A SURVEY OF MAJOR EQUIPMENT IN OKLAHOMA HIGH SCHOOL INDUSTRIAL ARTS MANUFACTURING PROCESSES LABORATORIES

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CHAPTER I

INTRODUCTION

The field of industrial arts has experienced many changes in teaching methods and physical classroom conditions in order to keep pace with modern industry. Industry has made substantial improvements in the design, safety, and technology of major laboratory equipment. While the industrial arts laboratory does not have the economic resources of an advanced industry, it should strive to obtain fairly up-to-date equipment. A major equipment survey conducted in 1949 attempted to evaluate the equipment status of Oklahoma industrial arts laboratories. One of the survey recommendations was that industrial arts teachers be required to keep up-to-date laboratory equipment inventories.

Current inventory information is needed by industrial arts teachers and planners in order to successfully evaluate the present condition of Oklahoma industrial arts manufacturing processes laboratories. Considerable emphasis should be placed on current inventory information for future evaluation, renovation, or planning of industrial arts manufacturing processes laboratories.

Statement of the Problem

One needs a basis for comparison when evaluating, updating, or building an industrial arts laboratory. Minimum standards have not been set for Oklahoma Industrial arts manufacturing processes laboratories, which

makes effective evaluation of present laboratory needs very difficult. A great deal of the available inventory information concerning present industrial arts laboratory equipment has become obsolete. Current equipment inventory lists from Oklahoma high school industrial arts manufacturing processes laboratories should establish useful major equipment guidelines for average laboratory requirements.

Purpose of the Study

This study examined 63 Oklahoma industrial arts programs offering manufacturing processes courses and identified the areas of major equipment needs. Data were also collected on the physical condition of major equipment currently in use. Information concerning the amount and physical condition of current major equipment was compared with findings of a 1949 major equipment survey.

Major Objectives

This research attempts to answer the following questions:

1. What major equipment is currently in use in the Oklahoma high school industrial arts manufacturing processes laboratories?

2. What is the physical condition of major equipment currently in use in the Oklahoma high school industrial arts manufacturing processes laboratory?

3. How does the current amount and physical condition of major equipment in use in the Oklahoma high school industrial arts manufacturing processes laboratory compare with a 1949 major equipment survey?

Assumptions

This study was conducted with the following assumptions:

1. The industrial arts teachers involved in this study were able to assess the physical condition of major equipment.

2. The industrial arts departments selected for this study were representative of other industrial arts departments in the state of Oklahoma.

3. The 1949 major equipment survey used for comparison in this study contains valid inventory information.

Limitations of the Study

This study was limited by the fact that the mailing list in this study was taken from the 1980-81 directory of full-time industrial arts teachers employed by the State Board of Education, and may contain some high schools that no longer offer a manufacturing processes course. The implications of this study may not be applicable to some industrial arts programs because of the representative sampling of Oklahoma high schools.

Definition of Terms

Education: The aggregate of all the processes by means of which a person develops abilities, attitudes, and other forms of behavior of positive value in the society in which he lives (7).

Equipment: Articles such as furniture, machinery, and books that are used without being consumed (7).

Industrial Arts: A phase of the educational program concerned with orienting individuals through study and experience to the technical-

industrial side of society for the purpose of enabling them to deal more intelligently with consumers' goods, to be more efficient producers, to use leisure time more effectively and enjoyably, to have a greater appreciation of material culture, and to act more intelligently in regard to matters of health and safety, especially as affected by industry (7).

Industrial Education: A generic term used to designate various types of education of an industrial nature, vocational industrial education, industrial arts, technical education, and apprenticeship training in both public and private schools (7).

Laboratory Equipment: Refers to equipment and tools housed in the industrial arts laboratory for the instruction and training of industrial arts students.

Laboratory (Industrial Arts): A space or room, or a number of rooms, adequately equipped with tools, materials, visual aids, and machines characteristis of several phases or forms of industry (7).

Major Equipment: Refers to a portion of the power tools or machines conceivably found in an industrial arts laboratory. The major equipment in this study shall include the following: table saws, band saws, radial arm saws, jig saws, miter saws, metal cutting saws, drill presses, wood turning lathes, sanders, planers, jointers, grinders, shapers, routers, mortisers, tenoners, air compressors, electric arc welders, flame cutting machines, oxy-acetylene welders, milling machines, gas fueled forges, and dust collection systems.

Manipulative Skill: Proficiency in handling or operating tools or machines, in planning or investigating processes, or in designing, shaping, forming, or fabricating various objects (7).

Manual Training: An earlier type of school shop activity usually

restricted to fixed exercises in woodwork, metalwork, and mechanical drawing; gave way first to manual arts and later industrial arts (7).

Manufacturing Processes: Processes that make finished products out of basic materials by applying direct labor and machine operations to convert the basic materials into finished goods (15).

Philosophy: A set of criticized values in life so organized as to facilitate making intelligent decisions as to policy or conduct whenever there is a choice of value (12).

Physical Condition: Used in describing the appearance, safety, and mechanical worthiness of industrial arts laboratory equipment included in this study.

Universal Saw: The universal saw has two arbors, so that a rip saw and a crosscut saw can be mounted at the same time, either of which can be brought into use simply by turning a handwheel (8).

Variety Saw: The variety saw has only one arbor. When changing from ripping to crosscutting, therefore, the machinery must be stopped and the saw blade changed (8).

Scope of the Study

1. The study included only Oklahoma high school industrial arts programs offering manufacturing processes courses in 1981.

2. The survey instrument was sent to randomly selected Oklahoma high schools listed in the 1980-81 directory of full-time industrial arts teachers employed by the State Board of Education.

3. The study asked only questions concerning the amount, size, age, manufacturer, and physical condition of major equipment in the manufacturing processes laboratories.

CHAPTER II

REVIEW OF LITERATURE

Introduction

To recognize the educational value of industrial arts, one should first recognize the advancements that have occurred in teaching methods and physical classroom conditions over the years. The term "manual training" was used to indicate the presence of shopwork in the educational curriculum in the early history of industrial arts. The first manual training school in the United States was opened in 1880, by Dr. Colvin M. Woodard of Washington University. The general education philosophy promoted in shopwork is explained by Dr. Woodard in the following excerpt from Conners (4):

> An exercise, whether with tools or with books, is valuable only in proportion to the demand it makes upon the mind for intelligent, thoughtful work. In the school shop the stage of mechanical habit is never reached; the only habit is that of thinking (p. 65).

Manual training established to evidence that tools, machinery, and materials of industry can be used for instructional purposes in educational programs.

Identification of the Need

Because of improvements in instruction and technology, industrial arts should today be considered a valuable asset to the public education system as well as to modern industry. Industrial arts classes allow

students to design and build laboratory projects, which can expose students to new areas of learning. The designing of laboratory projects can compel students to plan ahead and correct any potential problems. The building of laboratory projects allows students the opportunity to develop manipulative skills by working with their hands. According to Miller and Smalley (13, p. 221), "The project method is a practical unit of learning and work which may involve manipulative activities, research, problem solving, or other activities by the student under the direction of the teacher." Students using various hand tools and controlling different types of power equipment have the chance to learn the manipulative skills not often found in general education classes.

The value of industrial arts as an aid to student performance is acknowledged by Barlow (1, p. 494) with the following statement: "Few people realize the extent to which industrial education can contribute to the general goals of education. The industrial education environment provides reality for abstract concepts and real life experiences." Industrial arts programs attempt to instruct students in "real life experiences," which involves laboratory equipment and facilities as a primary educational factor (1).

Laboratory equipment should be maintained in good operating condition for safety and reliability, and should be comparable to equipment used in business and industry. Careful selection and proper maintenance of industrial arts laboratory equipment can ensure the safety and longevity of equipment (10).

The first step in providing suitable industrial arts laboratory equipment begins with the attainment of well built, high quality equipment. In most cases, the industrial arts teacher is faced with the

important task of providing and maintaining suitable laboratory equipment for the industrial arts program. Emphasis on the importance of selection of good quality laboratory equipment is stated by Brown (2):

> Wise acquisition of equipment, materials, and services helps to ensure smooth laboratory operation and an absence of program disrupting equipment breakdowns, and equipment and supply shortages. It increases the probability that the laboratory will be one in which students will like to work and the teacher will enjoy his teaching. The work environment will be much safer, and the range of work that can be carried on will be satisfactorily wide (p. 219).

The second step in the selection of industrial arts laboratory equipment is to select the ideal equipment that will meet the objectives of the industrial arts program (5). The amount and type of ideal major equipment necessary for industrial arts laboratories is governed by four factors:

1. The number and maturity of students enrolled in each class.
2. The subject that is to be taught.
3. The size and location of the room.
4. The probable amount of money available (11, p. 34).

Programs that attempt to teach students in the manufacturing processes areas of industrial arts should have ideal laboratory equipment in order to enhance the abilities of each student.

A basis for comparison is needed when evaluating, updating, or building an industrial arts laboratory. A current inventory list should be made to determine if industrial arts laboratories contain the ideal tools and major equipment necessary for the successful instruction of industrial arts curriculum (9). Cannon (3) asserts that:

> Probably no school could be found that would serve as a complete example for any other, but a study of the tools and equipment could be made to determine whether or not the tools and equipment have served the purpose for which they were purchased (p. 15).

Inventory information from Oklahoma high school industrial arts manufacturing processes laboratories should establish useful equipment guidelines for average laboratory requirements.

Few studies have been conducted concerning only the amount and physical condition of major equipment used in the Oklahoma industrial arts laboratories. Past major equipment studies emphasized equipment needs, but included other environmental conditions of the industrial arts laboratory such as: floor space, lighting, class size, subject taught, and location of the building or room.

A survey of major equipment in the high school industrial arts laboratories of Oklahoma could be made to determine whether or not the tools and equipment have served their purpose (3). Teague (17) has stated in his thesis the following purpose:

> 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 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 (p. 7).

Stover's (16) thesis is similar in purpose to Teague's 1949 major equipment survey. The objective of Stover's study was to determine the quantity, quality, most common brands, size, and unit cost of the major equipment in the high school industrial arts shops of Tennessee. Also of considerable importance to Stover's study were the location, size, type of heating system, and type of building used for industrial arts laboratories. Stover (16) stated the following purposes in his study:

> Recorded data of this kind will be of future value to individuals who may wish to study the status of industrial arts in Tennessee for the year 1952. Collected and recorded information of this type will be useful to administrators or others who may wish to determine the needs of the industrial arts shops. Furthermore, one may use collected material of this type as a basis for selecting equipment for a new shop or it could be useful material for shop planning (p. 2).

The factual establishment of the amount and condition of major equipment now in use in the Oklahoma high school industrial arts laboratories could serve as a base for establishing equipment standards when compared to the results of Teague's 1949 major equipment survey.

Results of Previous Research

Teague's (17) thesis is similar in some aspects to the research proposed by this study, and references reveal the equipment survey as the most recent. The major difference between the present study and Teague's study is that Teague conducted a survey of all major equipment involved in industrial arts programs, while the proposed research is interested only in major power equipment used in the manufacturing processes areas of industrial arts.

