the teacher, with no teaching experience inaugurated the work. (9, page 4-5).

This brief narration is at present all of the known facts about the

early form of industrial arts in Oklahoma. Dr. Hunt expresses a hope for future enlargement of historical data in these words: "It can be seen that this brief report on the history of industrial arts in Oklahoma schools is entirely incomplete. May we hope that it will be extended at a very early date".

Recent Developments in Industrial Arts in Oklahoma. Studies have been made in several phases of industrial arts both on a local and on a statewide basis in Oklahoma prior to this time. An exhaustive research by Tinkle in 1946 shows a remarkable growth over the period of 42 years during which industrial arts has been included in Oklahoma schools. According to Tinkle, "Industrial arts is taught in three hundred and nine schools by four hundred and nine teachers which includes twenty-nine superintendents, twenty-three principals, and thirteen women". (25, page 61). These figures include elementary, junior high school and high schools. Some of the summarized results of the Tinkle study are given in the following account:

> In the year 1946, ten counties in Oklahoma did not have industrial arts as compared with twenty counties of the same category in 1937. Industrial arts is offered in only one school, each, in eight counties.
>
> Over a hundred girls take courses in industrial arts and trades.
>
> Industrial arts classes are named in such a way as to prevent proper identification of courses taught.
>
> Tulsa County, with twenty-nine schools having industrial arts, ranks highest as compared to Oklahoma County, which is second with industrial arts offered in twenty schools. (25, pages 62-63).

Conclusions by Tinkle are that industrial arts is being taught in smaller schools and class sizes are being reduced, which allows greater emphasis to be placed on individual instruction. In addition Tinkle recommends that mechanical drawing be added to the curriculum of more schools so that students might be taught more of the why and how by shifting some of the emphasis presently placed on manipulative ability. (25, page 63)

A brief analysis of the Directory of Teachers and Administrators of Industrial Education in Oklahoma Secondary Schools, Colleges and Universities, School Session, 1948-1949 shows that there are 534 teachers of industrial arts subjects in 341 accredited junior and senior high schools in Oklahoma in 1949. This is an increase of 32 schools and of 125 teachers over the number given by Tinkle in 1946. New departments in shopwork to be added at the start of this school year will result in an even greater increase.

CHAPTER III

AN ANALYTICAL DESCRIPTION OF THE NAMES OF SUBJECTS TAUGHT AND SHOP ROOMS OR BUILDINGS IN 132 OKLAHOMA HIGH SCHOOLS

It has been said that standardized practices and a commonly accepted terminology in the field of industrial arts are most needed of any improvement. It is true also that familiarity with a field of endeavor is synonymous with an understanding of all the pertinent language and of experiences related to that field. Understanding and familiarity, however, which may be common only to individuals trained in a specific area of activity are meaningless to those who are untrained in the same area. Such a state may be descriptive of the whole industrial arts program especially as it pertains to different phases and to subject matter which is offered.

Shop Subjects Taught. Information about many shops is to the effect that areas or phases of shopwork are taught without appreciable amounts of major equipment for the teaching of some of the subjects which were reported. This could easily be done by utilizing facilities provided originally for other areas of shopwork when the combined activities are conducted in the same shop.

Sixty-two descriptive titles of shop subjects were a part of the information in 132 returned check-lists. All subject descriptions are worded as they appear in the check-list forms. The number and names of subject matter titles are listed in Table I.

Size of Rooms or Buildings. Descriptions of buildings and rooms in which shopwork or drafting is taught were submitted by 132 teachers from over the state. The least amount of floor space found to be in use was

TABLE I

NAME AND NUMBER OF SUBJECT TITLES TAUGHT IN 132 OKLAHOMA HIGH SCHOOL SHOPS OR DRAFTING ROOMS

Name of Subject Taught	Total in all Schools
Woodwork	51
Woodwork I	11
Woodwork II	10
Woodwork III	2
Woodwork IV	2
Woodwork 1a	1
Woodwork 1b	1
Woodwork 2a	1
Woodwork 2b	1
Bench Woodwork	3
Hand Woodwork	15
Hand Woodworking I	2
Hand Woodworking II	2
Fundamentals of Woodworking	1
Beginning Woodwork	1
Jr. High Woodwork	1
Elementary Woodwork I	1
Elementary Woodwork II	1
General Woodwork	3
Advanced Woodwork	2
Machine Woodwork	13
Cabinet Making	2
Wood Shop I	1
Wood Shop II	1
Shop	3
Shop I	8
Shop II	8
Shop III	1
7th & 8th Grade Shop	1
Jr. High Beginning Shop	1
Fundamentals of Shop	1
General Shop	6
Girls Shop	1
Farm Shop	1
Machine Shop	1
Manual Arts I	1
Manual Arts II	1
Manual Training I	2
Manual Training II	1
Industrial Arts & T. & I. Ed.	1
Industrial Arts I	4
Mechanical Drawing	24
Drafting	7
Advanced Drawing	1
Architectural Drawing	1
Machine Drawing	1
Finishing	1

TABLE I (Continued)

NAME AND NUMBER OF SUBJECT TITLES TAUGHT IN 132 OKLAHOMA HIGH SCHOOL SHOPS OR DRAFTING ROOMS

Name of Subject Taught	Total in all Schools
Foundry	1
Pattern Making	1
Crafts and Model Building	2
Plastics	1
Printing I	1
Vocational Printing	1
Journalism	1
Leather Work	1
Metal Spinning	1
Radio Mechanics	1
Electricity	3
Auto Theory	1
Auto Mechanics	1
General Metal	1
Welding	3
Total	226

less than 500 square feet. The greatest amount stated was in excess of 4,000 square feet. A majority of descriptions were of shops having between the amounts of 500 square feet and 3,200 square feet, inclusively. Desirable floor plans and areas for the various types of unit shops are prescribed by Mays and Casberg (12, pages 9-12) and for the general shop by Newkirk (13, pages 82-83). Determinations of room dimension by Mays and Casberg are based on findings for which these authors cite page 50 of Ittner, Planning the School Workshop from the Architect's Viewpoint are as follows:

General Woodshop	30 by 58 feet
Metal and Machine Shop	30 by 64 feet
Auto Mechanics Shop	38 by 88 feet
Mechanical Drawing Room	29 by 36 feet
Print Shop	23 by 42 feet

These dimensions are described by Mays and Casberg as the design optimum for a class size of 24 pupils. Mays and Casberg state that "The best practice seems to suggest about one to two as the most desirable

proportions for a school shop." (12, page 10)

Newkirk recommends that "The general shop should provide from 70 to 100 square feet of floor space per student and have the relative proportion of one to two. Thirty by seventy-five feet makes a suitably sized general shop to accomodate a class of twenty to twenty-five students". (13, page 82)

Slightly less than 29 percent of the woodworking shops in this study were found to have the approximate proportion of one to two. Extremes for the remaining 71 percent varied between one to one and one to five. The average for this group approximated five to nine.

Drafting rooms in the survey were slightly wider than the recommended one to two proportion. This was true also for the electrical and general shops in the report. The metal shops, machine shops, and auto mechanics shops were found to vary slightly, but not widely from the recommended ratio.

The floor areas as found to prevail in Oklahoma high school shops or drafting rooms in 1949 are commensurate with class sizes and percent of the total number of schools listed by Tinkle in 1946 (25, page 40) as is evidenced by the following comparison. Tinkle's findings determined that less than 6 percent of the high schools have class enrollments of above 35 students and that less than 8 percent have less than ten in a class. Of the school shops in the present study 11.3 percent have between 400 and 800 square feet of floor space which indicates that a few shops might fall short of the desirable 60 to 70 square feet per pupil as described by Mays and Casberg (12, page 10) for unit shops. At the other extreme, 6 percent of the shops have over 3,600 square feet of floor space, which, in the case of similarly represented numbers, would provide slightly more than 100 square feet of shop floor space per pupil

for each of the largest classes found by Tinkle. A comparison between the average floor areas of shops and drafting rooms in this survey is compared with floor areas computed from the dimensions prescribed by Mays and Casberg and by Newkirk as quoted. Table II shows these comparisons by types of shops reported in the returned check-lists.

TABLE II

A COMPARISON OF FLOOR AREAS RECOMMENDED BY MAYS AND CASBERG, AND BY NEWKIRK WITH THOSE EXISTING IN SCHOOL SHOPS IN OKLAHOMA

Type of Shop or Room	Average Areas in Sq. Ft. of Shops in this Study	Area in sq. ft. Computed From Dimensions by Mays Casberg and by Newkirk
Woodworking	2,379	1,740
Drafting	1,232	1,044
Electrical	1,770	1,311
Metalwork	1,950	1,920
Auto Mechanics	3,200	3,344
Printing	1,168	966
Machine Shop	3,008	1,920
General Shop	2,466	2,250

It is generally accepted that rooms where shopwork is taught should be 14 to 16 feet from floor to ceiling. Of the 132 usable answers which were returned 44 teachers reported ceiling heights of 12 feet, the greatest number for any one given height. Twenty-one teachers included ceiling heights of 10 feet, the second largest group. Fifteen shops were described as having 8-foot ceilings and two were reported as having 7-foot ceiling heights. The lowest ceilings reported were 7 feet and the highest, submitted by one teacher, 25 feet. Two teachers omitted the information on ceiling height in answering the check-list. The room heights most frequently reported ranged between 8 and 12 feet, inclusively. This number totaled 95 or 72 percent of the number of usable responses.

Age and Construction of Buildings. Reports on buildings or rooms in which industrial arts courses are taught included the dates of

construction as pertinent information. Shop buildings have been completed this year and at some time during 1948 and 1947 in the following towns in Oklahoma.

1949

Checotah
Coalgate
Fox
Vian
Wanette
Wister

1948

Coyle
Enid (rebuilt)
Granite
Hobart
Mountain View
Perkins
Spiro
Turpin

1947

Allen
Appache
Ardmore
Calumet
Cameron
Capron
Carnegie
Corn
Dacoma
Durant
Fort Gibson
Grove
Keyes
Madill
Purcell
Reed
Sulphur
Wakita
Watonga

Other completion dates are distributed fairly evenly over the lapse between the oldest date reported (1907) and the end of World War II. A list of dates of erection of buildings, showing the year in which the buildings was completed and the number which was reported for that year is given in Table III. Years in which no completion dates occur are omitted in order to conserve space.

Several of the reportedly new buildings were acquired from the War Assets Administration. As such, these would be of wooden frame construction and of a temporary or semi-permanent useful life expectancy. In a few instances mention was made of schoolhouses which were relocated from outlying annexed school districts for use as industrial arts shops.

Information about types of construction was not solicited for any but separate buildings. Many separate buildings have been relegated to

TABLE III

DATES OF COMPLETION AND NUMBER OF BUILDINGS

Year Building was completed	Number of Buildings Completed each Year	Year Building was Completed	Number of Buildings Completed each Year
1949	6	1928	6
1948	19	1927	1
1947	8	1926	4
1945	2	1925	2
1942	1	1924	2
1941	1	1923	3
1940	8	1922	1
1939	7	1921	2
1938	8	1920	5
1937	2	1919	4
1936	1	1918	3
1935	2	1915	1
1934	1	1914	1
1932	1	1910	3
1931	2	1908	2
1930	2	1907	2
1929	1	Not stated	20
Total			132

TABLE IV

TYPES OF CONSTRUCTION UTILIZED IN 65 SEPARATELY LOCATED SHOPS

Types of Construction	Number of Shops
Wood Frame	24
Brick	14
Native Stone	6
Cement Block	5
Brick Veneer	2
Concrete	1
Tile-Stucco	2
Rock Veneer	1
Quonset	1
Unspecified	9
Total	65

use in schools from some other location or service. Data on the number of buildings of each type of construction is compared in Table IV.

It is suggested here that the manner of development and adoption of of industrial arts as a unique phase of public education has resulted in its being added to the school curriculum rather than having been included in the original plan at the establishment of the school and that the appreciably large number of separate shop buildings is due in part to the lack of suitable room in the main school buildings.

Types of Heating Used in 132 High School Shops of Oklahoma. Several types of heating could be utilized in an area representative of several important natural resources and of the industries which exist as a result of those resources. The methods of heating which are employed in school shops are important when factors of safety and health, are considered as well as those of convenience and economy.

Nine different types of heating equipment were specified by teachers of shopwork in the 132 usable check-lists of the 144 which were returned. The various types of heating equipment and the number of shops in which a type is found are elaborated in the following list:

Steam Radiators	53
Gas Stoves, Natural	40
Gas heated forced air	15
Gas Stoves, Butane	8
Coal Stoves	6
Gas Heated Steam Radiators	5
Wood Stoves	3
Hot Water	1
Kerosene Stove	1
Total	132

In an exploratory study of the status and need for research in school buildings and equipment the American Council on Education Studies lists an adopted standard of school heating as stated in the 1937 Proceedings of the National Council on Schoolhouse Construction: The listed standard for classroom heating stipulates:

> That all spaces regularly occupied by pupils be so heated that a temperature of 68 degrees may be consistently maintained during occupancy, with due regard to proper humidity and air motions; except that gymnasiums, shops, corridors, swimming pools, etc., be given special attention as regards temperature conditions and regulations commensurate with their use.
>
> That all spaces regularly occupied by pupils be so ventilated as to maintain healthful air conditions at all times during occupency. (1, page 15)

An explanatory paragraph at the end of the list of standards states that they are based largely on judgement rather than on research findings. This suggests that it is an idealized condition and ventured suggestively in the light of making preparations for maintenance of those standards in the original plan of a building.

Heating of school shops may be accomplished in several ways as is indicated by the answers on the inquiry sheets. Further study should be made on heating and other factors entering into the operation of school shops, insofar as those factors are resultant of or are a part of local school environment.

Location of Shop Rooms or Buildings. As some attention is given to the location of shops and drafting rooms in the teaching of shop planning and organization classes it was thought that a brief comment on building location would be of interest. Some of the areas in which research was found to be needed are listed by the American Council on Education Studies. Those which are applicable to the problem of building planning are included here:

> 1. Proportion of floor space should be allotted to different school activities, such as administration, library, physical education, health, shops, laboratories, classrooms, and community needs.
> 2. Flexibility in design and construction to meet rapidly changing educational requirements. Rooms too small or too large to house activities which they must serve result either in unnecessary teaching costs or in the waste of space and higher operation costs.
> 3. Expansibility. It is extremely important that school buildings be so located, planned, and constructed that additions can be made easily and economically.

4. Location of different types of rooms in the building in order to meet educational requirements most efficiently. Rooms which should be contiguous are often found to be widely separated, thereby causing unnecessary travel, congestion, and expense in construction and administration.