Because Teague's survey included questions concerning major power equipment in the manufacturing processes area, many of the survey results are utilized in this research study. In 1949, industrial arts teachers totaled 534 in 341 schools of Oklahoma (17). Teague discussed and analyzed major equipment information from 132 usable Oklahoma high school survey returns. These survey returns reported industrial arts laboratory equipment the following number of times for each area of shopwork:

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

The survey reported a small number of graphic arts equipment. Most of the survey returns listed some type of woodworking equipment.

The following individually listed major equipment information is reported from Teague's study (17). Each of the different types of major equipment has been identified and evaluated separately in order to more clearly research Teague's survey results.

Table Saws

The results concerning the "variety saw" and the "universal saw" have been combined under the title of table saw, as they perform essentially the same basic operations and differ only in construction. The condition of table saws was described in all but four cases, and is established as listed below:

3	New
8	Excellent
72	Good
28	Fair
4	Poor
4	Not stated
119	

In the 132 usable returned equipment check-list forms, 119 table saws were listed. Of the 119 reported table saws, 49 were variety saws and 70 were universal saws. The average age for 107 of the table saws, on which the age was reported, is 6.8 years.

Band Saws

In the 132 school shops reached by the survey, there are 82 band saws reported. A list showing the evaluated condition and number of band saws under each rating is included:

3	New
3	Excellent
52	Good
13	Fair

8	Poor
3	Not stated
82	Total

The average age of 69 band saws, on which the age was listed, is 8 years.

Jig Saws

The average age of 89 jig saws for which data were reported is 5 years. Physical conditions are noted within a range of "excellent" to "worthless," reported as follows:

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

Jointers

No purchase date was listed for 15 of the 96 jointers reported in the equipment survey returns. The average age for jointers, on which age was reported, is 7 years. The physical condition of machines reported was as stated below:

5	New
7	Excellent
61	Good
18	Fair
3	Poor
2	Not stated
96	Total

Drill Presses

Drill presses totaled 108 in the 132 usable survey returns. Average age of 88 drill presses on which the purchase date was a part of the

included information was 6.3 years. Drill press condition was described and listed as:

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

Shapers

For the 132 industrial arts laboratories surveyed, 43 shapers were counted in the woodworking equipment. Five years was computed to be the average age of 37 machines on which the date of purchase was completed in the survey. The conditions of the shapers are listed as:

5	New
4	Excellent
29	Good
3	Fair
2	Poor
43	Total

Surfacers

Few high school shops were equipped with surfacers, as is indicated by the 20 surfacers totaled in the survey returns: 17 of the surfacers were in good condition or better, and 3 surfacers were reported as fair to poor condition. Average age of the 16 surfacers on which the age was listed was 7.8 years.

Belt Sanders

Of the 27 belt sanders reported in the study, no age indication was given for 8 machines. For those machines on which a date was given, the

average age was 5.8 years. The condition of the sanders was as follows: 2, new or excellent condition; 15, good condition; 6, fair condition; and 4, poor condition or worse.

Power Grinders

The physical condition of power grinders was given in all but 12 cases, and is established as listed below:

4	New
7	Excellent
57	Good
25	Fair
10	Poor
12	Not stated
115	Total

Of the 115 power grinders, the average age for those on which the age was stated is 8 years.

Wood Turning Lathes

Information is analyzed for 161 wood turning lathes reported in the equipment survey. The average age of the wood turning lathes is 9 years. The physical condition of the lathes is as follows:

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

Mortisers

Few mortisers were reported in use in the high school laboratories included in the survey. Teague states the cost and application as a possible factor in the low numbers reported of mortising equipment and

devices. The average age of the 11 reported mortisers is 12.4 years, which is somewhat exaggerated by one 37-year-old machine. The physical condition of the mortisers has been omitted because of the small number of returns.

Tenoners

Tenoners were reported as virtually nonexistent in high school industrial arts programs surveyed, as only two were reported.

Other Major Equipment

Other major equipment in the manufacturing processes areas reported by Teague, but not investigated with great detail, includes the following:

Name of Equipment	Total Number
Radial Saws	4
Air compressors	2
Routers	1
Combination Shaper, Router and Drill Press	1
Gas Furnaces	19
Gas Welders	33
Electric Arc Welders	19
Engine or Metal Lathes	16
Metal Cutting Band Saws	1
Metal Shaper	1

Methodology of Previous Research

The major equipment survey of Oklahoma high school shops, conducted by Teague, was a representative sampling of industrial arts programs where shopwork or drafting courses were known to be taught (17). The mailing list for Teague's survey was taken from the Directory of Teachers and Administrators of Industrial Education in Oklahoma Secondary Schools,

Colleges, and Universities, school session 1948-49 (19). The data-gathering instrument used in Teague's study was of the check-list form. The check-lists, accompanied by letters of transmittal, were mailed directly to 296 selected high schools.

The check-list forms contained lists of the desirable machines and major equipment for eight different subject areas of industrial arts. Equipment check-list information requested included size, date of purchase, original unit cost, condition of usefulness, name of manufacturer, and number of machines in use. Additional information requested on the check-list included the name of the shop or room, the size of the room, date the room was built, ceiling height, subjects taught, location of shop room in the main building, and whether or not it was a separate building. Of the initial 296 equipment check-lists mailed, 45 percent of the check-lists were returned and contained usable information.

Stover's (16) study of the major equipment in Tennessee high schools in 1952 used the same type of data-gathering instrument and methodology as Teague's study. Questionnaires in the form of check-lists were mailed to 193 industrial arts teachers whose names were taken from the Tennessee Directory of Industrial Arts. (20). Stover experienced difficulty with the mailing list of industrial arts teachers in Tennessee, because the mailing list was not current. In some cases, it was necessary for the check-list to be forwarded to the correct instructor because the industrial arts teacher had changed teaching positions after the directory had been prepared. Ten high school principals returned the questionnaire, indicating an industrial arts program did not exist in their school systems.

Two months after Stover's check-lists were mailed, 53 percent of the check-lists had been completed and returned. In an attempt to obtain

more information, Stover personally visited 29 of the teachers who had not returned a major equipment check-list. Following the personal visit, 25 teachers returned the information requested. Data for Stover's study were supplied by the return of 67 percent of the initial 193 major equipment check-lists mailed to industrial arts teachers in Tennessee.

Summary

The research conducted by Teague and Stover is similar to the research proposed by this study. However, the two research studies may have attempted to report information over an excessively wide subject area (6). The equipment surveys requested information concerning major laboratory equipment, as well as information concerning the industrial arts building or laboratory, class size, and subjects taught. Stover and Teague attempted to gain an overall representation of high school industrial arts laboratories with their major equipment surveys.

The study written by Stover in 1952 used the same basic format as Teague's 1949 study. The questionnaire and methodology used in Stover's study closely resembled the earlier study written by Teague. Stover (16, p. 6) states, "The questionnaire used to collect the data for this study is almost parallel to the one used by Teague." The major difference between the two studies is that Teague's survey was conducted in Oklahoma, and Stover's survey was conducted in Tennessee.

Most of the manufacturing processes major equipment involved in Teague's survey was for use in woodworking courses in Oklahoma industrial arts laboratories. The average age was 7.3 years for all of the major equipment on which the age was reported in the equipment survey conducted

in 1949. The reported physical condition of all major equipment examined is as follows:

4%	New
5%	Excellent
58%	Good
21%	Fair
8%	Poor
4%	Not Stated

It should be noted that some indications of equipment condition could be influenced by the fact that guidelines are not clearly defined for physical condition.

CHAPTER III

METHODOLOGY

Introduction

The first purpose of this study was to identify Oklahoma high school industrial arts programs offering manufacturing processes courses in 1981, and examine the major equipment in their laboratories. The amount, age, and physical condition of the major equipment in these industrial arts programs were reported. In addition, the major equipment data collected in this survey were compared with information reported in a Oklahoma high school industrial arts major equipment survey conducted in 1949.

Design

The development of the survey instrument was based on Teague's (17) research study of Oklahoma high school industrial arts major equipment in 1949. Stover's (16) survey of major equipment in Tennessee high schools provided additional information for the development of the survey instrument. Instrument development was organized into three separate steps.

The first step of the instrument development was to arrange a major equipment list that would apply to this study. Industrial arts manufacturing processes major equipment includes a portion of woodworking, metalworking, and general shop equipment. The ideal major equipment of the woodworking, general, and metalworking laboratories listed in Modern

School Shop Planning (14) provided assistance in establishing the ideal list of equipment for the survey instrument. The ideal manufacturing processes major equipment list was compared with the results of the major equipment survey conducted by Teague. By comparing the ideal major equipment list with the equipment most likely to be found in Oklahoma industrial arts laboratories, it was possible to develop a concise major equipment list applicable to this study (see Appendix C).

The second step in the development of the instrument was to establish the most efficient method of gathering information about the age, amount, and physical condition of the ideal major equipment in this study. Based on the information provided by Teague's 1949 survey and Stover's 1952 survey, a check-list form was rationalized to be an effective method of gathering the desired information. The major equipment list was arranged on the check-list form in two basic groups: woodworking equipment and metalworking equipment. In order to save space and avoid confusion, one side of the survey instrument listed woodworking equipment and the other side listed metalworking equipment. Extra space was provided on the equipment check-list for listing any additional major equipment.

The final step in the check-list construction was to limit the response areas on the check-list in an attempt to obtain a usable number of returns. Based on the average ages of manufacturing processes equipment reported by Teague and Stover, the check-list section for the approximate age of equipment was divided into three age groups: 0 to 5 years, 6 to 20 years, and over 21 years. In order to more accurately classify the physical condition of equipment, the check-list section for the assessment of equipment was divided into three condition levels: good, fair, and poor. A trial test of two of the proposed equipment check-

lists, in the Oklahoma State University industrial arts laboratory, verified the check-list form as an efficient method of obtaining the desired information.

In an attempt to gain insight into the value, quality, and different types of equipment in the manufacturing processes areas, space was provided on the check-list for listing any additional major equipment, the name of the manufacturer, and the size of the equipment. Although information concerning additional equipment, manufacturer, and size of equipment was not recognized as one of the primary objectives of the study, it is conceivable that this information could possibly reveal significant trends.

Procedures for Data Collection

The Oklahoma high schools chosen for this study were obtained from the Directory of Industrial Arts Education (21), which lists teachers employed full time by the State Board of Education for the year 1980-81. The directory contained 406 high school industrial arts education departments offering manufacturing processes courses. In order to reduce the cost of this study, it was deemed necessary to limit the survey to a representative sampling of 100 high school industrial arts departments (see Appendix A).

The 406 industrial arts departments listed in the Directory of Industrial Arts Education were numbered 1 through 4 in consecutive groups, for the random selection of industrial arts departments. For each consecutive group, a die was cast and the corresponding numbers were recorded. The result of this method of random selection was a list of 102 high school industrial arts departments offering manufacturing processes

courses. In order to omit the two extra listings from the study, the list of 102 industrial arts departments was divided into two groups of 51 each. The two lists were numbered 1 through 51, and dice were cast to omit one listing from each group. One hundred high schools were randomly selected from the Directory of Industrial Arts Education to be used as a representative sampling for this study (see Appendix A).

A letter requesting survey information was sent to 100 Oklahoma high school industrial arts programs offering manufacturing processes courses (see Appendix B). Enclosed in each of the survey letters was a letter of transmittal, a major equipment check-list, and a self-addressed stamped return envelope.

The letter of transmittal briefly explained the reasons for the study, requested assistance in completing the equipment check-list, and stated a set of guidelines for use in completing the physical condition section of the equipment check-list. The guidelines stated in the letter of transmittal was an attempt to assist industrial arts instructors in the assessment of their equipment. Listed below is the physical condition guidelines as stated on the letter of transmittal:

GOOD--Operating properly and safely, has all guards in place

FAIR--Not functioning as well as possible, no safety hazards

POOR--Difficult to operate, broken or missing parts, a potential safety hazard.

A second request was sent to those instructors who had not returned a completed check-list at the end of a three-week time limit (see Appendix D). The second request letter was much like the first, but used a slightly different format in the letter of transmittal. A letter of

transmittal, equipment check-list, and self-addressed stamped return envelope were enclosed in the second request letter.

Three weeks after the second request was mailed, a postcard requesting the return of the check-list was sent to those instructors who had not returned an equipment survey check-list (see Appendix E). The deadline for all remaining equipment check-list returns was set for two weeks after the mailing of the postcards.

Treatment of Data

The data received from the major equipment check-lists were tabulated as a quantity distribution for each of the responses to the listed major equipment. Additional major equipment and information listed by respondents were descriptively reported. The current amount and physical condition of major equipment in use in the Oklahoma high school industrial arts manufacturing processes laboratory were compared with Teague's (17) 1949 major equipment survey. Bar graphs were used to illustrate the amount, approximate age, and physical condition of major equipment reported in sufficient numbers to graph (see Chapter IV).

CHAPTER IV

RESULTS

The research findings used in this study are statistical statements based upon the check-list responses from Oklahoma high school industrial arts programs offering manufacturing processes courses. The results of this study are presented and analyzed in this chapter.

Return Rates

The initial letter of transmittal, major equipment check-list, and self-addressed return envelope were mailed to 100 randomly selected Oklahoma high school industrial arts programs offering manufacturing processes courses. A three-week time limit was set for the initial mailing of the check-lists. At the close of the three-week time limit, 40 percent of the major equipment check-lists had been returned.

Because 60 percent of the equipment check-lists had not been returned, a second survey attempt was made in order to obtain additional survey returns. A second letter of transmittal, major equipment check-list, and return envelope were mailed to those Oklahoma high school industrial arts programs which had not returned a check-list. A three-week time limit was set for the second mailing of the survey. The second mailing had a 35 percent return rate, with 21 completed major equipment check-lists returned.

The third and final attempt to receive additional survey returns was conducted with a two-week deadline. A postcard, requesting the return of the major equipment check-list, was mailed to each of the remaining 39 high school industrial arts programs which had not returned a survey check-list. Five check-lists were received after the mailing of the postcards. A 12.8 percent return rate was recognized following the mailing of the postcards.

A total of 66 completed major equipment check-lists were returned from the 100 Oklahoma high school industrial arts programs to which the survey instrument was sent. Three of the returned check-lists were omitted from the survey analysis because industrial arts programs had discontinued their manufacturing processes courses. The total number of completed major equipment check-lists analyzed in this chapter is 63.

Data Summary

Information received from 63 Oklahoma high school industrial arts programs was tabulated for each of the responses to the listed major equipment. The total number of major equipment reported from 63 Oklahoma high school industrial arts laboratories is 983. Data revealed 11.8 percent of the reported equipment as metalworking equipment, with 88.2 percent of the reported equipment as woodworking equipment. The different types of major equipment in this study have been evaluated separately in order to more clearly research survey results. This research reports the amount, physical condition, approximate age, and most prevalent manufacturer of major equipment in the 63 industrial arts laboratories reported by the respondents.

Woodworking Equipment

The information received from 63 Oklahoma high school industrial arts programs concerning woodworking equipment is presented in tabular form in Table I, and in graphic form in Figures 1 through 15.

Metalworking Equipment

The information received from 63 Oklahoma high school industrial arts programs concerning metalworking equipment is presented in tabular form in Table II, and in graphic form in Figures 16 through 21.

Table Description

Table III contains responses to additional major equipment reported that was not listed on the survey check-list. Space was provided on the survey check-list for listing additional major equipment for this study. Most of the additional major equipment listed in Table III is reported as being in good physical condition. The approximate age of additional major equipment in Table III is listed as being 6 to 20 years old.

Tables IV and V contain the most prevalent major equipment manufacturers and the total number of major equipment reported for each of the manufacturers in this study. Because of the many various manufacturers of major equipment, only those equipment manufacturers listed four or more times were included in these tables. Table IV lists Rockwell-Delta as the most prevalent manufacturer of woodworking equipment in this study. Table V lists Lincoln as the most prevalent manufacturer of metalworking equipment in this study.

TABLE I

CONDITION OF WOODWORKING EQUIPMENT REPORTED
BY 63 OKLAHOMA HIGH SCHOOLS

Item	Total No.	Physical Condition			Approximate Age (Years)		
		Good	Fair	Poor	0-5	6-20	Over 21
Table Saws	85	49	31	5	14	56	15
Band Saws	70	39	24	7	13	44	13
Radial Saws	66	33	29	4	16	39	11
Power Mitre Box Saws	27	22	4	1	18	8	1
Jig Saws	48	26	18	4	13	26	9
Drill Presses	67	26	30	11	9	41	17
Sanders	66	27	27	12	17	37	12
Surface Planners	52	34	15	3	11	29	12
Jointers	72	44	27	1	10	40	22
Grinders	57	22	28	7	5	37	15
Mortisers	14	1	11	2	---	3	11
Shapers	56	31	18	7	16	25	15
Tenoners	2	2	---	---	1	1	---
Dust Collection Units	22	12	5	5	8	12	2
Air Compressors	51	24	21	6	11	30	10
Wood Lathes	112	40	48	24	18	65	29