5. Comprehensive cost analysis studies of buildings and equipment.

6. Long-range planning. State-wide master plans should be developed to analyze population migration, growth in rural and urban communities, highway development and land utilization trends. (1, pages 24-25).

These are only a part of a long list of proposed needs for research relative to school housing and other planning problems.

All completed check-lists included the descriptive information about buildings which were separate or which were included within the main school building. Sixty-five buildings were separate from the main school facilities. Relative locations of the remaining 67 reported are shown in Table V which also includes figures for separate rooms.

TABLE V

LOCATION OF SHOPS OR ROOMS RELATIVE TO MAIN SCHOOL BUILDINGS

Location	Number of Rooms or Buildings
Separate	65
Ground Floor	41
Basement	21
2nd Floor	3
3rd Floor	1
4th Floor	1
Total	132

Two separate rooms were housed with home economics classes and vocational agriculture shops, respectively and two were located in basements of buildings other than those used in the school. Of the 65 buildings or rooms located separately 62 were at a distance of less than 4 blocks. One-fourth mile, and 2 miles were the distance given for the remaining three separate buildings.

The course titles reported in this study are somewhat descriptive of what is taught in them if there is present a degree of familiarity with industrial arts subjects. Notwithstanding, this condition can be described in the same manner as the situation found to exist in 1946 by Tinkle, who stated that "Industrial arts classes are named in such a way that a person would be unable to tell what kind of a course is being taught". (25, page 62)

Conditions of housing with reference to existing floor areas, while not above improvement are good generally. Locations of shops in the school system are a part of the findings of this study. Construction and heating are important from several points of view. The American Council on Education Studies cites these major concerns pertinent to school housing which have not yet been satisfactorily answered:

1. Is window ventilation a satisfactory method under all conditions? If not, under what conditions is it satisfactory?
2. If mechanical systems of heating and ventilating are used, how many cubic feet of air per pupil are required?
3. To what extent and under what circumstances can air be recirculated?
4. What are the optimum temperature and humidity conditions for health and learning?
5. Is air conditioning feasible and economical under typical school conditions?
6. What are the relationships between building design and building materials and ventilating problems? (1, pages 19-20)

Not all of the answers to the aforementioned questions and to those which are the primary concern of this study are forthcoming. Eminently possible is the prospect that with the solution of present problems new and different ones will present themselves.

CHAPTER IV

WOODWORKING MACHINES AND MAJOR EQUIPMENT IN OKLAHOMA HIGH SCHOOL SHOPS

Early school shop history is written around and about woodwork. Little is known about the first uses of wood and of the methods employed to work and shape it into usable products. Efforts at building machinery for working with wood are known to have been made as early as the fifteenth or sixteenth centuries. Development of machinery for woodworking has been slow and somewhat spasmodic. Much of the modern improved woodworking machinery has been planned and perfected during the last half century. Progress in three interrelated fields; methods of driving, safety in operation, and speed has made possible the present individually powered, better designed modern machines. (Hjorth 8, pages 14-17)

The woodworking machinery used in school shops varies in size and numbers with the community, the type of school, and the age level of the students. According to Hjorth (8, page 22) a well equipped trade or industrial arts woodworking shop of the senior-high-school grade level usually has the following machines:

1. Circular saw
2. Band saw
3. Planer
4. Jointer
5. Wood trimmer
6. Mortiser
7. Sander
8. Grinder
9. Portable router and shaper
10. One or more lathes.

An accelerated demand for woodworking machines for use in the school shop and in the home workshop has resulted in specialized production of smaller and less expensive machines. That these small machines are popular is proved by findings of the research about which these paragraphs are a part of the written account.

Variety Saws. More often present in school shops are machines which

are familiar not so much by specific names but by general types. The variety saw, being less expensive and more readily adaptably to the lighter work which is done in school woodworking shops, is most often used in those school shops which operate on limited funds with proportionately small student enrollments. Variety saws listed were fewer in number than were jig saws or band saws. In the 132 usable returned equipment check-list forms 49 variety saws were listed.

The greatest number of variety saws treated in the study are in the high school shops of towns with less than 2,000 population. An analysis on the sizes and the number tabulated in each size is described in Table VI.

TABLE VI

NUMBER AND SIZES OF VARIETY SAWS IN OKLAHOMA HIGH SCHOOL SHOPS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
6"		1		
8"	8	2	1	
10"	8	7	3	
12"			2	1
14"			1	1
16"	1	1	3	
Omitted	6	3		
Total	23	14	10	2

The average age for 37 variety saws on which the age was known was 7.5 years. The newest machines were one year old or less, and there were seven of these. One saw, an Oliver, was 29 years old. Two other Oliver saws were ancient, 24 and 25 years old, respectively. Of all the machines discussed, Oliver made saws are older but reasonably consistent with other makes as to original cost.

Delta machines were ranked highest in cost for comparable sizes. The highest original unit cost for a 10-inch saw was $375, the lowest

original unit cost for any saw was $45 on a Montgomery Ward 8-inch saw. The highest original unit cost on any saw was $600 for an 11-year-old Oliver of unspecified size.

The condition of variety saws was described in all but four cases and established as is listed below:

Excellent	1
Good	28
Fair	14
Poor	2
Not stated	4
Total	49

Eleven different manufacturer's brand or distributor's trade names were noted. Brand names were not mentioned for two variety saws. The greatest number of any one make was 19. The following list includes the number of machines and the names of distributors or manufacturers:

Delta	19
Oliver	8
Sears-Roebuck	7
Montgomery-Ward	4
Yates-American	3
Atlas-Preston	1
Walker-Turner	2
Boice-Crane	1
Northfield	1
Crescent	1
Not named	2
Total	49

Although no specific figures are quoted, observation of returned forms convinces this writer that equipment in most school shops is limited to one type of circular saw excepting a few instances. A very few shops have both a variety saw and a universal saw as a part of the regular equipment.

Universal Saws. The average age of the 70 universal saws reported in the 132 returned check-list forms is 6.4 years. Two machines were

purchased in 1948. Dates of purchase on 45 machines were listed as 1939 or later. No purchase date was filled out on 14 forms.

Four school shops were equipped with two universal saws each as a part of their shop machinery. Forty-five of the 70 universal saws are of 8 and 10-inch size. Table VII shows sizes and number of universal saws in towns of representative population groups.

TABLE VII

NUMBER AND SIZE OF UNIVERSAL SAWS IN OKLAHOMA HIGH SCHOOL SHOPS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
6"	1			
8"	10	5	2	
10"	16	11	3	
12"	2			1
14"				1
16"			2	
Omitted	6	5	2	1
Total	35	21	11	3

The evaluated condition of the 70 universal saws as listed in this paragraph shows an average condition of good or better. Conditions reported are:

New	3
Excellent	7
Good	44
Fair	14
Poor	2
Total	70

The lowest original unit cost for a 10-inch Boice-Crane saw purchased in 1949 was $138. The highest listed original unit cost of a 10-inch universal saw was $310 for a Delta saw purchased in 1949. Information in the returned check-lists did not afford a comparison of relative costs of different makes or brands of machines. Some makes were reported a sufficient number of times to allow some comparative

speculation as to which of them are more commonly preferred. Twenty-six or slightly over one-third of the total number surveyed are Delta made machines. A list of distributors and manufacturers names and the number of machines is as follows:

Delta	26
Sears-Roebuck	12
Walker-Turner	8
Oliver	7
Wallace	4
Montgomery-Ward	4
Crescent	2
Boice-Crane	2
Yates-American	1
American	1
Multiplex	1
Speed-E-Kut	1
Union	1
Total	70

Band Saws. Table VIII shows the number of band saws in towns of different sizes.

TABLE VIII

NUMBER AND SIZES OF BAND SAWS IN OKLAHOMA HIGH SCHOOL SHOPS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,000 pop. or over
8"	1			
10"	2		1	
12"	4	1	1	
14"	11	11	2	
16"	1	5		1
20"	1	1	2	
24"			4	
26"				1
28"	1			
30"		2	4	3
32"		1		
Omitted	11	7	3	
Total	32	28	17	5

No distinction between types of band saws was requested. Information obtained is restricted to the limits of size, condition, and other

items of data as is described in an early chapter of this writing. There are 82 band saws in the 132 school shops reached by the survey. Several school shops have more than one band saw as a part of the equipment in those shops. Two teachers reported three band saws each. Three teachers reported two band saws as a part of the shop equipment in their school. More machines are totaled for towns of less than 10,000 population. A simple explanation at this juncture points out that there are proportionately more towns of less than 10,000 population in Oklahoma than there are of above that number.

The average age of machines in Table VIII is 8 years. No date of purchase was filled out for 13 machines. Dates of purchase for 48 band saws fall within the last 10 years. Nine of these machines are one year old or less. The two oldest machines are 39 and 37 years old. Including the two oldest, 13 machines are 15 years old or older.

A list showing the evaluated condition and number of band saws under each rating is included.

New	3
Excellent	3
Good	52
Poor	8
Not stated	3
Total	82

As an over-all picture for this piece of equipment the condition may be assumed as good or at least fair.

The lowest original unit cost of any size band saw was $30 for a 1¼-inch Montgomery-Ward machine purchased in 1948 and evaluated "fair" as to condition. The highest listed original unit cost was $450 for a 1¼-inch Yates-American saw purchased in 1935 and reported to be in excellent condition. Original unit cost ranged from these quoted for a 1¼-inch band saws to $750 or over for 30-inch machines or larger.

These manufacturers names appeared in the order and number stated. The most frequently occurring manufacturer and distributor of band saws was Delta for which 30 listings are totaled. Next in numerical frequency were Oliver made machines which were 12 in number. Manufacturers were not named for six of the 82 band saws. Six band saws bore the Sears-Roebuck trade name, five, Montgomery-Ward, and five more were Yates-American trade brands. Nine other manufacturers or distributors were named from one to three times each.

Jig Saws. Sizes of jig saws in the reports vary from 6 to 36 inches. The number and sizes of jig saws found in Oklahoma high school shops and in communities of a stated size group are computed in Table IX.

TABLE IX

NUMBER AND SIZES OF JIG SAWS IN OKLAHOMA HIGH SCHOOL SHOPS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,000 pop. or over
6"	2	1		
8"	1			
10"	1			
12"	1			
14"	2		1	
16"	2	1	1	
18"	6	1	1	
20"		1		
24"	13	12	4	3
30"	1			
36"	3			
Omitted	15	8	5	1
Total	47	24	12	6

Jig saws are more often a part of the shop equipment in the school shops of towns or communities of less than 10,000 population. A few are found in the schools of towns of over 10,000 population, still fewer in towns of over 50,000 inhabitants. This is possibly accountable by the fact

that where finances and a greater number of pupils enrolled permit a more complete system of unit shops is provided. The jig saws are ordinarily used by lower level classes than high school. Over half of the 89 jig saws on which data are tabulated are found to be in use in towns of less than 2,000 people. Almost a third of the total are in communities of between 2,000 and 10,000 population. Two jig saws were reported for each of seven school shops. The average age of the 89 jig saws for which data are tabulated is 5 years. The latest date of purchase was in 1949 and the oldest reported jig saw is 19 years old. Fifty-eight or slightly over 65 percent of the total number are less than 10 years old. No purchase date was noted for 20 machines. Most omissions of dates of purchase were for machines with the higher original costs which leads to the supposition that most of the equipment of this description was older than that on which more complete information was given.

Evaluations of conditions are noted within a range from "excellent" down to "worthless". Reported conditions are as follows:

New	3
Excellent	3
Good	44
Fair	30
Poor	7
Worthless	1
Not stated	1
Total	89

Original unit costs of jig saws studied are widely varied as are the sizes which have been previously mentioned. The lowest cost to be listed for a 24-inch machine was in the amount of $20. For the same size the highest original unit cost was in the amount of $150. Lowest costs were for Montgomery-Ward and Sears-Roebuck products while the highest were for Boice-Crane, Walker-Turner and Delta makes of machines. Differentiating factors, such as condition, cost, and age prevent a common basis for

comparison between the different named products. Any handicap to the drawing of conclusions by reason of these mentioned factors is not severe. By this it is meant that low cost might rank high as a criterion for the selection by a school shop operating on a limited budget while quality, durability, and intended use of a machine might outweigh the handicap of expense where funds were not limited.

The manufacturers' or distributors' trade name of jig saws acknowledged in the returned forms and the number of machines bearing those names are cited in the following list:

Delta	40
Sears-Roebuck	16
Montgomery-Ward	7
Boice-Crane	3
Shopmaster	4
Homecraft	2
Walker-Turner	2
Oliver	1
Yates-American	1
Crescent	1
Wallace	1
Undetermined	11
Total	89

Further study is suggested as to the variety of purposes for which jig saws are used. There is much which is assumed or believed about the place of this machine or similar ones in the realm of work experiences. Strongly in favor of their being a strategic component of the total equipment in any shop are the factors of expense, safety, and adaptability. Jig saws are less expensive, generally, than band saws of comparable size. While the principle of their operation does not feature speed, the smaller cutting blades are ideal for sawing intricate curved cuts and designs. Hjorth (8, page 106) states that "All inside cutting and small, sharp curves are better handled on the jig saw, because of the finer blades used."

Jointer. Most frequently listed in all school shops were the 6-inch jointers. While the actual number of machines reported from smaller schools it is greater than that of those taken from larger systems it is estimated that the percentage of equipment present in those shops is much lower compared to basic needs than is the percentage of equipment present in the bigger school shops. Three school shops are furnished with two jointers each. The number and sizes of jointers reported are shown in Table X.

TABLE X

NUMBER AND SIZES OF JOINTERS IN OKLAHOMA HIGH SCHOOL SHOPS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
4"	3	2		
5"	1			
6"	30	17	8	1
8"	5	4	3	1
10"	1	1		
12"	1	4	3	
14"			1	
16"		1	1	1
Omitted	3	3		
Total	44	32	16	4

Comparisons can be approximated of differences taken singly as in that of age. Computed from dates of purchase columns of the survey from the average age for jointers in Oklahoma school shops is 7 years. Fifty-nine of the 96 numbered are less than 10 years old. Two purchase dates were for 1949. Dates of purchase were not listed for 15 machines.

The 6-inch jointer with the greatest original unit cost is an Oliver machine listed at $300, purchased in 1947, and is in good condition. The lowest original unit cost of any 6-inch jointer listed was $30 for a Delta machine purchased in 1939 and in fair condition. A 16-inch Oliver jointer asserted to be in poor condition was given the greatest original

unit cost listed at $750. As with other machines no common basis of comparison is allowable due to the extreme differences in age, cost, and size of machines surveyed. Evaluated condition of machines reported was as stated below:

New	5
Excellent	7
Good	61
Fair	18
Poor	3
Total	96

Taken in descending order of the times in which they were listed the names and number of manufacturers and distributors trade names of jointers are enumerated here:

Delta	39
Oliver	12
Sears-Roebuck	13
Walker-Turner	4
Yates-American	4
Crescent	4
Montgomery-Ward	5
American	2
Wallace	2
Boice Crane	2
Fay and Egan	1
Barton	1
Shopmaster	1
Union	1
Undetermined	5
Total	96

The greater number of trade names in the preceding list are of commonly known distributors or makers of industrial and school shop woodworking equipment. One or two of the more infrequently seen names are of older machines for example "Union".

Drill Presses. There is controversy as to the indispensability of the drill press in the school shop. Argument for or against this previous statement has some justification. It is true that hand tools are

obtainable at a fraction of the cost required for a drill press. It is true also that many of the uses for which a drill press is adaptable in woodworking can be done efficiently and well with hand tools. These points of contention do not hold when considering any area of shopwork other than woodworking. Many of the attachments or adaptors for use on or with the drill press greatly increase the scope of its use in the school shop, and make of it a useful even if not an essential addition to the equipment in a school shop. The number of drill presses present in

TABLE XI

NUMBER OF DRILL PRESSES IN OKLAHOMA HIGH SCHOOL SHOPS

Number in towns of 2,000 population or less	50
Number in towns of 2,001 to 10,000 population	35
Number in towns of 10,001 to 50,001 population	15
Number in towns of 50,001 or more population	8
Total	108

school shops are listed after four sizes of towns, as shown in Table XI.

The condition of drill presses was described in all but nine cases and established as is listed below:

New	5
Excellent	6
Good	69
Fair	15
Poor	4
Not stated	9
Total	108

The average condition of these machines may be termed as "good".

Some confusion is apparent as to a common approach at size description of drill presses. Seven different methods of designating size were resorted to for the 108 drill presses enumerated in the 132 usable returned check-lists. No size was given for 46 machines. Drill presses are fairly evenly distributed within the sizes of towns as specified in

the list. Thirteen schools have two drill presses each and two schools have three each.

The earliest date of purchase for any drill press was in 1930 and the most recent in 1949. Average age of 88 machines on which purchase dates were a part of the included information was 6.3 years. Purchase dates of 66 machines were during the last 10 years. Three machines were bought in 1949. No date of purchase was stated for 20 drill presses.

Sixteen different brands of machines were represented in the total of the 108 numbered. These are listed below:

Delta	49
Walker-Turner	24
Sears-Roebuck	13
Boice-Crane	4
Canedy-Otto	3
Montgomery-Ward	3
Wallace	1
Homecraft	1
Atlas	1
Western Auto	1
Oliver	1
Buffalo	1
Hv. Duty	1
Edlund	1
U. S. Electric Tool Co.	1
Black & Decker	1
Not listed	2
Total	108

The most expensive drill press was acquired at an original unit cost of $350, is a Walker-Turner product and was purchased in 1948. The lowest cost listed was $24 for a seven-year-old Sears-Roebuck drill press.

Additional research is recommended in the uses and applications of the drill press as they apply to the teaching of shopwork. This writer is curious about the success of attachments designed for limited use on the drill press such as those for shaping, surfacing, and sanding in addition to those used for mortising. Also it is suggested that a more

concise method of expressing size be practiced in the teaching of information and use of the drill press.

Shapers. The shaper is recognized as one of the most versatile as well as the most dangerous of woodworking machines. The safety factor may enter the considerations along with that of expense in limiting its popularity in high school shops. Table XII showing number of machines and sizes of communities is included here:

TABLE XII

NUMBER OF SHAPERS IN OKLAHOMA HIGH SCHOOL SHOPS

Number in towns of 2,000 population or less	12
Number in towns of 2,001 to 10,000 population	14
Number in towns of 10,001 to 50,000 population	13
Number in towns of 50,001 population or over	4
Total	43

The percentage of medium to larger schools having shapers is actually not much greater than for other machines but is high when compared to the number found in the school shops of small towns.

Only 43 shapers were counted in the woodworking equipment for the 132 school shops surveyed. There were 5 attachments for use on the drill press or on the circular saw. Notable in this instance, is the tendency toward a higher proportion of machines in the towns of above 2,000 people. Diversity of description found in the returned check-list forms on sizes of shapers prevents elaboration or conclusive comparison on those data. Thirty of the shapers included in the detailed analysis are less than 10 years old. Five years was computed to be the average age of the 37 machines on which date of purchase was filled out. Five shapers were purchased in 1949. The earliest date of purchase for any one machine was in 1935 as compared with 1949 as the most recent.

Shapers are produced and sold at prices which vary with size and type, purpose and quality. The highest original cost of any shaper listed in the check-list was $650 for a Yates-American while the lowest original unit cost was $125 for a Delta machine purchased in 1948. The date of purchase of the Yates-American shaper now being discussed was in 1947. Costs of shaper attachments for the drill press varied from a low of $10 to a high of $48. Shapers were surveyed as having 12 distributors or manufacturers names which are enumerated in the following list:

Delta	19
Yates-American	8
Stanley	3
Sears-Roebuck	3
Oliver	1
Driver	1
Wallace	1
Boice-Crane	1
Parks	1
Not named	2
Total	43

No comparison was derived between different brand names except to establish frequency in which those names are found in school shops.

Twenty-nine shapers were reported in good condition, 4 reported in excellent condition, 5 were reported new. A poor evaluation was placed on two machines and three were judged to be in fair condition. No relation was noted between age, condition or cost. It is worth noticing, however, that most lower costs are for newer machines.

Surfacers. Few high school shops are equipped with even a small surfacer. Surfacers on which data were totaled in the 132 usable returned check-lists totaled only 18 in number. This means that one shop in seven, roughly calculated, has a surfacer of some size between 12 and 24 inches. Larger surfacers are found in greater numbers in the school shops of towns of 10,000 to 50,000 people. The grouping for

smaller shops is of 12-inch size. Number and sizes of surfacers are described in Table XIII.

Two extremely ancient model surfacers, one 28, the other 30 years old inflated the average age of the 16 surfacers on which date was listed to 7.8 years. Twelve machines were less than 10 years old. The greatest original cost of any surfacer was $2,000 for each of two machines, an Oliver purchased in 1921 and a Crescent purchased in 1948. Both of these were 24-inch surfacers. A 12-inch surfacer purchased in 1948 was listed at $335 as the lowest original unit cost.

TABLE XIII

NUMBER AND SIZE OF SURFACERS IN OKLAHOMA HIGH SCHOOL SHOPS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
12"	2	1		
18"		1	1	1
24"			5	1
Omitted	4	3	1	
Total	6	5	7	2

Seventeen machines were in good condition or better. One was reported in fair condition and two others in poor or unserviceable condition. The trade name of Yates-American and Crescent were listed four times each. Oliver was listed three times and two other trade names, Boice-Crane and Crescent, once each.

It is admitted that to meet the standards of modern industrial methods industrial arts teaching must provide experiences which are at least representative of similar activities in industry. This brings up the question of machinery and equipment which it is believed should be installed in school shops and if it is possible to place it there under the present system of financing public secondary education. There is no

complete answer which supplies a workable approach to improvement of industrial arts facilities over and above what now exists.

Belt Sanders. Twelve of the 26 belt sanders reported in the study are in school shops of towns of less than 2,000 population. One disc sander which was reported from a small school brings the total for sanding machines to 13. Two schools reported two belt sanders each. The number of belt sanders studied in the survey are listed in Table XIV after the size of town from which they were reported:

TABLE XIV

NUMBER OF BELT SANDERS IN OKLAHOMA HIGH SCHOOL SHOPS

Number in towns of 2,000 population or less	12
Number in towns of 2,001 to 10,000 population	5
Number in towns of 10,001 to 50,000 population	8
Number in towns of 50,001 or more population	2
Total	27

Slightly over one-fifth of the school shops reached by the survey have belt sanders as a part of their equipment. While not generally regarded as a necessity, the belt sander is, nevertheless, a valuable and highly useful tool. A usual justifying reason for its not being included in machinery requisitions is that by saving labor the use of it robs beginning pupils of experience in the operation of scraping and hand-sanding. Another reason is expense, both initial and that of maintenance. Abrasive belts are more expensive than hand scrapers, sandpaper and manual work supplied by the student.

Dates of purchase were not stated on eight machines, leaving an average age for those on which a date was given of 5.8 years. As a major item of shop equipment belt sanders are sold over a wide price range according to the types and size. The greatest original unit cost

cost of 16 belt sanders on which that item was filled out was slightly over $163. One belt sander made in the shop cost $100.

No analysis was made of sizes or the relation of size to the number or condition of machines. One of the sanders was in a worn-out condition. Three others were in poor condition, six were reported fair, fifteen good, and two of them new or excellent.

Ten trade names were filled out in that section of the check-list provided and are listed as follows:

Sears-Roebuck	4
Porter-Cable	4
Boice-Crane	3
Oliver	2
Skilsaw, Inc.	2
Yates-American	1
Clarke	1
Montgomery-Ward	1
Delta	1
Crescent	1
Shopmade	1
Not listed	6
Total	27

Little significance to brands or makes of belt sanders is indicated with relation to condition.

Glue Pots. Two of the school shops included in the study reported two glue pots each. Including these, sixty-six glue pots ranging in size from one-half pint to one gallon make up the number in the study. The fact that almost half of the school shops surveyed reported glue pots in company with a few mentioned instances of make-shifts being used to heat glue, dispels some belief that school shop teachers are leaning toward use of modern liquid or more easily prepared casein glues.

The average age for this item is seven years. The average cost of those on which an original unit cost was listed is slightly less than $11. Only three glue pots are new and over half of those evaluated were

in poor condition. Over half of the glue pots described by trade names are the "Sta-Warm" brand. No manufacturers or distributors names were given for 41 glue pots.

Power Grinders. Size and number of power grinders is described in Table XV.

TABLE XV

NUMBER AND SIZE OF POWER GRINDERS IN HIGH SCHOOL SHOPS OF OKLAHOMA

Size	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
4"	5	3		
1/4 h.p.	23	9	7	
1/3 h.p.	5	4	5	2
1/2 h.p.	3	9	1	
3/4 h.p.	1			2
1 h.p.	1	2		
Omitted	14	11	5	3
Total	52	38	18	7

Eighteen of the power grinders listed in Table XV were purchased in 1940. Sixty-six more of the 115 were purchased within the last 10 years. The average for those on which age was given is eight years.

Condition of power grinders was described in all but 12 cases and established as is listed below:

New	4
Excellent	7
Good	57
Fair	25
Poor	10
Omitted	12
Total	115

The number of machines after the described condition preceding it establishes a normal condition of good or better for power grinders.

The highest original unit cost quoted was $400 for a 12-inch one horsepower grinder, a Driver, bearing no date of purchase. The least

original unit cost of any power grinder was $11. This machine was a Montgomery-Ward purchased in 1948, and had a 4-inch wheel.

Trade names of manufacturers and distributors aggregate a sum of 20 concerns. Number of power grinders and names of products or makers are as follows:

Not stated	30
Walker-Turner	15
Delta	14
Oliver	12
Montgomery-Ward	9
Black and Decker	7
Sears-Roebuck	6
Stanley	4
U. S. Electric Tool Co.	2
Cincinnatti	2
Dixon	2
Clausing Mfg. Co.	1
Delfour	1
Wallace	1
Driver	1
Miller-Falls	1
Dunlap	1
American	1
Elta	1
Metalmaster	1
Albertson & Co.	1
Shopmade	1
Total	115

Care of shop equipment either hand or machine operated is dependent on the presence and efficient use of a suitable grinder. The high proportion of shops which have this machine is a testimonial to the belief that it is a desirable addition to any shop facility.

Saw Filing Machines. It is expected that shop machines of an auxiliary function are not thought to be necessary in many cases where the extra expense would constitute a burden. This is justifiable when the sole use of such equipment is restricted to that for maintenance by the instructor. The prudent use of devices such as the saw filing machine in the teaching process, however, has merit. This contention does not

belie that basic hand skills of tool care should first be developed in the student. Rather it is preferred to emphasize the belief that in order to appreciate properly machine processes an individual must be provided with full understanding of the advantages which those processes or operations have over the same work executed by hand manipulation. Another impressive factor can be introduced into this line of reasoning. That is, through access to adequate facilities for tool care, which, in the present discussion, is the fitting of saws, a high standard of workmanship can be maintained.

Saw filing machines, seven in number are a recent addition to the equipment of high school shops as is verified by the dates of purchase reported in the check-lists for that equipment. Two saw filing machines are each powered with a one-fourth horsepower motor. Trade names of manufacturer or distributor were not listed on these two. One other purchased in 1948, for which the information about cost, size, and name of manufacturer is not listed is evaluated in good condition. An original unit cost of $400 is given for one of four Foley saw filing machines. Three of these have purchase dates in 1948 and three of them are in good condition. Size was not specified on any of the four. The date of purchase is blank on one and one other was evaluated as fair while the remaining three were reported to be in good condition.

In view of the recency of addition of certain items of equipment which has not been used heretofore in school shops a possibility for research may evolve at some future time in the area of trends taken by established patterns of equipping school shops.

Wood Turning Lathes. Information is analyzed for 161 wood turning lathes. This number is divided about proportionately with the number of

towns falling into four size groups as is established in Table XVI.

TABLE XVI

NUMBER OF WOOD TURNING LATHES IN HIGH SCHOOL SHOPS OF OKLAHOMA

Number in towns of 2,000 population or less	60
Number in towns of 2,001 to 10,000 population	45
Number in towns of 10,001 to 50,000 population	40
Number in towns of 50,001 population or over	16
Total	161

Eighteen school shops are equipped with two wood turning lathes each as compared with six other school shops, each of which is reported to have three of these machines. These and two other incidental listings appear in Table XVII.

TABLE XVII

NUMBER OF WOOD TURNING LATHES REPORTED FROM 33 HIGH SCHOOL SHOPS

Number of school shops having 2 wood turning lathes	18
Number of school shops having 3 wood turning lathes	6
Number of school shops having 4 wood turning lathes	6
Number of school shops having 5 wood turning lathes	1
Number of school shops having 6 wood turning lathes	2
Total	33

The average condition of the wood turning lathes being discussed is just slightly less than good. Evaluations in the returned check-lists enumerate the condition thus:

New	6
Excellent	4
Good	80
Fair	45
Poor	21
Not stated	4
	161

The average age of the wood turning lathes in the analysis is nine years. Purchase dates on 88 of the machines are 1939 or later. A date of purchase was not reported for 33 wood turning lathes. The oldest

machine reported was purchased in 1920 as contrasted with the newest on which the date of purchase was 1949.