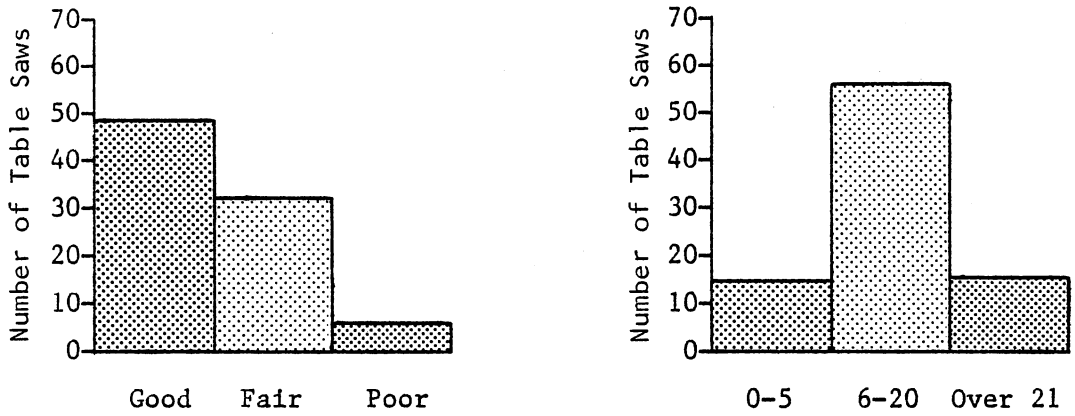

Figure 1. Physical Condition and Approximate Age of Table Saws

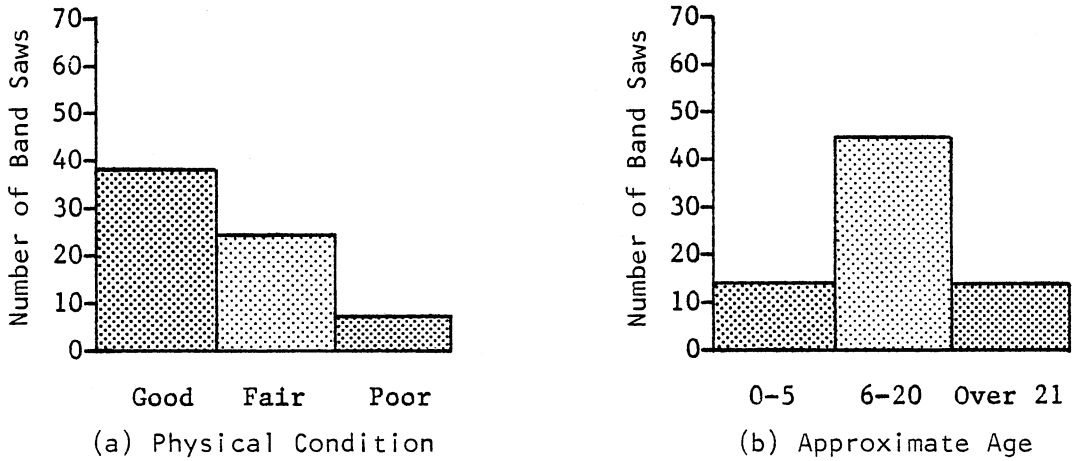

Figure 2. Physical Condition and Approximate Age of Band Saws

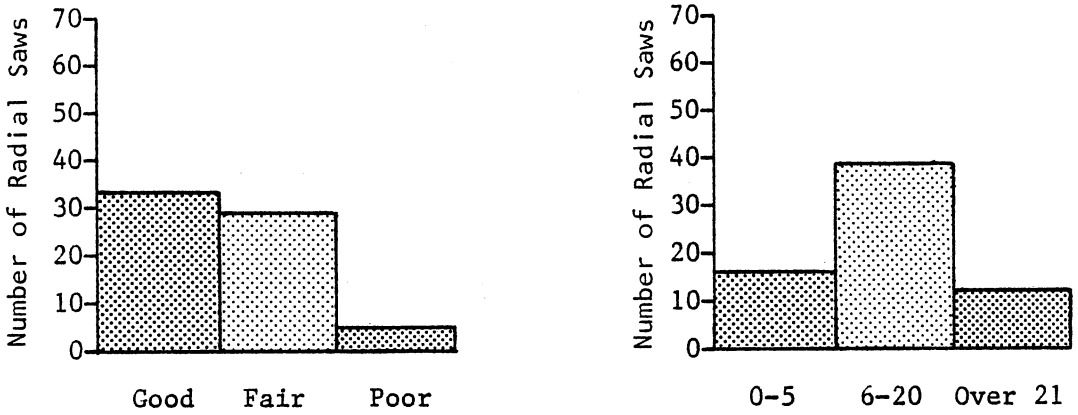

Figure 3. Physical Condition and Approximate Age of Radial Saws

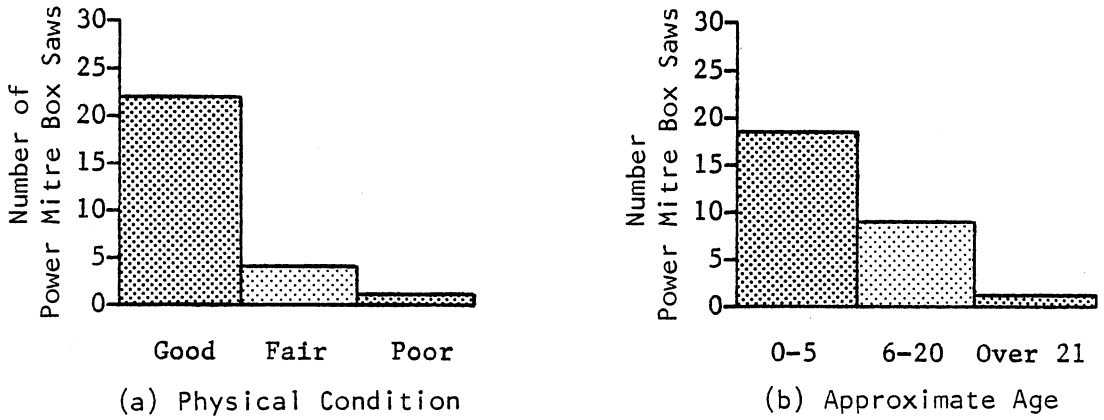

Figure 4. Physical Condition and Approximate Age of Power Mitre Box Saws

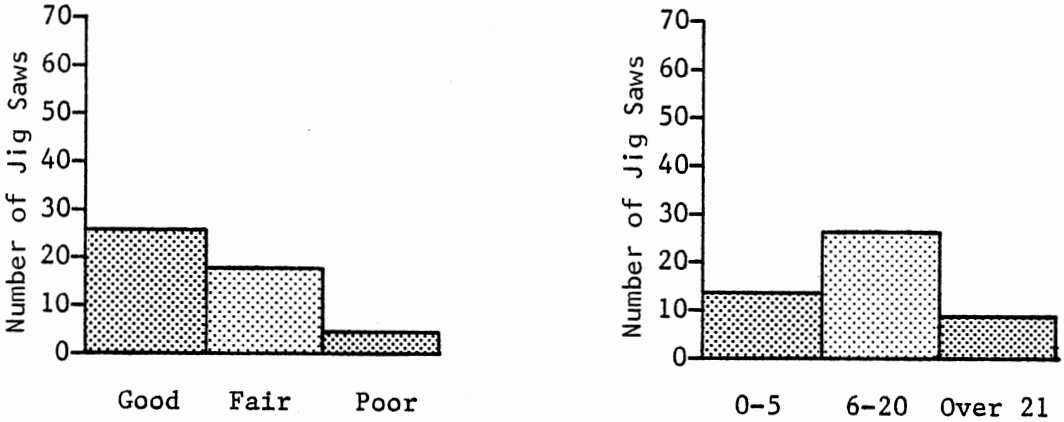

Figure 5. Physical Condition and Approximate Age of Jig Saws

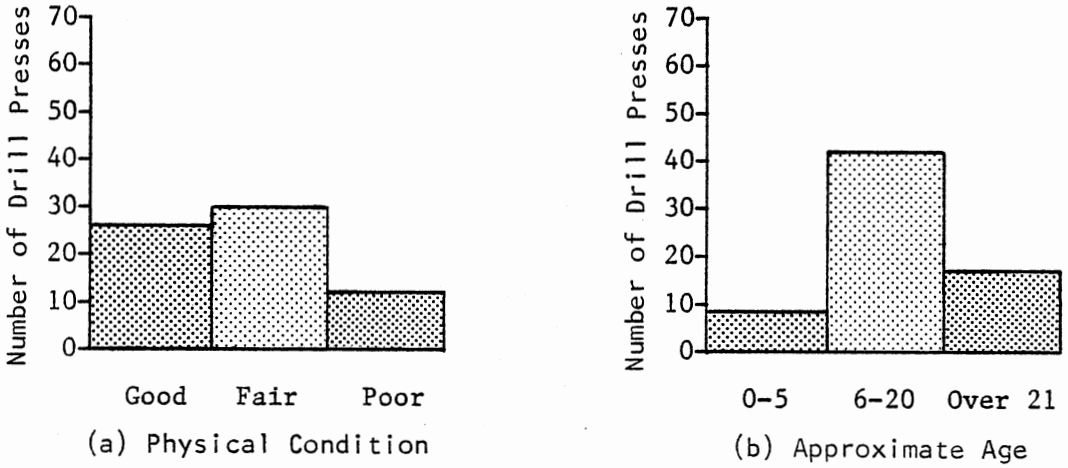

Figure 6. Physical Condition and Approximate Age of Drill Presses

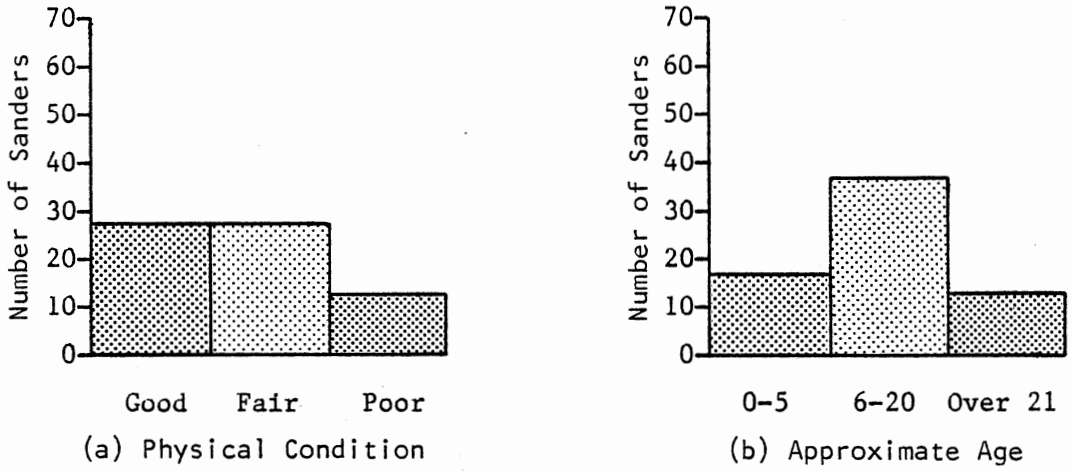

Figure 7. Physical Condition and Approximate Age of Sanders

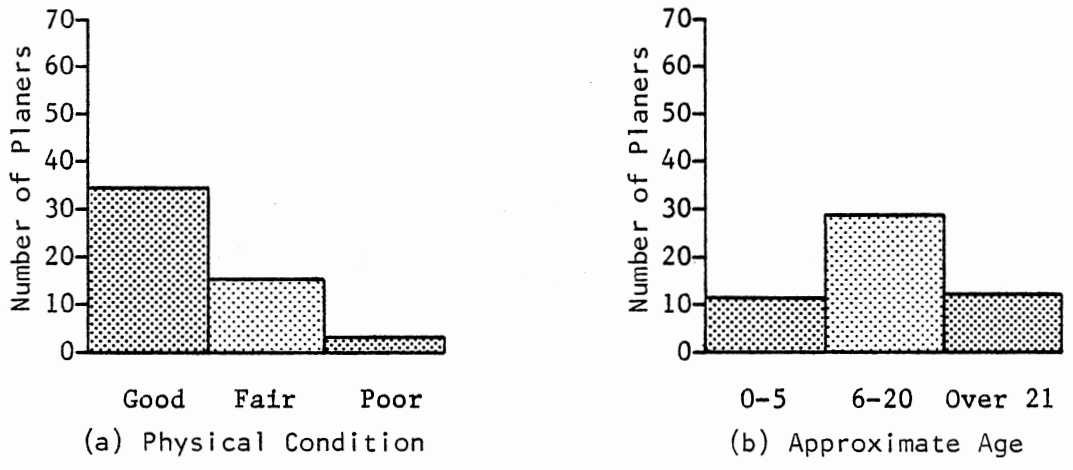

Figure 8. Physical Condition and Approximate Age of Surface Planers

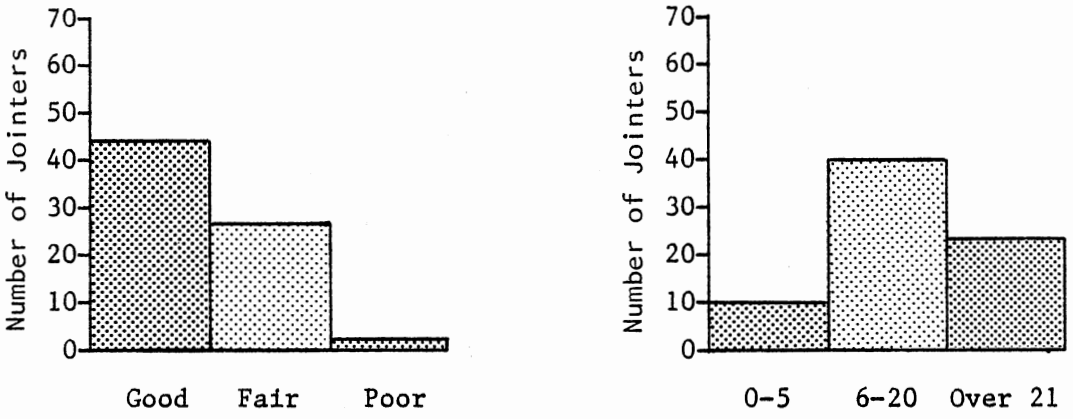

Figure 9. Physical Condition and Approximate Age of Jointers

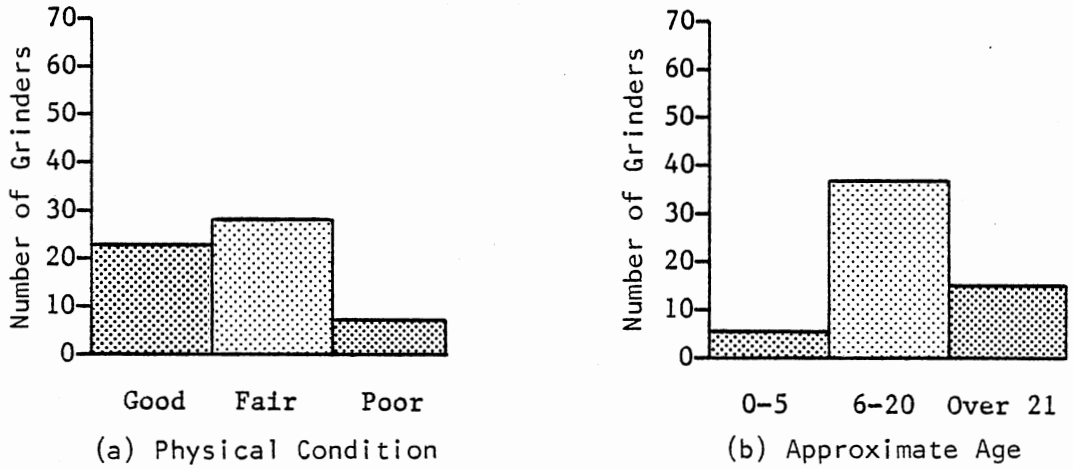

Figure 10. Physical Condition and Approximate Age of Grinders