Trade names of manufacturers or distributors of the wood turning lathes in this study and the number of machines bearing those names are as follows:

Delta	41
Oliver	35
Sears-Roebuck	16
Yates-American	11
Montgomery-Ward	10
Walker-Turner	8
Sheldon	6
Fay and Egan	5
American	4
Duro	3
Homecraft	3
Wallace	2
Shopmaster	2
Dunlop	1
Power King	1
Kenmore	1
Murray	1
Abernathy	1
Atlas	1
Driver	1
Not stated	8
Total	161

A Delta lathe was reported to have the greatest original unit cost of $49. This machine is fairly new having been purchased in 1947. The least original unit cost for a machine on which all the items columns of the check-list were filled out was $19. Informational items on this lathe are as follows: 27-inch bed, fair condition, date of purchase, 1948, and the distributor, Montgomery-Ward.

Benches. Woodworking benches reported from 105 school shops are 1,186 in number and are of indiscriminate size. The number and size of woodworking benches on which size descriptions are available is compared in Table XVIII.

Sizes of woodworking benches are widely varied and rightly so. Arrangement of basic equipment in any shop is dependent on the over-all floor space available and the shape of the rooms in which the shop is to be used. Machines and work areas can be placed more conveniently by adapting one or both horizontal dimensions to the space in which they are to be located. Many of the woodworking benches are shop made and where this type of bench is listed the size dimensions are usually greater than similar ones for standardized equipment.

TABLE XVIII

NUMBER AND SIZE OF WOODWORKING BENCHES IN OKLAHOMA HIGH SCHOOL SHOPS

Size by No. of Work Stations	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,000 pop. or over	Number of Work Stations Provided
Single	59	54	34	65	212
Double	172	117	65	77	862
4-Place	40	15			220
6-Place		9	2		66
Totals	271	205	101	142	1,360

Size descriptions were not submitted from 32 school shops. From these 32 shops a total of 477 benches are thus unclassified and are eliminated from the following discussion. From the 73 shops remaining, 719 benches provide a total of 1,360 working stations. An average of 18.6 work stations for each of 73 shops is computed from this total. In view of these calculations it is doubtful if all woodworking shops have adequate pupil space. At the same time it is quite probably that unbalances of population between the urban and outlying schools cause overloads on urban facilities and serious impairment of state fund allotments because of low daily school attendance at the other extreme.

Computed from available information the over-all average age of woodworking benches is 16.5 years. Some dates of purchase were as early as

1912 in addition to 86 benches purchased in 1920. Purchase dates for 375 benches all were within the last 10 years while this information was omitted for 484 units.

An analysis of average cost per pupil work station is provided in Table XIX. Makes of benches for which insufficiently complete information is available are listed without resultant averages.

TABLE XIX

NUMBER, AGE, NAMES OF MANUFACTURERS, AND COST PER PUPIL UNIT OF WOODWORKING BENCHES IN OKLAHOMA HIGH SCHOOL SHOPS

Name of Manufacturer	No. of Benches	Average Age in Years	Average Cost Per Pupil Unit in Dollars
Sheldon	168	14	34.43
Brodhead-Garrett	9	--	25.00
Montgomery-Ward	32	7	17.82
Shopmade	181	7	12.30
Abernathy	10	--	---
Kewanee	8	--	---
Omitted	660	--	---

Condition of equipment affects the morale of teachers and pupils in the shop. Therefore, the setting up of minimum standards by which to arrive at an objective and constructive analysis of what is good or bad is extremely important. The evaluated condition of the woodworking benches treated in this study is graded between excellent and very poor. The following list enumerates the number of benches and the variations of quality.

Excellent	76
Good	342
Fair	356
Poor	206
Very Poor	31
Not stated	175
Total	1,186

No correlation between the condition and the manufactured brands of equipment is attempted. As with other requested items of information the trade names of many woodwork benches, over half of all those subjected to

analysis were not provided. In addition to those omitted, 181 benches were built in the school shop. Worthy of notice is that the average condition of shopmade benches is fair or better. Still more notable is the fact that costs of benches made in the shop approximate about half that of purchased models of similar size.

Whether in a hand or machine woodworking shop, work benches are the foremost basic equipment. Newer designs tend to glamourize the convenience of underneath storage and the use of 4-place benches. This writer is not aware of all the advantages, or disadvantages in a departure from conventionally established practices, but it is certain that features built into equipment which will facilitate tool storage directly at the hand of a student workman will tend to save steps to and from a centrally located tool or supply room, hence speed up his project and thereby intensify his interest and confidence in his ability to do.

Mortiser. Perhaps the widest divergence from a central tendency yet found in the present study is apparent in the application and cost of mortising equipment or devices. Only a few mortisers or attachments are in use in the high school shops which are included in the survey. The number of mortisers and sizes of towns where these are located are enumerated in Table XX.

TABLE XX

NUMBER OF MORTISERS IN 11 OKLAHOMA HIGH SCHOOLS

Number in towns of 2,000 population or less	2
Number in towns of 2,001 to 10,000 population	3
Number in towns of 10,001 to 50,000 population	4
Number in towns of 50,001 population or over	2

In addition to the machines listed in Table XX thirteen mortising attachments for the drill press or shaper are included for analysis.

twelve of these are for use on the drill press and only one adaptable to the shaper. The trade name of manufacturers or distributors is not listed for ten of the attachments which are included in the analysis. One each, a Walker-Turner, a Montgomery-Ward, and a Delta attachment is tabulated. All of these are in good condition and less than ten years old.

It is pointed out that there seems to be small justification for attachments to be used on other machines. The time expended in installing and disassembling those for the drill press almost necessitates their being left attached in order to be available for class use. This in turn eliminates a drill press from normal use. The cumulative result is that the shop is almost deprived of the drill press or must acquire an extra machine the cost of which when added to the cost of the attachment is almost as great if not equal that of a regular standard model of mortiser. At the same time it is admitted that there are strong arguments and reasons for the use of most of the machine attachments used in the school shop.

The number and names of manufacturers and distributors of mortisers are presented in the following account:

Oliver	3
Crescent	1
Wallace	1
Fay and Egan	1
Omitted	5
Total	11

The total numbers include only the mortisers which were claimed by teachers from whom information was requested. Of any one of these machines $2,400 is the greatest reported original unit cost. This mortiser is 10 years old and in good condition. One Oliver mortiser purchased in 1930 has an original unit cost of $300 and is in excellent

condition. Another Junior Oliver is new, and has an original unit cost of $600. A computed average cost of all the mortisers on which information is nearly enough complete to afford an analysis is approximately $717. This figure is somewhat misleading as the cost of most of the listed machines is less than $600.

Purchase dates on mortisers establish an average age of 12.4 years. This figure is somewhat exaggerated by one extremely old Crescent machine purchased in 1912 and reported to be in usable condition from Enid schools.

Tenoners. Of the woodworking machines anticipated to be in use in Oklahoma high school shops the virtual nonexistence of a tenoning machine has been established by results of the returned check-lists.

Two tenoning attachments were reported. One shopmade, adjustable tenoning attachment was listed for the Wister High School Shop; and the other attachment was reported from the school shop at Thomas, a town of less than 2,000 population. Data for this device, which judging by the method of size description is for use on a table saw, is as follows:

Size	6-inch blade
Date purchased	1938
Original Unit Cost	$10.50
Condition	Good
Name of Manufacturer	Delta

Essentially for production use, the tenoner is not necessary in the type of work usually conducted in a school shop. It probably will be admitted that as an educative medium such a machine could be justified since it is used in industries for shortening labor hours and operations.

Portable Sanders. No visible concentration of numbers is indicated in any one size of community. The portable sanders represented in the

study comprise a total of 65 machines as is to be seen by Table XXI.

TABLE XXI

NUMBER OF PORTABLE SANDERS IN OKLAHOMA HIGH SCHOOL SHOPS

Number in towns of 2,000 population or less	30
Number in towns of 2,001 to 10,000 population	22
Number in towns of 10,001 to 50,000 population	11
Number in towns of 50,001 population or over	2
Total	65

Condition of most of the portable sanders is found to be good generally, as is bespoken by the number of these machines evaluated and reported. The number of machines and the frequency by which each evaluated condition appeared in the returned survey form is classified in the following manner:

New	2
Excellent	3
Good	39
Fair	12
Poor	4
Omitted	5
Total	65

Names of manufacturers and distributors of portable sanders enumerated in the study are only eight in number. The following list designates trade names and the number of times they occur in the returned check-lists:

Porter-Cable	21
Skilsaw, Inc.	21
Sears-Roebuck	8
Clarke	3
Montgomery-Ward	1
American	1
Walker-Turner	1
Sterling	1
Omitted	8
Total	65

All of the machines reported are less than 10 years old. Average age for those being discussed is 3.8 years. The comparative newness of

portable sanders is doubtless due to their being the result of recent design and to a failure of teachers in most school shops to add modern equipment. Possibly deserving of some of this credit is a late development of durable belts and abrasives for use on sanding machines. In addition the adapting of electric motors to use in small, light machines is a fairly recent technique. The item of expense, however, leaves room for doubt as the cost of larger models of portable sanders approaches or equals that of larger, stationary type machines. Illustrative of this suggestion is the range of original costs which vary between $20 for a machine, unspecified as to make or size, and $175 for a Porter-Cable belt type sander.

There are several popular adaptations of sanders in general. Referring, specifically to portable models of machines, varying purpose techniques do not require changes of design as the fact that it is a portable device is in itself sufficient adjustment to many needs.

While not mentioned at great length in the writings of woodworking or shop planning specialists the portable sander has been proved by reason of its presence in school shops to be a popular machine. Incidental conversation with shop teachers has caused this writer to agree that as a substitute for large and more expensive equipment the portable sander has wide possibilities in that size of projects or operations do not limit its usefulness.

Other Woodworking Equipment. Tools and devices for special purposes are omitted from most shop equipment because of the extra expense as in the case of radial or cut-off saws which are valuable and highly adaptable in a shop but are not purchased because the cost is regarded as disproportionate to the need and use for them. Another example is that of

paint spray equipment. With the continued improvement of finishing materials, lacquer, and others, it is a debatable question whether the major emphasis of teaching the use of finishes for which the demand and popularity may be waning or more attention should be directed at instruction about and with the modern varieties.

At the time the survey was planned it was assumed that a few machines and items of equipment would be found only in rare instances. This proved to be true. An analysis is attempted in Table XXII of the name, size, where it is given, and the number of machines or equipment. Trade names of extra equipment and machines are listed in the following account:

Radial Saws	Multiplex
Paint Spray Guns	DeVilbiss, Benkm and Crown
Electric Drills	Omitted
Combination shaper, router, and drill press	Walker-Turner
Mitre Box	Stanley
Picture Framing Vise	Stanley-Marsh

The type, size, and number of extra woodworking machines and items of equipment are enumerated in Table XXII.

TABLE XXII

NAME, SIZE, AND NUMBER OF EXTRA MACHINES OR MAJOR ITEMS OF WOODWORKING EQUIPMENT IN OKLAHOMA HIGH SCHOOL SHOPS

Name	Size	Total Number Listed
Radial Saw	10"	1
Radial Saw	12"	2
Radial Saw	16"	1
Paint Spray Gun	—	5
Electric Drills	—	3
Compressor	—	2
Portable Router	—	1
Combination Shaper, Router & Drill Press	—	1

A knowledge of what is thought to be important in the way of woodworking equipment by teachers in the field somewhat justifies the present

discussion. Since findings of value derived from this study will be used to the extent that they are given value by teachers in training or by teacher trainers it is thought that such discoveries which are out of the regularly conceived pattern will in some way be of assistance.

A review of Chapter IV shows woodworking machines and equipment for 117 high school shops in Oklahoma. Exclusive of extra equipment and machines for use in woodworking, totals and other data are summarized. Each of the machines or items of equipment is listed and the information compiled is as stated in Table XXIII.

TABLE XXIII

NAME, NUMBER, AVERAGE AGE AND RANGE OF COST OF VARIOUS WOODWORKING MACHINES AND MAJOR ITEMS OF EQUIPMENT IN 117 OKLAHOMA HIGH SCHOOL SHOPS

	Average Age in Years	No. of Items	Limits of High and Low Cost in Dollars
Variety Saw	7.5	49	45 - 375
Universal Saw	6.4	70	138 - 310
Band Saw	8.0	82	14 - 450
Jig Saw	5.0	89	20 - 150
Jointer	7.0	96	30 - 750
Drill Press	6.3	88	24 - 350
Shaper	5.0	43	125 - 650
Surfacer	7.8	18	325 - 2,000
Belt Sander	5.8	26	100 - 163
Glue Pot	7.0	62	--- 11* ---
Power Grinder	8.0	115	11 - 400
Saw Filing Machine	?	7	--- 400* ---
Wood Turning Lathe	9.0	161	19 - 49
Benches	16.5	1,186	12.30 - 34.43**
Mortiser	12.4	12	300 - 2,400
Tenoner	11.0	2	--- 10.50* ---
Portable Sander	3.8	65	20 - 175

The most basic machines and devices for woodworking are older. This is established to a limited extent by the average age of woodworking

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* Average or only cost listed.
** Costs per pupil unit.

benches which is somewhat greater than that of most of the devices for use in machine processes, exclusively. Woodworking benches are essential to both hand and machine operations. Ages for the various machines are comparatively recent and undoubtedly have been affected by developmental stages which are attributable to popular demand. An example of this is afforded in a comparison of the average age of 12.4 years for the mortiser, a heavy machine, which has been in use for a long time, and the average age of 3.6 years for a portable sander, a relatively new development. The use of portable machines for the teaching of woodwork is a recently adopted practice. This is validated when it is pointed out that portable motor-driven machines have been in production only since 1909 and popularly in use after several more years. (Ujorth 8, page 19). According to Ujorth, mortising machines have been designed and used since 1634 in the United States.

Consistently low age averages for all of the woodworking machines in the study indicates that a majority of machine and machine-types of equipment have been installed in school shops since 1930. Most of the older machines were reported from towns of sufficient size to afford a more elaborate assortment of equipment at the time shopwork was added to the school activities.

CHAPTER V

DRAFTING EQUIPMENT IN OKLAHOMA HIGH SCHOOLS

The true place of drafting as it is related to school shopwork is subject to some speculation. French and Svenson quote a conclusion drawn by them from a survey of mechanical drawing the findings of which were issued by the Department of Public Instruction, State of Ohio. The words of these authors are quoted here:

> A system of standardization appears to be needed to give the subject the standing to which it is entitled as a cultural subject as well as a practical one, a real language to be studied and taught in the same way as any other language. (6, page vii)

The purpose of mechanical drawing in Oklahoma high schools may be given more definite emphasis when it is assumed to be similar to that stated by the aforementioned writers who declare the following objectives:

> To develop the power of visualization; to strengthen the constructive imagination; to train in exactness of thought; to teach how to read and write the language of the industries; to give modern commercial practice in making working drawings. (6, page vii)

The statement of purpose in the preceding quotation from the state adopted text-book for high school drafting in Oklahoma lends to the suggestion that the objectives of that area of teaching in Oklahoma are somewhat similar in pattern.