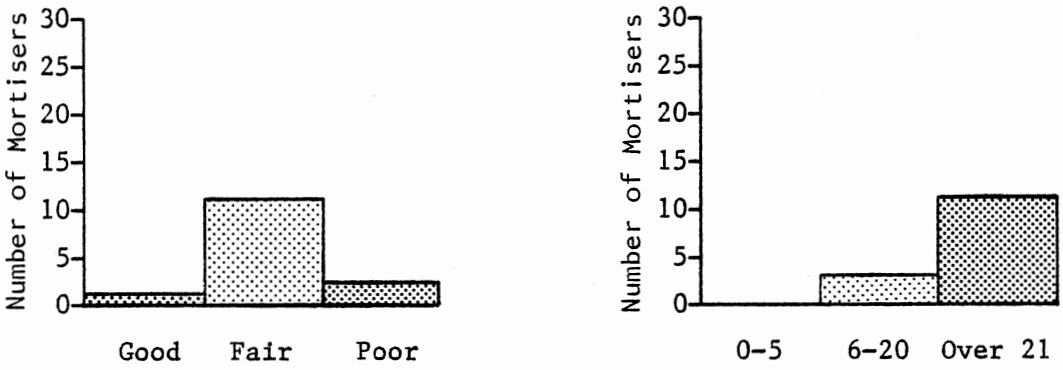

Figure 11. Physical Condition and Approximate Age of Mortisers

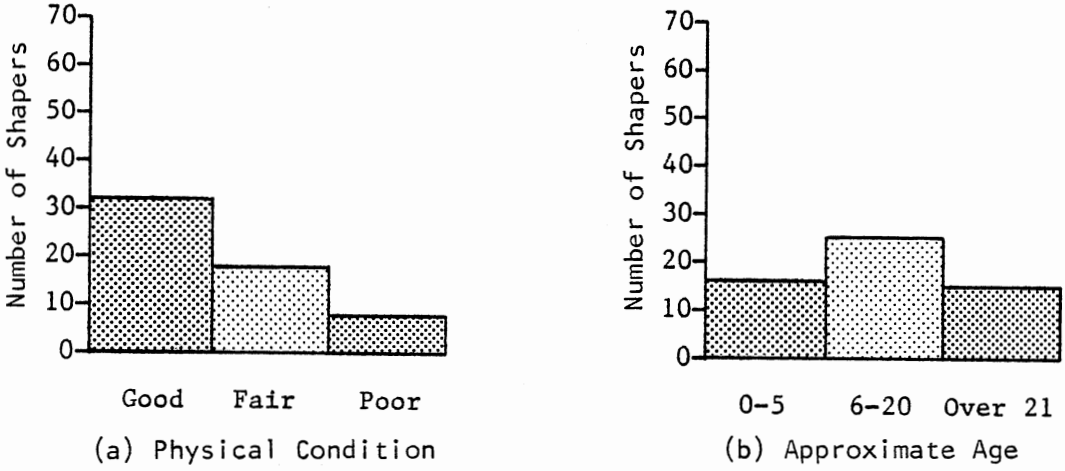

Figure 12. Physical Condition and Approximate Age of Shapers

Figure 13. Physical Condition and Approximate Age of Dust Collection Units

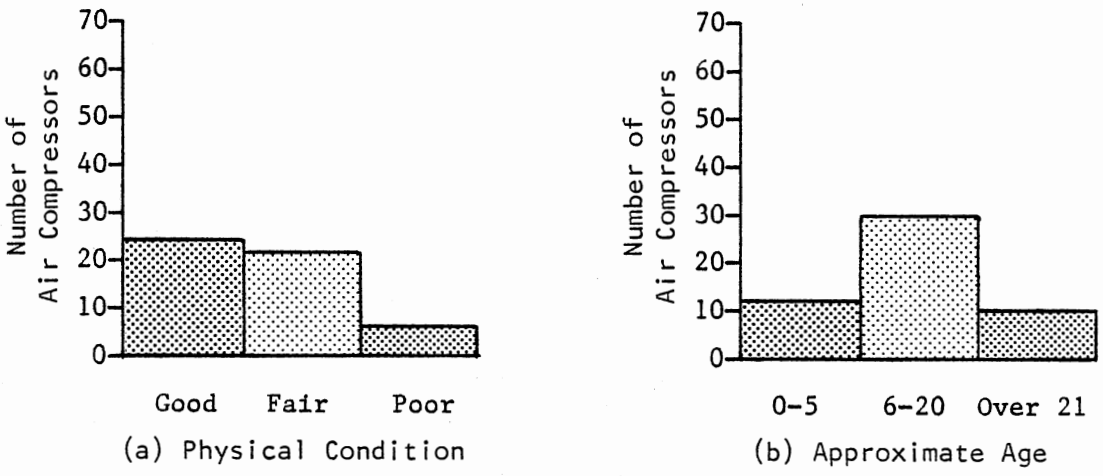

Figure 14. Physical Condition and Approximate Age of Air Compressors

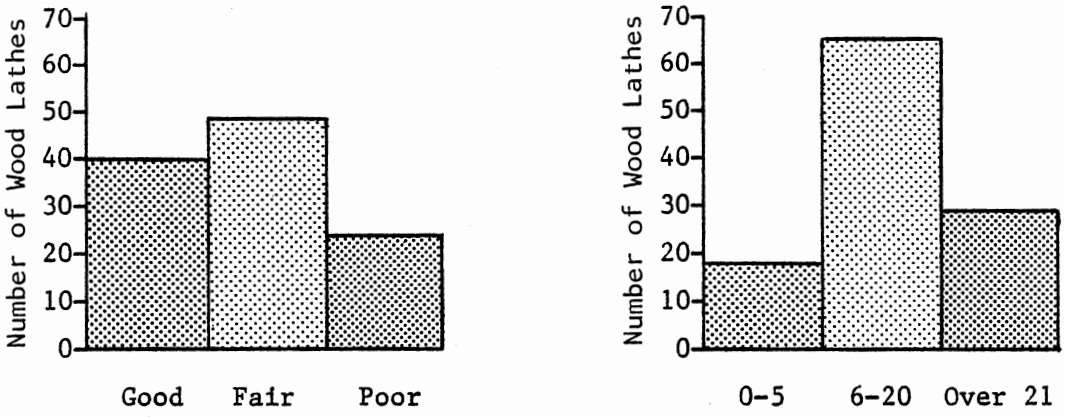

Figure 15. Physical Condition and Approximate Age of Wood Lathes

TABLE II

CONDITION OF METALWORKING EQUIPMENT REPORTED
BY 63 OKLAHOMA HIGH SCHOOLS

Item	Total No.	Physical Condition			Approximate Age (Years)		
		Good	Fair	Poor	0-5	6-20	Over 21
Electric Arc Welders	42	32	8	2	11	29	2
Oxyactylene Welder	15	9	6	0	2	13	0
MIG Welder	4	3	1	0	1	3	0
TIG Welder	2	1	1	0	0	2	0
Flame Cutting Machine	2	1	1	0	1	1	0
Power Hacksaw	3	2	1	0	1	2	0
Metal Cutting Band Saw	9	4	2	3	1	6	2
Pedestal Grinder	8	4	4	0	0	6	2
Surface Grinder	1	1	0	0	0	0	1
Milling Machine	5	1	2	2	0	1	4
Gas Fueled Forge	2	0	2	0	0	2	0
Drill Press	10	7	3	0	0	6	4
Engine Lathe	13	3	9	1	1	2	10