From findings in the study which is the subject of this thesis it is evident that most of the teachers whose work includes many phases of shopwork are cognizant of the need for drafting as an additive to the normal program of work conducted in the shop. It is not possible to ascertain the methods employed by the teachers who responded to the survey. A possible area of research in drafting is some form or method

of proving the advantages or disadvantages of formalized courses in drafting as compared with a fused method of teaching it as a part of the shopwork offering.

Information has been requested by means of a survey form which was mailed to each of 296 selected high school shop and drafting teachers in Oklahoma. Discussions and findings in this chapter are important only as they pertain to school owned equipment which is furnished for use by students in drafting classes of those schools. Drafting is not offered in all schools where industrial arts is included in the curriculum. From those in which drafting is offered, a relatively few teachers report extensive amounts of school owned equipment. Some reports include more than adequate amounts of such equipment while others report very small amounts or none at all. Some reports state that students furnish the required instruments for their own use.

Tables of numbers and sizes as they appear in the following pages are descriptive of the itemized information in the returned check-list forms. This information includes the status of cost, size, number of items, condition and name of manufacturer or distributor of reported equipment. Probably the most uniform characteristic of reported information is the inconsistency of amounts, size, and cost, between items of equipment reported from different schools.

Drafting Boards. While drafting is admittedly the language of industry this sterling acknowledgment is not completely meaningful in the actual practice of imparting shopwork skills and industrial information. As evidenced by the attendant figures, approximately half of those schools which are taken into account in this study, have school owned drafting boards for use by the students. Drafting boards, 2,225 in total

amount, are a part of the school furnished drafting equipment of 64 Oklahoma high schools. The comparatively large number of these affords a rounded average of 35 boards for each school which in the absence of unequal distribution would allow an individually used drafting board for every student in two daily drafting classes of 16 pupils. That there is uneven distribution which deprives the immediately preceding suggestion of an extensive significance is born out by data included in Table XXIV.

TABLE XXIV

NUMBER AND SIZE OF DRAFTING BOARDS IN 64 OKLAHOMA HIGH SCHOOLS

Size in Inches of Width and Length	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
12 x 16	12			
12 x 18	45			
14 x 18	5	20		
14 x 20	13			
15 x 21		20		
16 x 20	22	30	154	
16 x 23		23		
16 x 24		42	20	
17 x 22		60		
18 x 24	62	92	231	184
18 x 25		13		
18 x 26		18		
18 x 30	6			
20 x 24	20	93		220
20 x 25	12			190
20 x 28		12		
20 x 30		20		
22 x 18		22	70	
22 x 24			180	
24 x 24	8			
24 x 30		36	35	
24 x 36	2	10		15
Not stated	45	37	34	92
Totals	252	566	724	701

The sizes of drawing boards as listed in column one of Table XXIV was taken from a standard drafting supplies catalog.

Many school shops are not equipped with drafting boards or do not furnish them to the students. The most popular sizes of drafting boards

as they are established by the number reported from the representative schools is between 18 by 24 inches and 22 by 24 inches. No date of purchase is available for 476 drafting boards though 914 of those aggregated are less than ten years old. An average age of all those for which figures are usable is 13.1 years. Parallel with the data for age, the condition of 408 drafting boards was not recorded. These are assumed to be in the approximate condition as those in the following list:

New	6
Good	573
Fair	1,006
Poor	212
	1,817

Drafting boards are durable and relatively inexpensive. Costs are varied from fifty cents to $2.50 each. Unit costs are not available for approximately half of the 2,225 boards which were reported.

Surprisingly, only a few of the drafting boards now being discussed are shopmade. Trade names of manufacturers and distributors are enumerated in the following list:

Undetermined	1,005
Eugene Dietzgen Co.	909
Shopmade	242
Frederick Post	14
Graf-Ams Company	14
Brodhead Garrett	41
Total	2,225

Little significance is attached to makers or distributors of drafting boards except from an informational viewpoint. Worth mentioning, however, is that regardless of make, the expense of outfitting a whole class with the best of these is little more or less than the cost of one woodworking bench. In a few school shops drawing boards to be secured in the vises on woodwork benches were reported to be used.

T-Squares. The basic instrument of drafting or mechanical drawing, the T-Square, is a part of the school owned drafting equipment in 63 of the school shops which are represented in this study. There are a total of 1,333 T-Squares reported in the returned check-lists from 63 drafting teachers. Of this aggregation a distribution of the size and number of T-Squares is presented in Table XXV.

TABLE XXV

NUMBER AND SIZE OF T-SQUARES IN OKLAHOMA HIGH SCHOOL DRAFTING ROOMS

Size in Inches	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
16"	14			
18"	37	60		
24"	53	258	188	66
26"		72		
28"		20		
30"	44	32	111	32
36"	2			6
Omitted	155	83	36	64
Total	305	525	335	168

These figures are suggestive that the 24-inch T-Square is the more popular size. The average age of all T-Squares on which the dates of purchase are known is established at 6.4 years. No purchase dates were reported for 481 T-Squares but other dates and years indicate that information included from these would not be startlingly different.

As with several other items of drafting equipment the T-Square is not expensive. The lowest original unit cost reported for this item is sixty cents for a 24-inch T-Square compared with the greatest listed cost of $3 for one of the same size. Slightly higher costs appeared in the information but are for the larger T-Squares.

The item of cost is not indicative or an accurate guide to the condition of this equipment. An analysis of evaluated condition and the number

of items for which evaluations are available is included in the following list:

New	6
Good	541
Fair	340
Poor	95
Not stated	351
Total	1,333

Due to the different degrees of completeness in the information offered no correlation has been established between the age, condition, and trade brands of T-Squares. The names of makers and distributors, however, appeared in the study as follows:

Undetermined	630
Eugene Dietzgen Co.	463
Post	128
Shopmade	79
Graf-Aps Co.	14
War Surplus	19
Total	1,333

The appearance of war surplus items or material in school shops is not as common as might be supposed. This statement is borne out only to the extent of the conditions or names which were definitely stated in the reports and is therefore not all-conclusive.

Stools. By some standards or scales of rating, such a small item of equipment as a stool probably is not given major proportion. Nevertheless, stools are an important consideration in the outfitting and planning of drafting facilities.

Stools which total 551 in number were reported in the information from 24 schools. Computed from these totals 23 students could be seated by the average drafting facility in the survey. This number is not great but is probably consistent with the average size of drafting classes in Oklahoma. A distribution of the number of drawing stools, the number of

drafting rooms, and the size of towns where drafting is taught is particularized in Table XXVI. The averages are based on the total number of stools as computed with the number of drafting rooms reported from towns of the sizes specified in Table XXVI.

TABLE XXVI

THE AVERAGE NUMBER OF STOOLS IN OKLAHOMA HIGH SCHOOL DRAFTING ROOMS

	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
No. of Drafting Rooms	25	28	13	7
No. of Stools	8	235	169	139
Average No. of Stools per room	.32	.39	13	19.8

These figures are decidedly different than when reviewed for the 24 school drafting rooms which report the aforementioned stools. The tendency toward greater numbers of stools per class room is noticeable by the almost uniform increased average from smaller to larger communities.

Condition of drafting stools is slightly better than fair. This statement is confirmed in the following list.

New	6
Good	271
Fair	174
Not stated	100
Total	551

The average age of the drafting stools in the study is 12.2 years, with the oldest set being 29 years old and the newest one year old. Of the 551 stools reported 187 have been purchased since 1939. No purchase date was in the information for 229 stools.

Lowest original unit cost to be listed was thirty cents for a shop-made stool and the highest of $12.50 was for stools unspecified as to

make, but which were purchased in 1948 and are in good condition. Trade brands of drafting stools for which that information was a part of the data are:

Eugene Dietzgen Co.	99
Shopmade	72
Post	20
Brodhead-Garrett	12
Not stated	348
Total	551

No comment is inspired by these findings other than to point out the relatively large number of shopmade stools and the substantially lower cost of these as compared with manufactured trade brands.

Drafting Machines. Only seven of the school shops which are a part of the present analysis have drafting machines. Of these one school shop has five, one has ten and another two. Twenty-three machines comprise the total number in the study. Table XXVII which includes the numbers of machines illustrates the distribution of these machines under the size of towns.

TABLE XXVII

NUMBER OF DRAFTING MACHINES IN SEVEN OKLAHOMA HIGH SCHOOL DRAFTING ROOMS

Number in towns of 2,000 population or less	6
Number in towns of 2,001 to 10,000 population	12
Number in towns of 10,001 to 50,000 population	4
Number in towns of 50,001 or over	1
Total	23

A determinable size, 18 x 24 inches, was listed for only one drafting machine although two other machines were described as portable and would therefore be of medium dimensions or less.

The ages of drafting machines are not great. One machine is 17 years old, another is 7 years old, but the average age for all 23 drafting machines is 2.1 years. Eighteen of the 23 total were purchased in 1949.

An average original unit cost of 19 machines for which a cost was included is $75.50. Differences in cost of drafting machines indicate a wide range of capacity or of design. The condition of the drafting machines reported are as follows:

New	13
Good	6
Fair	1
Not stated	3
Total	23

An average condition of "good" for drafting machines, considering that most of them are fairly new, is an expected development.

The names and number of manufacturers and distributors of reported drafting machines are as follows:

Star Watch Case Company	15
Eugene Dietzgen Co.	2
Manning-Wallace	2
Pease	1
Not stated	1
Total	23

It is desirable that a drafting room should have at least one drafting machine for instructional purposes. This is true for the reason that these devices are used extensively in the trade by skilled draftsmen. It could be mentioned at this point, however, that the teaching of drafting as an industrial arts subject is more of a generalized preliminary survey of the area of drafting and should be left at a prevocational level where involved techniques and speed devices are somewhat too advanced. This writer does not share that contention but it has a basis which is justified if the avowed objectives of industrial arts subjects are adhered to in their narrow sense. In advanced industrial arts courses the works become more and more vocational in purpose, which may account for the installation of drafting machines in some drafting rooms.

Blueprint Machines. Any device or technique which permits quantities of print to be reproduced from a single drawing is a great assistance if not a must in a drafting room. Blueprinting is a part of the course. Many methods have been practiced in blueprinting. Shop made blueprint machines are sometimes used, but judging by the fact that only two of the 16 which are discussed in this writing are shopmade it is probably that producing a blueprinting device in the school shop is not the best means of acquiring a good one.

Fifteen drafting rooms were reported to have blueprint machines. Sizes of the 16 blueprint machines in the study vary from 12 x 18 inches to 48 x 60 inches of dimension. The bulk of that number are in the school drafting rooms of towns of over 10,000 people. A distribution of these which shows the number of machines and the size of towns is indicated in Table XXVIII.

TABLE XXVIII

NUMBER OF BLUEPRINTING MACHINES IN OKLAHOMA HIGH SCHOOL DRAFTING ROOMS

Number in towns of 2,000 population or less	2
Number in towns of 2,001 to 10,000 population	2
Number in towns of 10,001 to 50,000 population	8
Number in towns of 50,001 population or over	4
Total	16

Ages of six machines were not ascertained by the survey. Of the 10 remaining blueprinting machines five are less than 10 years old. An average age of these 10 machines is 11.8 years and the earliest date of purchase for any machine is 1920.

Costs of blueprinting machines are not excessive and vary by fairly even proportion with size. No cost figures were submitted for the shop-made machines in the study which prevents a comparative cost analysis between these and manufactured brands. Approximate cost of $89 is the

computed average for eight machines for which an original unit cost was reported.

The blueprinting machines in this study are in slightly better than good condition as is verified by the following list:

Excellent	1
Good	9
Fair	2
Not stated	4
Total	16

Brand names, four in number, appeared in the returned survey forms according to the number written at the right of the names as they are listed:

Eugene Dietzgen Co.	4
Pease	2
Copymaster	1
Shopmade	2
Not stated	7
Total	16

As is stated by French and Svenson (6, page 75) electrically lighted blueprint machines obtain more uniform results than the more crude devices which make use of natural light. These writers also go on to say that the C. F. Pease Company manufactures one type of blueprinting machine with washer and dryer which is appropriate for school use.

Drafting Tables. No one factor or condition has been credited as the probable reason for a dearth of major drafting room equipment in the smaller schools. Of the 679 drafting tables which were reported from 28 high schools only 4.5 percent were reported from schools in towns of less than 2,000 people. Comparative figures will more elaborately portray the actual distribution within the schools. The numbers and sizes of drafting tables are ranked in Table XXIX.

The evaluated condition of drafting tables is good or better. This is established by the following list:

New	36
Excellent	66
Good	279
Fair	153
Bad	12
Not stated	133
Total	679

No correlation was possible between brand identities and condition nor between condition and age.

TABLE XXIX

NUMBER AND SIZE OF DRAFTING TABLES IN 28 OKLAHOMA HIGH SCHOOL DRAFTING ROOMS

Size in Inches of Width and Length	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over
22 x 36		7		
24 x 30	12	59		
24 x 34		22		
24 x 36	10	46		
24 x 38		24	6	
24 x 42		10		
28 x 36		31	66	
30 x 36		20	47	62
30 x 40			24	
30 x 42		20		
36 x 42				32
Undetermined	7	53	75	40
Total	29	298	218	134

The total number of tables, and names of manufacturers or distributors are listed here:

Sheldon	118
Eugene Dietzgen Co.	55
Kewanee	30
Brodhead-Garrett	13
Shopmade	265
Not stated	199
Total	679

Dates of purchase were not filled out for 219 drafting tables, almost

one-third of the whole number reported. Ages of less than 10 years for 211 tables and an average age of 12.8 years is computed for all of the tables included in the study. The earliest date of purchase, the year 1920, is denoted for 62 tables not all of which were reported from the same school. Original unit costs of drafting tables is varied between two extremes, a low of $1.50 for shopmade tables and a high of $95 for a 28 x 36-inch Sheldon made drafting table.

From preceding discussion it is apparent that shopmade equipment has been used acceptably in a number of schools. Among other reasons which are somewhat superfluous when overbalanced by the low cost are availability, adaptability, with some reservation made as to workmanship and smart appearance.

Drawing Sets. Drawing sets, 635 in number and of various sizes, are furnished for use by students in 32 schools which are a part of the study. The number of drawing sets and the proportional frequency by which these were reported is entered under the size of towns described in Table XIX.

TABLE XIX

NUMBER OF DRAWING SETS IN 32 OKLAHOMA HIGH SCHOOL DRAFTING ROOMS

Number in towns of 2,000 population or less	72
Number in towns of 2,001 to 10,000 population	122
Number in towns of 10,001 to 50,000 population	311
Number in towns of 50,001 population or over	130
Total	635

Conceivably, a drafting room or department might be well equipped and yet might not have as a part of that equipment a complete drawing set for individual student use. An ideal situation for motivation and interest would require that these be made available at school expense rather than otherwise. Still, controversially, other points of view

will undoubtedly contend that student owned equipment stimulates interest in the use of that equipment and that pride in ownership might contribute to a more lasting appreciation of drafting as a science and as an area of industrial arts work.

Size of drawing sets was expressed by the number of bows in a set, some by the number of pieces, others by catalog number. Two-bow sets, three-bow sets, seven-piece and ten-piece sets were most often described in the returned survey forms.

The described condition of drawing sets in the study is fair or better. Comparatively evaluated conditions are outlined below:

Excellent	51
Good	259
Fair	205
Poor	24
Not stated	86
Total	635

Trade brands are restricted to three which listed by the number of sets bearing these brand names are as follows:

Eugene Dietzgen Co.	341
Charvos	148
Post	7
Not stated	139
Total	635

A six-year average age was computed for those school-owned sets which were of an age determinable from the date of purchase given. Dates of purchase were not listed for 178 sets but from other included data it is definite that 395 of the 635 or well over half of the total are less than 10 years old. Purchase dates for 19 sets were in 1949.

The item of cost is varied by the size of the drawing sets and is difficult to determine comparably. A low cost of four dollars was given for a drawing set on which cost and condition were the only data. This

is in comparison to a $28 high which was for a Dietzgen made drawing set of unspecified size or age and in good condition. An average of the original unit costs which were a part of the information on 457 drawing sets is slightly over twelve dollars.

Conditions such as cost lends substance to the argument about advantages and disadvantages of the provision of drawing sets for student use by the school. The cost factor exerts pressure toward two alternative contentions. One of these is that paying for an item which costs twice to three times the price of a textbook is an obstacle to most students who might wish to study drafting. This is perhaps the most justified of the two thoughts. Another is that a major expense item causes undue stresses in the school budget. This too is a potent suggestion.

Other Drafting Equipment. Numerous items of equipment appeared in the survey through extraordinary courtesy and helpfulness of those teachers making the reports. Most of the equipment written in as extra is minor items such as scales, triangles, compasses, curves and lettering guides. The numbers of this mentioned equipment being comparatively few and in the absence of those items from all but two or three schools it is not possible to conclude an extensively detailed analysis.

A tabulation of industrial arts subjects taught in Oklahoma high schools yielded a total of 67 schools in which drafting is a part of the curriculum.

A review of Chapter V shows 64 of the 67 reported drafting rooms to be equipped with drafting boards. Sixty-three are equipped with T-Squares. Reports of equipment indicate that only 24 drafting rooms are equipped with regular drafting stools. The least seating facilities for

drafting are provided in schools of towns of below 2,000 population (See Table XXVI, page 75). Twenty-three drafting machines are a part of the equipment reported from seven high schools. Blueprinting machines, 16 in number, have been reported from as many drafting rooms. More of these are found in schools of towns of over 10,000 population. This is doubtless due to the fact that this size of community tends to afford more unit teaching of industrial arts subjects. Reports from 20 high schools show that only 4.5 percent of 679 drafting tables are a part of the drafting equipment in schools of towns below 2,000 population. Six hundred thirty-two sets of drawing instruments are furnished in 32 schools which are a part of the study. The average cost of these is slightly over $12 a set. It may be concluded that special facilities are provided in approximately one-third of the high schools where drafting is taught. As is indicated by the small number of schools which are equipped with drafting tables and stools drafting is probably taught as a part activity of some other industrial arts subject or is given secondary importance.

CHAPTER VI

OTHER MACHINES AND MAJOR EQUIPMENT IN OKLAHOMA HIGH SCHOOL SHOPS

The addition of areas other than woodworking to the school shop offering is probable in the near future. Shopwork in metals and graphic arts are seemingly restricted to medium or larger urban communities. Other teachings of a divergent nature are indicated slightly by odd items of equipment reported in the survey forms returned from school shops which specified some offering in agreement with the listed types of facility. The small amount of equipment reported for some areas of industrial arts teaching is out of proportion to the emphasis placed on those areas by modern living standards. Examples of this are electrical work and automobile mechanics. Some form of teaching in these subjects on a less restricted basis than for vocational training would be justified and doubtless welcomed in any school community.

Teaching facilities for metal work and ornamental ironwork are more plentiful and yet not overabundant. Consumer values and even appreciations of these areas of shopwork seem less desirable than for automobile mechanics or electricity, though it is not meant to place too slight an emphasis on any phase of the metal industries. The graphic arts are highly respectable in unit shops of the few really large schools in the survey. Arts and crafts work has a seemingly preliminary footing in the communities of less than 50,000 population which are represented in the survey.

The areas of shopwork which are discussed in this chapter are the six remaining on the survey form used after all usable information from areas of woodwork and drafting is included in two other complete, separate chapters. The total of all reported machines and equipment for

the shopwork which includes, electrical work, ornamental ironwork, automobile mechanics, graphic arts, general metalwork, and arts and crafts work is somewhat less than that for either woodwork or drafting. Information is tabulated and discussed in the following paragraphs for each of the six mentioned areas of shopwork.

Electrical Work. Few of the school shops represented in the study have appreciable amounts of the equipment which was itemized in the checklist forms. Much of the equipment reported is of indeterminate quality or value. Those items of equipment which are commonly used for experimentation and practice in electrical work have little information on them other than the number in a particular shop. The name and number of devices which fall into the category of the preceding statement are presented in Table XXXI.

TABLE XXXI

NUMBER AND NAME OF ELECTRICAL WORK EQUIPMENT ITEMS IN OKLAHOMA HIGH SCHOOL SHOPS

Name of Item	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,000 to 50,000 pop.	No. in Towns of 50,000 pop. or over	Total Number Listed
Electric Meter			10	33	43
Volt Meter	2		4	13	19
Radios	2			26	28
Telephones		2		8	10
Transformers	3		24	9	36
Angle Braces					0
Blow Torch	8	3	9	2	22
Electric Motor	47	10		14	71

The informational data on electrical working equipment in the returned forms is extremely meagre. In a few instances electrical motors were entered in the space for that type of equipment. In some cases where motors are the only item of equipment listed it is almost to be

assumed that these are extra auxiliary equipment and not used for instructional purposes.

Ornamental Ironwork. Equipment and facilities for the teaching of ornamental ironwork is not abundant in Oklahoma. This is evident from the findings in 132 returned usable check-lists. The number of each item of equipment in the survey form for ornamental ironwork is compared in Table XXXII with sizes of towns which are represented in the study.

TABLE XXXII

NAME AND NUMBER OF EQUIPMENT ITEMS FOR ORNAMENTAL IRONWORK IN OKLAHOMA HIGH SCHOOL SHOPS

Name of Equipment Item	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over	Total No. in all Shops
Forges	4	4	1	1	10
Anvils	12	20	5	10	51
Gas Furnace	—	2	10	7	19
Taps and Dies					
Machinist's Vises	38	25	44	42	149
Welding, Gas	19	4	3	7	35
Welding, Arc	8	6	4	1	19
Furnace, Melting	—	1	3	2	6
Molding Bins	—	—	2	1	3
Pouring Ladles	2	1	3	3	9
Cupolas	—	—	—	1	1
Pipe Vises	10	8	11	3	32
Pipe Stock & Dies	7	4	1	3	15

All of the items in Table XXXII are divided among 39 school shops. Total figures in the table indicate that most of these shops are well equipped for teaching most of the activities which are a part of ornamental ironwork. Items of the required basic equipment such as vises, anvils, and pipeworking apparatus are the most abundant. Equipment for gas welding was reported from 35 school shops, and facilities for arc welding from 19 school shops. Some facilities for shopwork in foundry, five melting furnaces, eight pouring ladles, three molding bins, and

not the least considerable of these items, one cupola shaft furnace, are noticeable by reason of having been reported from the two larger community groups designated in this study. One obvious reason for scarcity of foundry equipment in the smaller communities is the absence of a local or immediate need. That need and familiarity are factors which influence the popularity of different types of equipment in school shops is exemplified by a fairly even distribution of shop apparatus which is similarly useful in both rural and urban communities. This is with reference to the items already mentioned, namely, anvils, gas and arc welding facilities, pipe working tools and devices, and another item which was not mentioned, forges. Preponderant numbers of these items of equipment which were reported from rural or semi-rural communities stimulates the idea that much of the teaching in those areas is utilitarian rather than ornamental or avocational. The listings under ornamental ironwork are thus not conclusive by reason of an indefinitely established purpose for some of the equipment listed.

Automobile Mechanics. The teaching of simple automobile mechanics should be even if it is not a part of general education. However, the existing circumstances indicate there is little provision for instruction in any phase of automobile mechanics in the school shops which are represented in this study.

The position of automobile mechanics in the school curriculum is somewhat dubious. Hand tools and the individual working equipment are in the budgetary reach of almost any operating school or school shop department. Taught on an elementary level the devices and apparatus which are necessary to provide illustrative experiences in the principles of operation, minor repair, and preventive maintenance can very nearly be

provided from free or nearly free materials such as old parts, salvage, worn out vehicles and by other similar expedients.

Items of equipment which were reported are divided between 14 school shops. Names and number of items of equipment are described in Table XXXIII.

TABLE XXXIII

NUMBER OF ITEMS OF AUTOMOBILE MECHANICS EQUIPMENT IN 14 OKLAHOMA HIGH SCHOOL SHOPS

Name of Listed Item	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over	Total in 14 Shops
Hydraulic Lift	2				2
Battery Charger	1	1	2	3	7
Hoist			2		2
Honing Device			1		1
Auto Jacks			2		2
Universal Testing Machine			1		1
Socket Wrenches (sets)	1				1

The teaching of consumer values as well as understanding of principles fully justifies the inclusion of automobile mechanics in a school shopwork program.

Graphic Arts. According to Newkirk, "The graphic arts include some of the world's most important industries and rank about sixth in output when measured in dollars and cents". (13, page 49). Newkirk defines the graphic arts as an area of teaching which includes information, work experiences, and job execution in printing, etching, engraving, photography, bookbinding, silk screen, and illustrating. For use in the present study information was requested on the major equipment and machines used in the teaching of such graphic arts as are included in industrial arts printing classes, only. Five of the school shops in the

study have printing equipment in sufficient quantities for efficient operation. As is indicated by the small amount of equipment found in all shops little printing is attempted even on a general shop basis. Items of equipment and machines which are owned by the aforementioned five school shops are enumerated in Table XXXIV.

TABLE XXXIV

NUMBER OF ITEMS OF GRAPHIC ARTS EQUIPMENT IN FIVE OKLAHOMA HIGH SCHOOL SHOPS

Name of Item	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over	Total in Five School Shops
Hand Operated Job Press	2	1		3
Motor Driven Job Press	1	1	3	5
Proof Press	1	2	2	5
Type Cabinets	6	15	12	33
Cases of Type	75	172	222	469
Imposing Table	2	3	3	8
Silk-Screen Print		1	1	2
Variable Speed Motor			1	1

Printing is offered in the five school shops for which equipment is described in a unit shop with one exception. One of the five is a general shop. Little explanation is offered for the relative high number of unit shops. Since all of the tabulated information about industrial arts printing shops is from school shops in medium to large towns the suggestion is offered that no need exists for general shops.

General Metalwork. It is contended that work in the general metal shop should be in harmony with the special metal trades carried on in the surrounding community. Considering the scarcity of metal working industries in the average school community of Oklahoma it is not surprising that so small an amount of general metalworking equipment is found in the school shops over the state. Slightly less equipment was reported from

school shops in towns of less than 2,000 people than for those in towns of 50,000 population or over. But for a metal lathe and two other items, a stake plate and a soldering furnace no equipment for general metal work was listed from towns of 2,000 to 10,000 population. School shops in the larger towns are slightly better equipped than any one of the three other size groups. The name and number of items of general metalwork equipment is analyzed in Table XXXV.

TABLE XXXV

NAME AND NUMBER OF ITEMS OF GENERAL METAL WORK EQUIPMENT IN 12 OKLAHOMA HIGH SCHOOL SHOPS

Name of Item	No. in Towns up to 10,000 pop.	No. in Towns of 10,001 to 50,000 pop.	No. in Towns of 50,001 pop. or over	Total in all Shops
Metal Lathe	2		14	16
Forming Roll	2	1	1	4
Bar Folder	1	1	2	4
Beading Machine	1		1	2
Metal Band Saw			1	1
Shaper			1	1
Milling Machine			1	1
Burring Machine	1	2	1	4
Wiring Machine	1	2	1	4
Turning Machine	2	2	1	5
Hollow Mandrel	2			2
Stake Plate	2	2	1	5
Soldering Furnace	1	15	4	20
Squaring Shears		2	4	6
Pneumatic Riveter			4	4

Most of the machines enumerated in Table XXXV are inexpensive with the exception of the metal lathes. An original unit cost of $350 was reported for one machine. Purchased in 1948, it is in good condition and is of South Bend manufacture. One other metal lathe in question is an Atlas, in fair condition, and has no information given on it other than size. The 16 metal lathes vary in size from 10" to 16" in size.

Other factors than that of outright expense are considerable in explaining the dearth of metal working, even an exploratory basis, in the

industrial arts. Two suggested reasons for what will be termed reluctance to include or teach metalwork are these:

1. A tendency of school people, administrators, and community leaders to prefer the traditional offering of woodwork in the school industrial arts program.

2. A tendency of school administrators, teachers, and training institutions to be cautious in advocating changes over the resistance offered by traditionalists both in the school and in the community.

There are numerous other elements of approach from which to derive discussion. Many of these problems are worthy of exhaustive study with reference to the ways and means of curriculum offerings in an objective and a constructive manner.

Arts and Crafts Work. Work in the arts and crafts has a high avocational value and an uncanny attraction about it. Activities in arts and crafts work are of a nature to permit their performance by persons who might not otherwise be able physically or for any reason to indulge in more strenuous forms of shopwork.

Surprisingly, in spite of its small expense, little equipment is provided in the school shops reached by the survey for work in the arts and crafts. The name and number of arts and crafts work equipment items for which information was submitted in response to the survey is delineated in Table XXXVI.