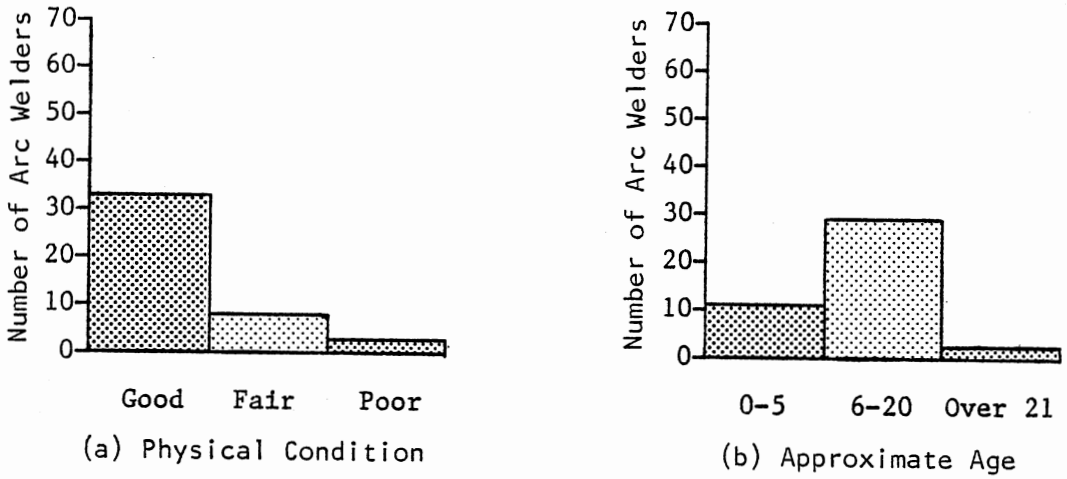

Figure 16. Physical Condition and Approximate Age of Arc Welders

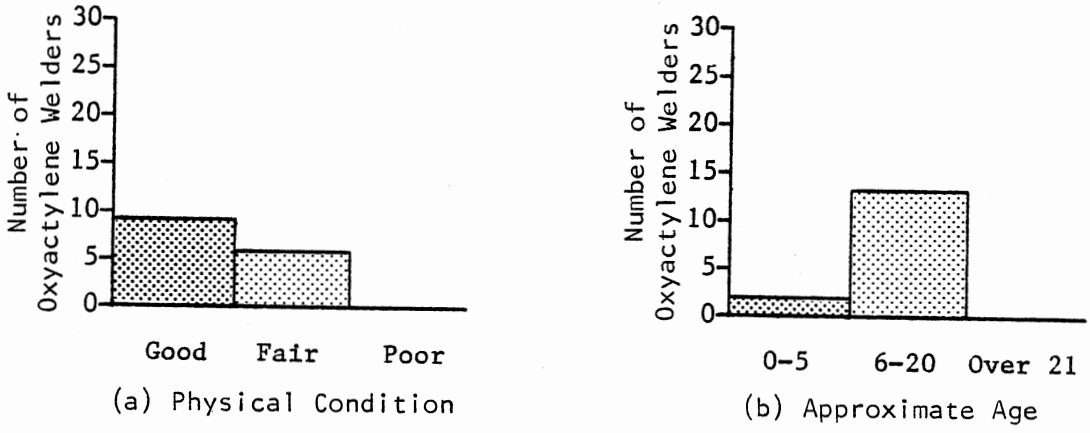

Figure 17. Physical Condition and Approximate Age of Oxyactylene Welders

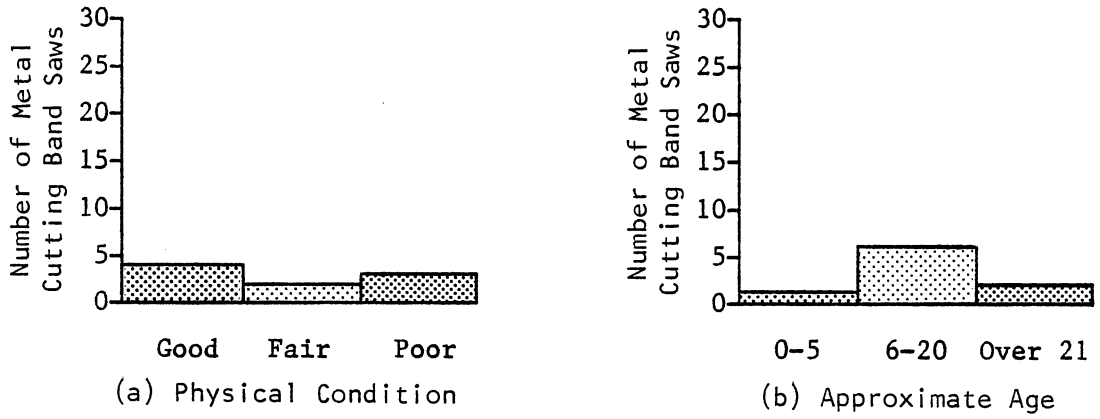

Figure 18. Physical Condition and Approximate Age of Metal Cutting Band Saws

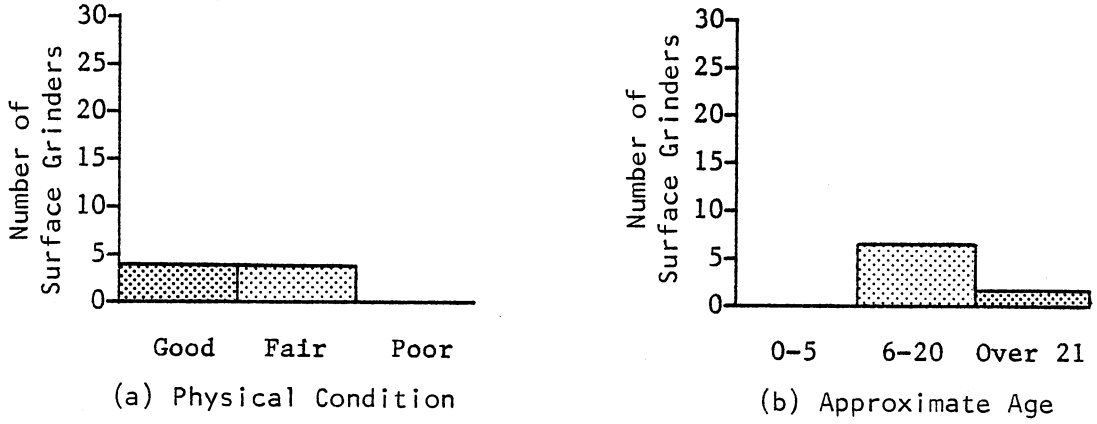

Figure 19. Physical Condition and Approximate Age of Surface Grinders

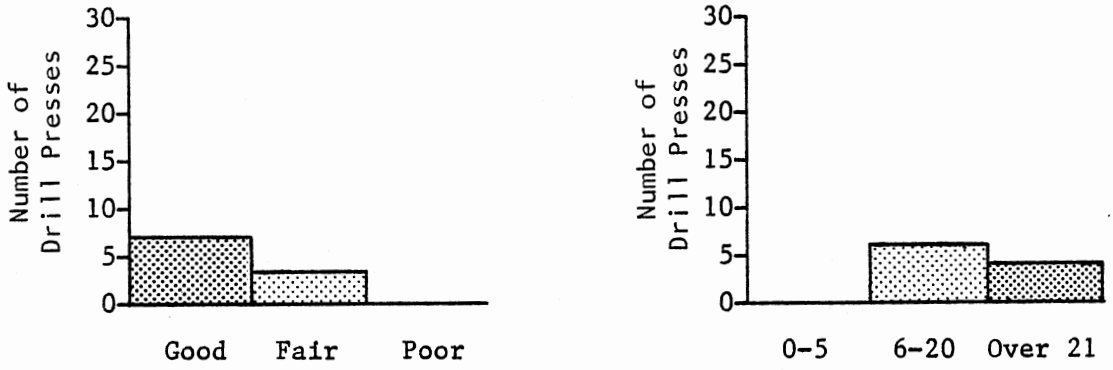

Figure 20. Physical Condition and Approximate Age of Drill Presses

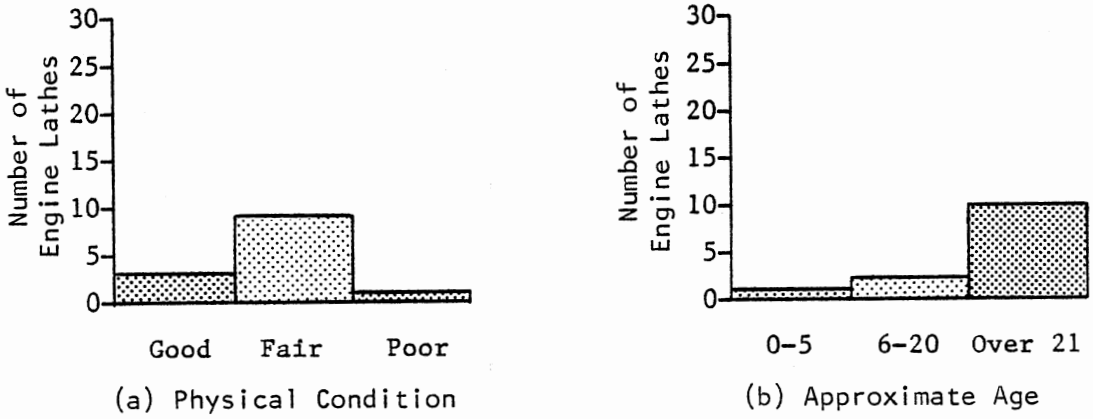

Figure 21. Physical Condition and Approximate Age of Engine Lathes

TABLE III

ADDITIONAL MAJOR EQUIPMENT REPORTED

Name of Equipment	Total Number Reported	Physical Condition	Approximate Age
Drum Sander	1	Poor	6-20
Panel Saw	1	Good	6-20
Spray Booth with Exhaust Fan	1	Good	6-20
Metal Cutoff Saw	1	Good	6-20
High Frequency Gluer	1	Fair	6-20
Precision Knife Grinder	1	Good	6-20
Pedestal Buffer	1	Good	6-20

TABLE IV

WOODWORKING EQUIPMENT MANUFACTURERS REPORTED

Name of Manufacturer	Total Number Reported
Rockwell-Delta	360
Powermatic	72
Delta	58
Oliver	46
Sears	37
Dewalt	29
Walker-Turner	10
Yates-American	9
Atlas	8
Broadhead-Garret	7
Black and Decker	6
Dayton	5
Aget	4

TABLE V

METALWORKING EQUIPMENT MANUFACTURERS REPORTED

Name of Manufacturer	Total Number Reported
Lincoln	23
Westinghouse	7
Miller	6
LeBlond-Regal	6
Forney	5
South-Bend	4
Smith	4

Results of Analysis

The survey data were totaled for each of the responses to the listed major equipment. In order to obtain an overall analysis of the major equipment, the total for each of the response areas was averaged and graphed accordingly. The average of the results was also needed for the comparison of this study with a similar study conducted by Teague (17) in 1949.

The major equipment was divided into two basic classifications: woodworking equipment and metalworking equipment. Metalworking equipment comprised 11.8 percent of the major equipment total for this study. Woodworking equipment comprised 88.2 percent of the major equipment total for this study. The bar graph below (Figure 22) illustrates the percent of woodworking equipment compared with the percent of metalworking equipment. Figures 23, 24, and 25 present, in tabular and graphic form, data reported for woodworking equipment, metalworking equipment, and all equipment, respectively.

Comparison of Results

The results of this study were compared with the findings of Teague's (17) survey conducted in 1949. The 1949 major equipment survey data are based on information received from 132 survey returns. A total of 970 pieces of equipment were reported and evaluated in the 1949 survey. The 1981 major equipment data are based on information received from 63 survey returns. A total of 983 pieces of equipment were reported and evaluated in the current study. In 1949, an average of 7.34 pieces of major equipment were reported per high school industrial arts program. The 1981 study reports an average of 15.6 pieces of major equipment per high

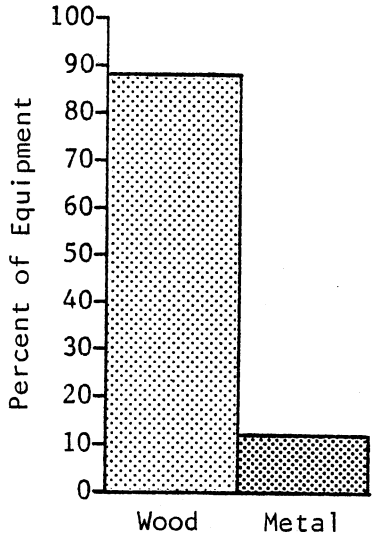

Figure 22. Percent of Woodworking Equipment Vs. Percent of Metalworking Equipment

Woodworking Equipment

Total Number Reported: 867

Physical Condition Reported:	Good	Fair	Poor
Number Reported	432	336	99
Percentile	49.8%	38.8%	11.4%

Approximate Age Reported:	0-5 Years	6-20 Years	Over 21 Years
Number Reported	180	493	194
Percentile	20.7%	56.9%	22.4%

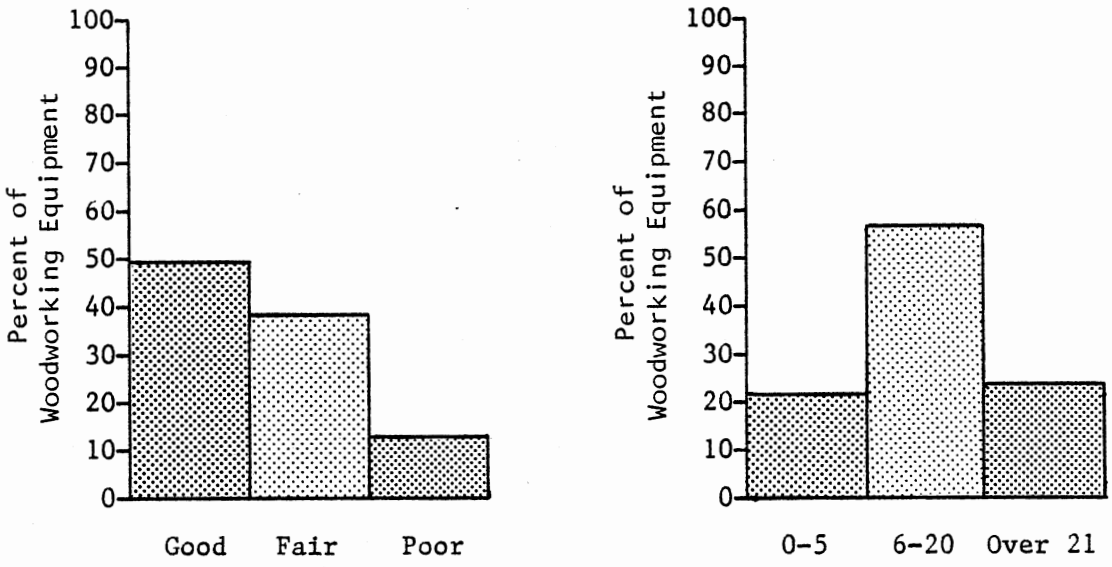

Figure 23. Physical Condition and Approximate Age Reported for Woodworking Equipment