With the possible exception of that used for leather working and wood carving it is evident by the amount of equipment reported that work in arts and crafts is not an extensive project in Oklahoma high schools. Leather hand-tooling could conceivably be vocational or prevocational instruction as is possible also for wood carving. A relatively small showing of major equipment, however, does not present a whole picture of the various effort in phases of arts and crafts. Other information in

the survey, shop subject or subjects taught, indicates that some offering in this area of shopwork is made along with other areas, the teaching of which receives more emphasis.

TABLE XXXVI

NAME AND NUMBER OF ITEMS OF ARTS AND CRAFTS WORK EQUIPMENT IN OKLAHOMA HIGH SCHOOL SHOPS

Name of Item	No. in Towns of 2,000 pop. or less	No. in Towns of 2,001 to 10,000 pop.	No. in Towns of 10,001 pop. or over	Total in all Shops
Leather Hand Tools (sets)	2	2	9	13
Wood Carving Sets	1	4	4	9
Etching Equipment		1		1
Buffing Wheels	2	5	7	14
Plastic Ovens		1	1	2
Vibro-Tool	1			1

Equipment for electrical work is fairly adequate in those schools where there is evidence that some phases of electricity are taught. School shops where ornamental ironwork is reported are only 39 in number. This is 21.9 percent of the schools represented in the study. Items in the list of equipment were reported in insufficient numbers to indicate that any of the shops where ornamental ironwork is taught are equipped with any degree of completeness. Results of the survey indicate that 14 school shops are equipped with apparatus and machines for the teaching of elementary automobile mechanics. The teaching of graphic arts in Oklahoma is not given emphasis in proportion to the importance placed upon this area of work in the realm of industry. Graphic arts equipment was reported from 3.6 percent of the 132 school shops reached by the survey. Facilities for teaching general metal work are available in 12 Oklahoma high school shops or nine percent of those in the study. Arts and crafts work tools and equipment are in use in school shops in a few instances.

CHAPTER VII

INTERPRETATIONS, ANALYSES, RECAPITULATION, AND RECOMMENDATIONS

In the establishment of minimum standards for school facilities and equipment, much of the reasoning is subjective. The flexibility of the statement regarding instructional equipment and supplies which is written into the 1948 Annual High School Bulletin, Oklahoma is given exercise by a review of the extremes of conditions in the findings of this study. For illustration purposes this clause is quoted:

> Instructional equipment and supplies such as: science apparatus, laboratory tables, and demonstration desks; shop tools and machinery; gymnasium equipment and supplies; equipment for home economics and agricultural laboratories; equipment and supplies for commercial, art, and music rooms; audio-visual aids equipment; maps and charts; library books, text books, and supplies should be adequate and used in such a way as to meet the needs of instruction for all courses and activities offered. (22, page 86)

How much or how little is an adequate provision for the instructional needs of course offerings? In the case of a class in shopwork an adequate facility would necessarily consist of the proper tools and equipment for the student to use in order to derive the most possible benefit from the time spent. In addition, sufficient space is needed in which to work. This space should be clean, attractive, well-lighted and heated, and located conveniently to tools, supplies, and for instructional supervision.

The degree of adequacy of facilities provided for shopwork and drafting in the high schools of Oklahoma is dependent upon a number of factors. Among these are the size of classes, kind of shopwork taught, how it is taught and to whom, grade level of classes, and the objectives of the courses taught. Other factors are equally considerable. Interpretation of information in the returned check-lists was attempted

in accordance with the objectives which are most generally agreed to be appropriate for high school industrial arts courses.

Interpretations. Some confusion of purpose exists in industrial arts as to what should be taught. This is in evidence by the variety of titles used to designate industrial arts courses. It is likely that crowded conditions exist in the 54 school shops for which less than 1,200 square feet of floor area was reported. This is verified by the modal class enrollment of about 25 students as reported by Tinkle. (25, page 39). Findings of this survey, however, indicate that housing is adequate in a majority of the schools represented in the study. Ceiling heights reported are sufficient in most cases to afford proper diffusion of natural and artificial lighting and to provide an ample air volume for the safeguarding of health.

The large number of new shops being built encourages the belief that industrial arts is achieving greater recognition in Oklahoma.

Desirable methods of heating are used in a majority of school shops. The late addition of shopwork to the school curriculum is probably the reason for the large number of shop buildings which are separate from main school buildings.

Equipment is adequate and of the proper kind for industrial arts classes in about half of the woodworking shops in Oklahoma high schools.

The newer, smaller, and less expensive machinery now being designed and purchased for use in school shops makes possible a wider and richer variety of experiences to be had by the student. The resultant lower cost of smaller machines places them in the financial reach of almost any Oklahoma school community. Power driven machines are a comparatively recent addition to the equipment in high school woodworking shops in

Oklahoma. The possibilities of drafting as an educative subject is not fully realized in all schools. Costs of equipment are low enought to make drafting facilities in the reach of almost any school. The drafting which is taught in most of the schools in the report is not intended to be of immediate vocational value to students. Its value is in the realm of general education.

Some means of popularizing shopwork in areas other than woodworking is needed. Metalworking equipment in many instances costs only slightly more than that for use in woodworking. Very little shopwork other than woodworking is offered in school shops of smaller communities. What departure there is from woodworking may have been influenced to some extent by mechanized farm and home machinery or appliances.

Arts and crafts work is taught only on a limited scale in Oklahoma although incidental findings in the returned check-lists indicate that some thought is being given to the inclusion of this subject in shopwork courses. A lack of adequate records on shop equipment and machines is obvious. Most of the reporting teachers were frank about availability of records where the definite information asked for could not be supplied. An encouraging number of the reports showed evidence of well-kept accurate records. Less complete information seems to be a rule with smaller schools where teacher turnover is frequent and curriculum offerings are unreliable.

Analyses. Of sixty-two different subject titles which appeared in the survey returns a total of 226 times, 29 subject titles describing woodwork were used in 129 or 57 percent of the cases. Drafting or mechanical drawing appeared 34 times or 26.9 percent of the cases in which all subject titles were used. This means that over half of the

course offering in the schools reached by the survey is some form of woodworking, and that a little over one-fourth of the subjects taught is drafting in some form. Thirty-three other subject titles in Table I, page 2, include both general and specific terminology. The term "manual training" was used three times, and "manual arts" twice.

The average floor space provided in the school shops and drafting rooms surveyed is greater than the averages computed from dimensions recommended by Hays and Gesberg, and by Newkirk in the following amounts:

Woodworking shops	639 square feet
Drafting rooms	188 square feet
Electrical shops	459 square feet
Metal shops	30 square feet
Printing shops	202 square feet
Machine shops	1,088 square feet
General shops	216 square feet

The average area for automobile mechanics shops in the survey is an exception to the aforementioned tendency and is smaller by 144 square feet than the desirable area as recommended by Hays and Gesberg.

Thirty-seven percent of the shop buildings reported have been built during the last 10 years. Types of construction utilized in 65 shop buildings which are separate from the main school buildings is in the following proportion: forty-six percent of the 65 are of fire resistant, semi-permanent or permanent construction. Except for one quonset type building the remaining 54 percent are wood frame structures or are unspecified.

A closed or forced air type of heating is used in 56 percent of the shops in the study. Thirty-seven percent of the total are heated by open stoves, 40 of which burn natural gas, six of which burn coal, three wood, and one kerosene.

Forty-nine percent of the shop buildings in the study are separate from the main school building. Thirty-one percent of these are located

on the ground floor of the school building and 16 percent are in basements. Three others are located on the second floor of building and two drafting rooms, one each are on third and fourth floors. Three separate shop buildings are at an excessive distance from the main school building. Two of these are one-fourth mile distance and one is at a distance of two miles.

Items of machinery and equipment in use in the 117 woodworking shops in the survey are listed in Table XXXVII according to the percentage of the total reported:

TABLE XXXVII

ORDER OF RANK OF REPORTED WOODWORKING MACHINES OR EQUIPMENT BY PERCENTAGE OF TOTAL SHOPS IN THE SURVEY

Name of Item	Percentage of Total Shops from which Item was reported
Power Grinder	98.4
Drill Press	92.4
Benches	89.3
Jointer	82.2
Jig Saw	76.5
Band Saw	70.0
Universal Saw	59.9
Glue Pots	56.5
Portable Sander	55.3
Variety Saw	41.8
Shaper	36.7
Wood Turning Lathe	28.2
Belt Sander	22.7
Surfacer	15.3
Mortiser	9.4
Saw Filing Machine	5.9
Tenoner	1.7

No one machine or item was reported from all shops. Several reports were of equipment for hand woodworking only but included short lists of machines. Typical of the machines in these reports were the jig saw, small band saw, wood turning lathe and jointer.

The school owned drafting equipment reported from 67 schools in the survey included the items in the listed percentage of total drafting rooms in the survey as is shown in Table XXXVIII.

TABLE XXXVIII

ORDER OF RANK OF DRAFTING EQUIPMENT BY PERCENTAGE OF TOTAL DRAFTING ROOMS IN THE SURVEY

Name of Item	Percentage of Total Drafting Rooms from which Item was reported
Drafting Boards	95.4
T-Squares	94.0
Drawing Sets	47.7
Drafting Tables	41.6
Stools	35.8
Blueprint Machines	24.4
Drafting Machines	1.4

Two unit drafting rooms in the survey are completely equipped with all of the items in the check-list. Several reports included mention of the use of student owned equipment as a regular practice.

Equipment for use in all of the areas of industrial arts shopwork was reported from the number of shops according to the percentages in Table XXXIX.

TABLE XXXIX

PERCENTAGE OF TOTAL SHOPS REPORTING EQUIPMENT FOR ALL AREAS IN THE CHECK-LIST

Name of Area	Percentage of Total Shops in the Survey
Woodworking	88.7
Drafting	50.7
Ornamental Ironwork	28.7
Electrical Work	16.6
Auto Mechanics	10.6
Arts and Crafts	10.6
General Metalwork	9.0
Graphic Arts	3.9

Equipment for both the areas of woodwork and drafting was reported from

33, or 25 percent, of the shops surveyed. Twenty-two or 17.7 percent of the returned usable reports included equipment for three areas of shopwork. Of all of the reports received 5, or 3.7 percent, were for shops with equipment for four or more work areas, and 66, or 50 percent, were from shops equipped either for drafting or for one shopwork area only. Amounts of equipment reported for the latter were adequate for unit shops. Two electric shops, both in the Tulsa schools, five printing shops, five unit drafting rooms and 54 unit woodworking shops were reported. It was pointed out in five reports of woodworking shops that only hand woodwork was taught. Some power equipment was reported from these schools. These percentages prove that over 50 percent of the shopwork equipment reported in the survey is in use in shops where more than one shopwork activity is taught. This is in far greater proportion than the six designated "general shops" reported in the survey. While conditions which exist at any one time cannot denote a trend, the foregoing analysis indicates that 25.7 percent of the shops in this study are equipped as general shops according to Newkirk's definition of a general shop which states that, "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." (13, page 15). This definition and the 25.7 percent involves 33 shops as compared with the six which were designated and entitled "General Shop" in the returned check-lists.

Recapitulation. The 534 industrial arts teachers in 341 schools of Oklahoma in 1949 comprises an increase of 125 teachers and of 32 schools over the same totals in 1946.

Information was discussed and analyzed in this study from 132 check-lists which were usable from 144 which were returned.

Sixty-two descriptive titles of shop subjects and of shops and drafting rooms appeared in the returned inquiry forms. Adequate floor space is provided in most shops and drafting rooms in this study. The oldest shop building reported is 42 years old. Construction will have been completed on six new shop buildings in 1949. Eight new buildings were completed in 1948, and 19 in 1947. Nine types of building construction have been utilized in 65 separately located shops. Twenty-four of the 65 buildings are of wood frame construction. Except for one quonset type metal building, the other 40 are of semi-permanent or permanent types of building material. Forty-one shop rooms in addition to the 65 separately located are on the ground floor of school buildings. Twenty-one are located in basements, three on second floors, one, each on third and fourth floors. The latter two are drafting rooms. Equipment was reported the following number of times for each area of shopwork in the inquiry form:

Woodworking	117
Drafting	67
Electrical Work	22
Ornamental Ironwork	38
Automobile Mechanics	14
Graphic Arts	5
General Metalwork	12
Arts and Crafts Work	14

Small amounts of equipment were reported in addition to the items included in the check-lists. Most extra equipment was for use in woodworking. The most expensive equipment was reported from the least number of schools. The equipment in woodworking shops varies in amount from hand tools only to a degree of completeness suitable for vocational types of classes. Drafting boards and T-Squares were most commonly the school owned drafting equipment reported from schools in the survey. Drafting machines were reported the least number of times.

Equipment for both woodwork and drafting was reported from 25 percent of the schools in the survey. Equipment for drafting and two shopwork areas was reported from 17.7 percent of the school shops studied. Five or 3.7 percent of the returned check-lists included equipment for four or more areas of shopwork.

The most completely equipped school shop from a small town is at Carnegie, a town of 1,740 population. The report from Carnegie included equipment for six areas of shopwork, none for drafting or automobile mechanics. Reports from three other towns included equipment as follows:

> Guthrie, population 10,018, equipment for five shopwork areas described as woodwork, drafting, and general shop.
> Shidler, population 718, equipment for four shopwork areas, described as woodwork and oil field mechanics.
> Wewoka, population 10,314, equipment for woodwork and drafting in use, has equipment for metal work and automobile mechanics to be put into use in the fall of 1949.

The most extensive amount of shop equipment reported was from Enid High School. Facilities were reported from this school in adequate amounts for eight unit shops to include, woodwork, drafting, automobile mechanics, general metal, electrical work, and welding, both arc and acetylene.

Fifty percent of the shops reached by the survey are equipped for only one activity, either drafting or shop. Amounts and kinds of equipment reported from 25.7 percent of shops surveyed proves that they are general shops if the equipment is used as reported.

Recommendations. A simple but adequate, complete, and up-to-date inventory of the equipment in a school shop should be required of shop teachers. This should be a part of the permanent financial record of the shop or industrial arts department.

A uniform agreement is needed between teachers in the state as to the names of courses taught. The adopted titles should be identifiable

with industrial arts but should be descriptive of what is taught in the course. It is suggested here that the specific names of taught activities such as forging, acetylene welding, or leatherwork, are more informative than the more generalized terms such as Shop I, Industrial Arts II, as examples. A taught course of drafting should be made a part of each course of shopwork taught. Related drawing which would afford a prerequisite study of four or six weeks before beginning shopwork projects. In this way a number of difficulties which accompany the beginning of each semester of new classwork might be eliminated. Chief among these would be that of persuading students to make proper working drawings.

Research studies could appropriately be made periodically and of a nature similar in purpose to the present one to determine trends and developments in the physical aspects of school shops. A study was recommended by Pope in 1930 (15, page 59) and is reiterated: "Floor plans with location of equipment and properties would be of value. The appeal could be made to the shop instructors to use the idea as a class project or for individual pupils." An analysis or study of industrial arts courses taught in Oklahoma school shops might afford an approach at more uniform practices of teaching and of terminology.

Field studies of the conditions prevailing in school shops which could be executed by practice teachers undergoing periods of apprenticeship in schools of the state might be a worthwhile project. Some arrangement such as this might be a means of overcoming or detouring the suspicion and resentment which seems to be present in some of the communities where research aimed at improvement is needed most.

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APPENDIX A

DIRECTORY OF RESPONDENTS

City and School	Names of Teachers	Address of Teacher
Adams, H. S.	M. H. Klasson	Adams
Allen, H. S.	A. G. Pipkin	Route 2, Allen
Alva, H. S.	Lester Gallon	Alva
Apache, H. S.	Ben W. Ballard	Box 52. Apache
Ardmore, H. S.	Maurice M. Alton	1109 Wolverton
Avant, H. S.	John J. Potter	Avant
Bakersburg, Eureka	M. B. Friesen	Hooker, Oklahoma
Bartlesville, Central H. S.	Wayne Van Liew	
Battiest, H. S.	E. W. Hamby	
Beaver, H. S.	Earl Niles	Box 151, Beaver
Bowlegs, H. S.	Herman Moore	Bowlegs
Bristow, H. S.	Darrell Stiles	Bristow
Buffalo, H. S.	Lester Nieman	Buffalo
Calumet, H. S.	R. B. Parnell	Calumet
Cameron, H. S.	Avley Ragland	Cameron
Canute, H. S.	Preston Thacker	Box 60, Canute
Capron, H. S.	Dale Pulliam	Capron
Carnegie, H. S.	Robert K. Phelps	
Cashion, H. S.	E. S. Stoner	Cashion
Checotah, H. S.	D. W. Merryman	315 North Broadway
Chelsea, H.S.	Robert Cannon	Chelsea Hotel
Claremore, H. S.	Robert A. Henry	329 E. 6th.
Coalgate, H. S.	George Stricklen	Coalgate
Colcord, H. S.	Rex Buchanan	Kansas, Oklahoma
Colony, H. S.	George Bennett	Alfalfa, Oklahoma
Cordell, H. S.	Millard England	Box 194, Cordell
Corn	Leonard Reimer	
Cloud Chief, Cowden	Kenneth Adams	Route 1, Mountain View
Coyle, H. S.	Nelson Gregory	Box 327, Coyle
Cushing, H. S.	Charles Godfrey	717 E. Moses
Cushing, H. S.	Orville Pote	Box 509
Custer City, H. S.	Cletus Johnson	Box 179
Decoma, H. S.	Durward Brown	Alva,
Davenport, H. S.	Charles Good	501 Iowa St. Chandler
Davis, Woodland Con # 1	Robert C. Moore	
Davidson, Wilson Con # 2	M. E. Friels	
Driftwood, H. S.	Paul Hampton	Box J
Drumright, H. S.	Robert Kingsley	401 S. Penn
Durant	M. E. Dobbins	402 W. Walnut
Durant Training School	Clarence Dyer	
Durham, H. S.	M. D. Groenwald	
Elmore City, H. S.	J. L. Medlock	Rt. 4, Pauls Valley
El Reno, H. S.	Woodrow Barton	806 W. Watts
Enid, H. S.	Herbert A. Seem	
Enid, H. S.	Myrl S. Kirk	
Fairfax, H. S.	Luie Pascoe, Jr.	Stillwater

City and School	Names of Teachers	Address of Teacher
Fletcher, H. S.	C. M. Ridgway	Box 129, Fletcher
Fort Gibson, H. S.	A. J. Henson	Fort Gibson
Foss, H. S.	Garland Dickerson	Foss
Fox, H. S.	Carl Roblyer	Box 141, Fox
Garber, H. S.	Ivan A. Holdar	Box 573
Glenpool, H. S.	R. C. Heidinger	
Granite, H. S.	Herbert C. McCall	
Grove, H. S.	Clarence B. Turner	Grove
Guthrie, H. S.	Orville Cordis	1809 E. Oklahoma
Henryetta, H. S.	Floyd Hubbard	Rt. 1, Box 347
Hickory, H. S.	Wayne Craig	1314 W. 12th.
Hobart, H. S.	R. C. Kleiner	429 N. Bailey
Hominy, Mound Valley	Elden Wagner	Route B
Hominy, H. S.	Ward Alexander	112 E. 5th.
Hugo, H. S.	Aaron W. Bates	Ervin Route
Keyes, H. S.	W. T. Jones	
Kingfisher, H. S.	Geen Gilmour	
Konawa, Vamoosa	George Hirn	Rt. 3
Lawton, H. S.	Paul Wilson	514 Morford Drive
LeFlore, H. S.	R. E. Scott	LeFlore
Madill, H. S.	Henry L. Mason	Box 142
Mangum, H. S.	Gerald Nichols	200 Maryland
Maud, H. S.	Glenn Rhoades	Box 772
Miami, H. S.	E. G. Gilbert	Route 2
Morris, Liberty H. S.	Hershel Long	Box 92
Mountain View, H. S.	O. L. Littlejohn	
Muskogee, Central H. S.	J. T. Huckstep	449 North K Street
Nash, H. S.	Everett Whorton	
Newkirk, H. S.	C. E. Cowles	
Norman, O. U. H. S.	L. D. Huddleston	
Norman, H. S.	Mrs. H. V. McDermott	807 Ponca
Nowata, H. S.	J. E. Large	229 North Pine
Okarche, H. S.	C. M. Hawkins	
Okemah, H. S.	Garvin A. Peck	409 S. 8th
Oklahoma City, Capitol Hill	Mrs. Thelma Coleman	1208 NW 17th
" " " "	W. L. Conner	1217 NW 37th
" " " "	W. H. Krieg	1212 NW 41st
" " Central	A. E. Phillips	
" " "	R. B. Shogren	2545 NW 21st
" " "	Robert Ferguson	
" " "	Harry E. Hicks	4336 SE 22nd
" " Classen	Alonzo Norwood	
" " Putnam City	Paul Simpson	720 N. Asbury Bethany
Okmulgee, H. S.	Albert Paolucci	704 North Griffin
Panama, H. S.	Oscar W. Borin	
Pauls Valley, H. S.	Dale P. Haynurst	Pauls Valley
Pawhuska, H. S.	James G. Peters	1604 Bigheart Ave.
Pawnee, H. S.	Ralph Teague	613 Forest
Perkins, H. S.	Elwood Hubbard	Box 94
Porter, H. S.	Edwin Swalley	
Prague	Mr. Mullin	

City and School	Names of Teachers	Address of Teacher
Pryor, H. S.	Carl Ford	13 Irving
Purcell, H. S.	Dona Teel	Box 301
Reed, H. S.	H. H. Winters	Reed
Ripley, H. S.	Hollie Barker	
Ryan, Union Valley	Walter Ashford	Discontinued
Sayre, H.S.	Carl Jones	
Seiling, H. S.	Joe Holland	Discontinued
Selman, H. S.	David Hebard	
Seminole, H. S.	Dennis Williams	516 West Russell
Shattuck, H. S.	Wilbur C. Jones	Box 366
Shidler, H. S.	D. A. Givens	
Spiro, H. S.	Carl Pollard	Box 252
Stroud, H. S.	L. A. Gilliam	Box 21
Sulphur, H. S.	Roy Stout	301 E. 5th
Temple, H. S.	J. O. Tennill	Box 578
Texhoma, H. S.	Freeman McKee	Box 5
Thomas, H. S.	Charles J. Ross	Box 123
Tonkawa, H. S.	Karl Mann	416 North 6th St.
Tulsa, Central	Carl D. Mason	908 South Winn.
Tulsa, Webster	Lee Paulding	2123 E. 41st
Tulsa, Will Rogers	Robert D. Rutherford	
Tulsa, Will Rogers	C. E. Gunn	2635 E. 8th
Tulsa, Will Rogers	S. L. Gunderson	
Tulsa, Will Rogers	H. A. Allender	2627 E. 8th
Tulsa, Edison	J. J. Frisch	319 E. Rosedale
Tupelo, H. S.	Curtis Cheek	
Turpin, H. S.	James Williford	
Tuttle, H. S.	John Lomax	
Vanoss, H.S.	Jim Gemill	Route 4, Ada
Vera, H. S.	George Tyner	
Vian, H. S.	Foxon Stinett	Route 2
Vici, H. S.	Allen Moore	
Vinita, H. S.	E. D. Stormont	
Walters, H. S.	J. E. Horton	210 E. Oklahoma
Wanette, H. S.	Fay L. Hudson	
Washington, H. S.	Orin E. Bradley	Box 96
Watonga, H. S.	U. B. Stephenson	1101 North Burford
Weatherford, H. S.	A. L. Lee	
Wewoka, H. S.	Thomas C. Taylor	Route 2
Wewoka, H. S.	Loyd Nash	1509 South Okfuskee
Wilson, H. S.	Aaron Fry	
Wilburton, H. S.	W. C. Roberts	
Willow, Ochna Con.	Karl Hager	
Wister, H. S.	J. W. Peery	Box 51
Wynnewood, H. S.	Zorna Berry	Box 194
Wynona, H. S.	Bentley Shockley	
Yale, H. S.	Chester Smith	

APPENDIX B

April 25, 1949

Dear Sir:

In the preparation of teachers of Industrial Arts in Oklahoma it is desirable to have established and a matter of record facts which are apparent in varying degrees but not definitely proved. The physical conditions under which Industrial Arts is taught are important. With this in mind the enclosed check-list has been chosen as a practicable method of securing information which will lead to accurate conclusions about the status and types of shopwork taught in Oklahoma high schools.

Check-lists are being sent to each of the 296 high school shop teachers in the State. The final study, to be based on data from the returned check-lists, is being undertaken by me under the direction of the Staff of the Department of Industrial Arts Education and Engineering Shopwork, Oklahoma A. & M. College, and is to provide material for the writing of a Master's Degree study entitled "A Survey of Major Equipment in High School Shops of Oklahoma in 1949."

In the check-list, machines and major items of equipment are grouped under eight different areas of shopwork. You are requested to enter the information about each machine or item of equipment which you have in your shop after the listed type of shopwork for which it is used.

A self-addressed and stamped envelope is provided for the return of your completed check-list. Your early response and cooperation will be sincerely appreciated.

Yours very truly,

Rufus D. Teague, Graduate Student
Department of
Industrial Arts Education
and Engineering Shopwork
Stillwater, Oklahoma

Approved by:

/s/ DeWitt Hunt
Thesis Adviser and Head
Department of
Industrial Arts Education
and Engineering Shopwork

A SURVEY OF MAJOR EQUIPMENT IN HIGH SCHOOL SHOPS OF OKLAHOMA IN 1949

Rufus D. Teague, Graduate Student
Department of Industrial Arts Education and Engineering Shopwork
Oklahoma Agricultural and Mechanical College
Stillwater, Oklahoma
Spring, 1949

City_____ Name of School _____

Name of teacher to whom this form is being sent _____

Name of shop or room _____ Size of room _____

Date shop or room was built_____ Ceiling height _____

Type of heating _____ Shop subject or subjects

taught in this room _____

On what floor is this room? _____Is this room a part of main

building? _____ If a separate building, how far is it from main

building? _____ If separate building, what type? _____

In the following check-list please give all the information requested for each machine or item of equipment which is located in your shop or drafting room. If you have machines or major equipment other than that included in the check-list please list it in the space provided under the proper listed area of shop-work. In the case of a general shop please include all the machines or major equipment which are used in that shop. Use approximations where definite information is not available. As for example: Date Purchased and Original Unit Cost.

	Name	No.	Size	Date Purchased	Original Unit Cost	Condition	Name of Manufacturer
WOODWORK	Variety Saw						
	Universal Saw						
	Band Saw						
	Jig Saw						
	Jointer						
	Drill Press						
	Shaper						
	Surfacer						
	Belt Sander						
	Glue Pot						
	Power Grinder						
	Saw Filing Machine						
	Wood-turning Lathe						
	Benches						
	Mortiser						
	Tenoner						
	Portable Sander						

	Name	No.	Size	Date Purchased	Original Unit Cost	Condition	Name of Manufacturer
DRAFTING	Drafting Boards						
	T-Squares						
	Stools						
	Drafting Machine						
	Blueprint Machine						
	Drafting Tables						
	Drawing Sets						
ELECTRICAL WORK	Radios						
	Telephones						
	Blow Torch						
	Transformer						
	Electric Meter						
	Electric Motors						
	Volt Meter						
	Angle Brace						
ORNAMENTAL IRONWORK	Forge						
	Anvils						
	Gas Furnace						
	Taps and Dies						
	Machinist's Vise(s)						
	Welding, Gas						
	Welding, Arc						
	Furnace, Melting						
	Molding Bins						
	Pouring Ladle						
	Cupola						
	Pipe Vise(s)						
	Pipe stock & dies						
AUTO MECHANICS	Hydraulic Lift						
	Honing Device						
	Battery Charger						
	Storage Batteries						
	Auto Jacks						
	Universal Testing Machines						

	Name	No.	Size	Date Purchased	Original Unit Cost	Condition	Name of Manufacturer
GRAPHIC ARTS	Hand Operated Job Press						
	Motor Driven Job Press						
	Proof Press						
	Type Cabinets						
	Cases of Type						
	Imposing Table						
GENERAL METALWORK	Forming Roll						
	Bar Folder						
	Beading Machine						
	Burring Machine						
	Wiring Machine						
	Turning Machine						
	Hollow Mandrel						
	Stake Plate						
	Soldering Furnace						
	Squaring Shears						
	Pneumatic Riveter						
	Plain Brake						
	Pan Brake						
ARTS AND CRAFTS WORK	Leather Hand Tools (sets)						
	Wood Carving Sets						
	Loom, Weaving						
	Etching Equipment						
	Buffing Wheel						
	Potters Wheel						
	Kiln						
	Plastic Oven						
	Book Binding Equip.						
	Silk Screen Print						

Date on which this check-list was filled out _____

Signature of teacher filling out the check-list _____

Street or mailing address _____

APPENDIX C

THE FOLLOW-UP CARD

May 17, 1949

Dear Sir:

As yet I do not have your completed check-list which you received on or about April 30.

The form sent to you is one method by which first-hand information may be obtained about facilities provided for the teaching of industrial arts. Your help will be greatly appreciated.

May I expect your completed check-list soon?

Yours very truly,

Rufus H. Teague
1003 South Duncan
Stillwater, Oklahoma

Typist, Christine Cotter Teague