Metalworking Equipment

Total Number Reported: 116

Physical Condition Reported:	Good	Fair	Poor
Number Reported	68	40	8
Percentile	58.6%	34.5%	6.9%

Approximate Age Reported:	0-5 Years	6-20 Years	Over 21 Years
Number Reported	18	73	25
Percentile	15.5%	34.5%	6.9%

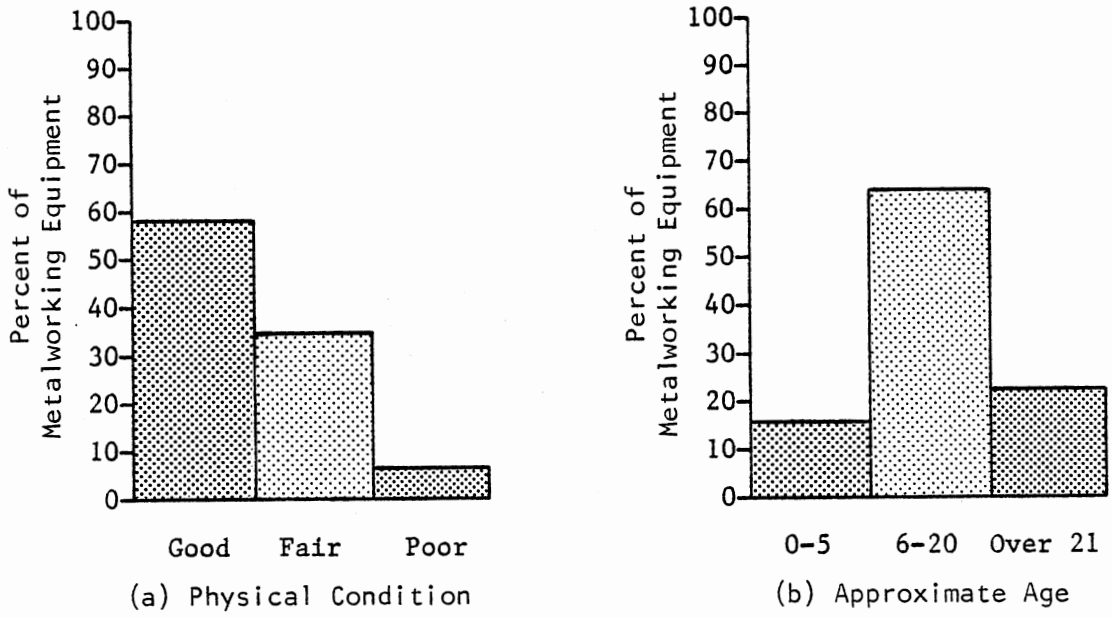

Figure 24. Physical Condition and Approximate Age Reported for Metalworking Equipment

All Equipment Reported

Total Number Reported: 983

Physical Condition Reported:	Good	Fair	Poor
Number Reported	500	376	107
Percentile	50.9%	38.2%	10.9%

Approximate Age Reported:	0-5 Years	6-20 Years	Over 21 Years
Number Reported	198	566	219
Percentile	20.1%	57.6%	22.3%

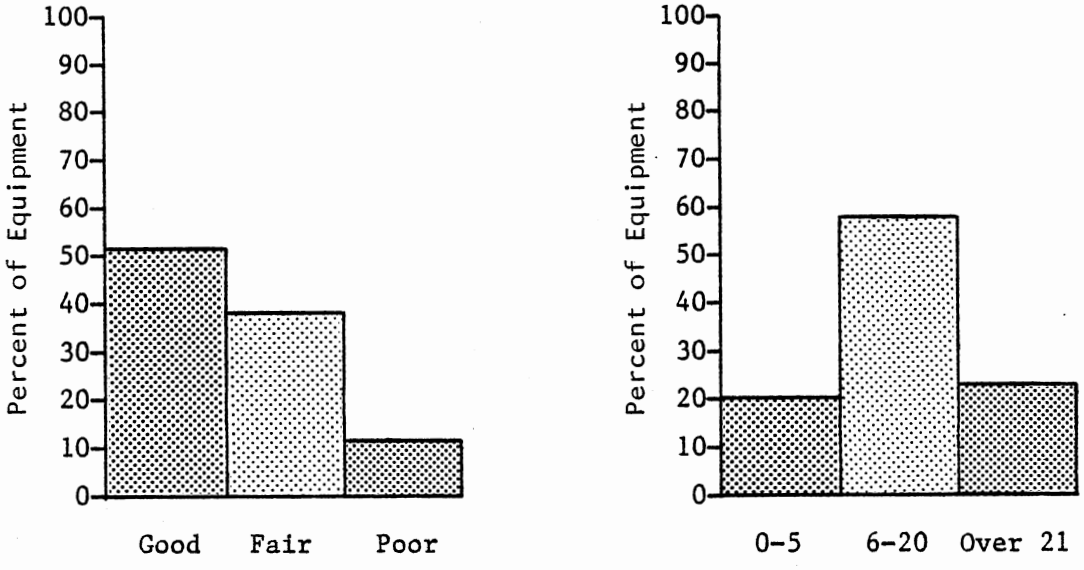

Figure 25. Physical Condition and Approximate Age Reported for All Equipment

school industrial arts program. A comparison of the total numbers of major equipment per high school industrial arts program reveals an increase of approximately 8.26 pieces of major equipment per high school industrial arts program.

The average age of major equipment in use in 1949 was 7.3 years old. The approximate age of 57.6 percent of the major equipment in the 1981 survey was reported in the 6 to 20 year old age. The total number of major equipment for which physical condition is reported in 1949 is 873, while the total number of major equipment for which physical condition is reported in 1981 is 983. The results of the physical condition of major equipment for the two surveys (1949 and 1981) are presented in Figure 26.

Physical Condition Reported:	New or Excellent	Good	Fair	Poor
1949 Percentile Reported	9.0%	58.0%	21.0%	8.0%
1981 Percentile Reported	---	50.9%	38.2%	10.9%

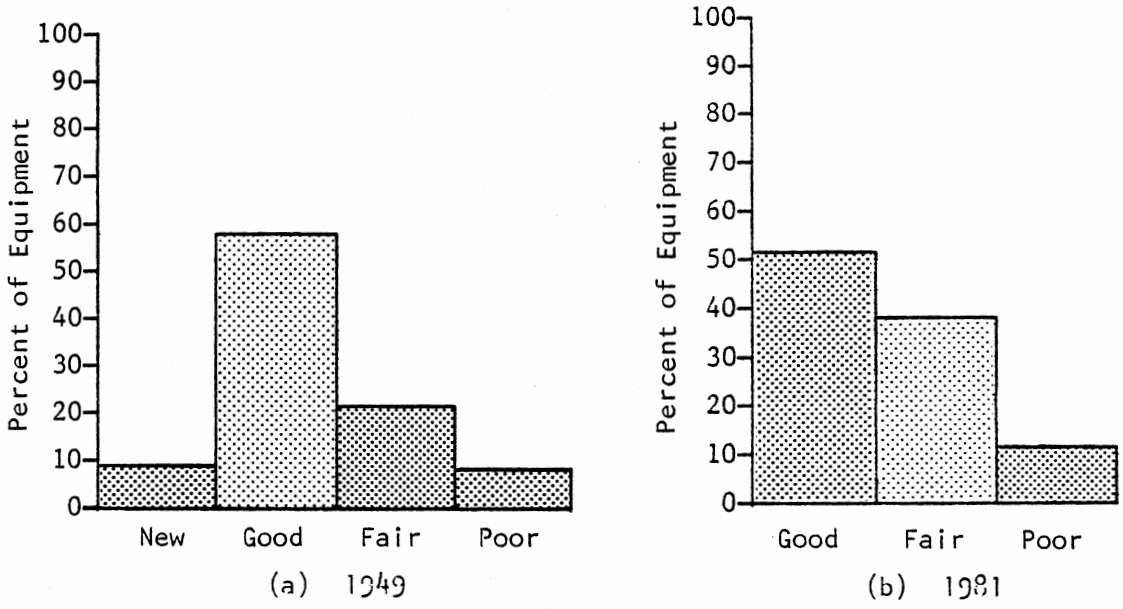

Figure 26. Physical Condition of Major Equipment Reported in 1949 and 1981 Surveys

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The primary purpose of this study was to identify Oklahoma high school industrial arts programs offering manufacturing processes courses in 1981, and to examine the major equipment in those laboratories. This study examined 63 Oklahoma industrial arts programs offering manufacturing processes courses, and collected data on the amount and physical condition of major equipment currently in use. The secondary purpose was to compare information concerning the current amount and physical condition of major equipment with the results of a 1949 Oklahoma high school industrial arts major equipment survey. The three major objectives with which this study dealt were cited in Chapter I and were to answer the questions:

1. What major equipment is currently in use in the Oklahoma high school industrial arts manufacturing processes laboratories?

2. What is the physical condition of major equipment currently in use in the Oklahoma high school industrial arts manufacturing processes laboratories?

3. How does the current amount and physical condition of major equipment in use in the Oklahoma high school industrial arts manufacturing processes laboratory compare with a 1949 major equipment survey?

A check-list was mailed to 100 randomly selected Oklahoma high school industrial arts programs offering manufacturing processes courses in 1981.

The check-list was designed to record major equipment information in those programs.

The check-list was mailed to the selected industrial arts departments on February 21, 1981. By April 14, 1981, 66 check-lists were returned, which revealed a 66 percent return rate. Of the 66 responses, three of the returned check-lists were omitted from the survey because the industrial arts programs had discontinued their manufacturing processes courses.

Conclusions

The first objective of this study was to identify the major equipment currently in use in Oklahoma high school industrial arts manufacturing processes laboratories. The check-list for this research contained a proposed ideal list of major equipment, with additional space provided for the listing of extra equipment. The results of this type of check-list construction provided an up-to-date list of major equipment and the amount of major equipment in use in the industrial arts programs. When the current data were compared with data from a 1949 survey, an increase in the total amount of major equipment in Oklahoma industrial arts manufacturing processes laboratories was indicated.

The second purpose of this study was to assess the physical condition of the major equipment currently in use in the Oklahoma high school industrial arts manufacturing processes laboratories. The physical assessment of major equipment was divided into three categories on the check-list: Good, Fair, and Poor. A set of guidelines for use in the completion of the physical condition section of the major equipment check-list was included in the letter of transmittal mailed with the check-lists. These

guidelines stated that good equipment should be operating properly and safely with all guards in place. The current data reported 50.9 percent of all major equipment as being in good condition, while 38.2 percent of the major equipment was reported as being in fair condition. The guidelines indicated fair equipment was not functioning as well as possible, but presented no safety hazards. The current data reported 10.9 percent of the major equipment as being in poor condition. Poor condition was stated in the check-list guidelines as equipment that was difficult to operate, had broken or missing parts, or presented a potential safety hazard. The physical condition reported by this study indicated a need for change in the equipment situation for at least 10.0 percent of all the major equipment in use in the Oklahoma high school industrial arts manufacturing processes laboratories.

The third objective of this study was to compare the current amount and physical condition of major equipment in use in the Oklahoma high school industrial arts manufacturing processes laboratories with a 1949 major equipment survey. A comparison of the current data and the 1949 major equipment survey data indicated an increase in the total number of major equipment in the Oklahoma high school industrial arts manufacturing processes laboratories. The physical condition of major equipment, when current data were compared with the 1949 major equipment survey data, indicated the equipment in use in 1949 was of better physical condition than equipment reported in the current survey.

Recommendations

The following recommendations are made. It is recommended that:

1. Industrial arts teacher education programs strengthen units on major equipment acquisition, maintenance, and repair.

2. Workshops or seminars be conducted by the office of the State Supervisor of Industrial Arts on the subjects of major equipment acquisition, maintenance, and repair.

3. Each Oklahoma industrial arts program establish a plan for the renewal of defective major equipment.

4. Each Oklahoma industrial arts laboratory be annually evaluated by the office of the State Supervisor of Industrial Arts to record the physical condition of major equipment.

5. All Oklahoma inudstrial arts facilities be inspected by the office of the State Supervisor of Industrial Arts for major equipment needs and potential safety hazards.

6. Minimum and optimum major equipment lists be developed by the Oklahoma State University Industrial Arts Department for Oklahoma industrial arts programs.

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(21) Directory of Industrial Arts Education. State Department of Vocational and Technical, Stillwater, Oklahoma, 1981.

APPENDIX A

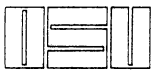
A LIST OF QUESTIONNAIRE RECIPIENTS

1.	Roy V. Davis	Achille H.S.	Achille
3.	Joe D. Heaton	Alva H.S.	Alva
5.	Gene R. Griffin	College H.S.	Bartlesville
6.	Gibson J. Beal	Bennington H.S.	Bennington
7.	Charles W. Hetrick	Blackwell H.S.	Blackwell
8.	James W. Lindsey	Bristow H.S.	Bristow
9.	Willis D. Colson	Burlington H.S.	Burlington
12.	Murl Wilkins	Choctaw H.S.	Choctaw
12.	Jobe Noble	Choctaw H.S.	Choctaw
14.	Jack W. Sawatzky	Washita Heights H.S.	Corn
16.	Charles Sojka	Cushing H.S.	Cushing
19.	Virgil Dowers	Edmond Memorial H.S.	Edmond
20.	Michael D. Caffey	Enid H.S.	Enid
21.	Don Bowers	Fairview H.S.	Fairview
23.	Chester L. Jordan	Gans H.S.	Gans
26.	Mark A. Mercer	Helena-Goltry H.S.	Helena
28.	F. L. Patterson	Hominy H.S.	Hominy
30.	Ray Garner	Jones H.S.	Jones
31.	Randall L. Monroe	Kingston H.S.	Kingston
32.	King E. Collins	Eisenhower H.S.	Lawton
33.	Donald L. Pamplin	MacArthur High	Lawton
35.	Henry P. Tillian	Marlow H.S.	Marlow
36.	David Rowland	McAlester H.S.	McAlester
37.	Ralph H. Garnett	Carl Albert H.S.	Midwest City
38.	K. R. Barton	Midwest City High	Midwest City
39.	Danny McKinney	Central Mid-High	Moore
40.	Gary McBroom	Moore High	Moore
43.	Michael A. McAairy	Mustang H.S.	Mustang
44.	Perry E. Bingham	New Lima H.S.	New Lima
45.	Stephen E. Sites	Norman H.S.	Norman
46.	Edward L. Creech	Nowata H.S.	Nowata
47.	Leon R. Miller	Okay H.S.	Okay
48.	Oscar E. Rice	Capitol Hill H.S.	Oklahoma City
49.	Willie G. Case	Classen H.S.	Oklahoma City
50.	Reese Harmon, Jr.	Douglass H.S.	Oklahoma City

51.	Chester McIlroy	Eisenhower Middle School	Oklahoma City
52.	Grayford H. Chesher	Marshall H.S.	Oklahoma City
52.	Jerry Frazier	Marshall H.S.	Oklahoma City
56.	Brad Huff	Putnam City West H.S.	Oklahoma City
56.	Eddie Yellowfish	Putnam City West H.S.	Oklahoma City
61.	Hershel L. Slone	Okmulgee H.S.	Okmulgee
62.	Dale L. Spradlin	Oologah H.S.	Oologah
63.	Francis H. Coulson	Wellston H.S.	Wellston
67.	Earl D. Zerby	Yukon H.S.	Yukon
68.	James C. Broughton	Webster H.S.	Tulsa
69.	Charles R. Loper	Will Rogers H.S.	Tulsa
70.	Ross Badgett	Tupelo H.S.	Tupelo
73.	Richard E. Slaten	Pioneer H.S.	Waukomis
74.	Charles W. Biggs	Graham H.S.	Weleetka
75.	Stevens Farris	Central H.S.	Tulsa
77.	Richard Bayes	Hale H.S.	Tulsa
79.	Richard Griesel	Pawnee H.S.	Pawnee
80.	Gordon A. MacDonnell	Ponca City H.S.	Ponca City
82.	John W. Walker	Purcell H.S.	Purcell
83.	William H. Kight	Salina H.S.	Salina
85.	Earl Campbell	Seminole H.S.	Seminole
87.	Timothy Reamy	Skiatook H.S.	Skiatook
89.	John Pugh	C. E. Donart H.S.	Stillwater
90.	Floyd J. Cox	Stilwell H.S.	Stilwell
91.	Gene Carter	Tahlequah H.S.	Tahlequah
92.	Robert West	Tishomingo H.S.	Tishomingo
93.	Earnest L. Dates	B. T. Washington H.S.	Tulsa
94.	Dale R. Simpson	Tonkawa H.S.	Tonkawa
95.	Gary Lehman	Chelsea H.S.	Chelsea
96.	Lester L. Milford	Empire H.S.	Duncan
98.	Gene R. Grove	Forgan H.S.	Forgan

APPENDIX B

INITIAL LETTER OF REQUEST



Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74074
CLASSROOM BUILDING 406
(405) 624-6275

February 21, 1981

Dear

Information concerning the amount and physical condition of major power equipment is needed for future evaluation, renovation, and planning of Oklahoma industrial arts laboratories. I am making a survey to aid in determining the amount and physical condition of major power equipment present in industrial arts laboratories. I would appreciate assistance in collecting equipment information from your industrial arts laboratory. Enclosed is an equipment check-list for securing information for this study.

When assessing the physical condition of equipment on the check-list, please use the following guidelines:

GOOD--Operating properly and safety, has all guards in place

FAIR--Not functioning as well as possible, no safety hazards

POOR--Difficult to operate, broken or missing parts, a potential safety hazard.

Extra space is provided on the equipment check-list for listing any additional stationary power equipment.

This confidential information will be collected and evaluated in a master's degree thesis entitled "A Comparison of Major Equipment in High School Industrial Arts Manufacturing Processes Laboratories of Oklahoma in 1981." Your cooperation in completing the equipment check-list and returning it in the enclosed envelope will be greatly appreciated.

Respectfully yours,

David W. Gilbert

David W. Gilbert,
Graduate Assistant

APPENDIX C

INSTRUMENT

NAME OF SCHOOL_____

CITY OR TOWN_____

INSTRUCTOR_____

NAME OF EQUIPMENT	NAME OF MANUFACTURE	Approximate Age of Equipment			SIZE	Condition of Equipment		
		0 to 5 years	6 to 20 years	Over 21 years		Good	Fair	Poor
Welder, Oxyacetylene								
Welder, Electric Arc								
MIG Welder								
TIG Welder								
Flame cutting machine								
Hacksaw, Power								
Saw, Metal cutting Band								
Grinder, Pedestal								
Grinder, Surface								
Milling Machine								
Shaper								
Forge, Gas fueled								
Drill Press								
Compressor, Air								
Lathe, Engine								

NAME OF SCHOOL_____

CITY OR TOWN_____

INSTRUCTOR_____

NAME OF EQUIPMENT	NAME OF MANUFACTURE	Approximate Age of Equipment			SIZE	Condition of Equipment		
		0 to 5 years	6 to 20 years	Over 21 years		Good	Fair	Poor
Saw, Table								
Saw, Radial								
Saw, Band								
Saw, Power Mitre Box								
Saw, Jig								
Drill Press								
Sander, Belt and/or disk								
Planer, Surface								
Jointer								
Grinder, Pedestal								
Router, Shaper								
Mortiser								
Tenoner								
Dust collector unit								
Compressor, Air								
Lathe, Wood Turning								

APPENDIX D

FOLLOW-UP LETTER OF REQUEST

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74074
CLASSROOM BUILDING 406
(405) 624-6275

April 21, 1981

Dear Sir:

On or about February 23, you should have received a letter and check-list requesting information for a major equipment survey. At present, I have not received your reply. Information concerning the amount and physical condition of your major power equipment is needed for future evaluation, renovation, and planning of Oklahoma industrial arts laboratories. I would appreciate assistance in collecting equipment information from your industrial arts laboratory.

When assessing the physical condition of equipment on the check-list, please use the following guidelines:

GOOD--Operating properly and safely, has all guards in place

FAIR--Not functioning as well as possible, no safety hazards

POOR--Difficult to operate, broken or missing parts, a potential safety hazard.

Extra space is provided on the equipment check-list for listing any additional stationary power equipment.

This confidential information will be collected and evaluated in a master's degree thesis entitled "A Comparison of Major Equipment in High School Industrial Arts Manufacturing Processes Laboratories of Oklahoma in 1981." Your cooperation in completing the enclosed equipment check-list and returning it in the enclosed envelope will be greatly appreciated. If you have already mailed your reply, please disregard this letter.

Respectfully yours,

David W. Gilbert

David W. Gilbert,
Graduate Assistant

APPENDIX E

POSTCARD REMINDER OF EQUIPMENT SURVEY

March 27, 1981

It is still not too late to be included in the major equipment survey. Won't you please return your check-list?

David W. Gilbert

If you have already returned your check-list, please disregard this note.

VITA

David Wayne Gilbert

Candidate of the Degree of

Master of Science

Thesis: A SURVEY OF MAJOR EQUIPMENT IN OKLAHOMA HIGH SCHOOL INDUSTRIAL ARTS MANUFACTURING PROCESSES LABORATORIES

Major Field: Industrial Arts Education

Biographical:

Personal Data: Born in Enid, Oklahoma, August 23, 1957, the son of Mr. and Mrs. Charles Keith Gilbert.

Education: Graduated from Tonkawa High School, Tonkawa, Oklahoma, in May, 1975; received the Associate of Science degree in Industrial Arts from Northern Oklahoma College in May, 1977; received the Bachelor of Science degree in Industrial Arts Education from Oklahoma State University in May, 1979; completed requirements for the Master of Science degree in December, 1981.

Professional Experience: Student teaching, Ponca City East Junior High, fall semester, 1978; substitute teaching, Stillwater Public Schools, fall semester, 1980; graduate teaching assistant, Oklahoma State University, spring semester, 1981; automotive and welding instructor, Northeastern Oklahoma A & M College, 1981-82.

Professional Organizations: Member of Oklahoma Technical Society.