AN ABSTRACT OF THE THESIS OF

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(Major Professor)

Because of the great development of the metal industries and the extent to which metals are used in everyday life, there is reason to determine the extent and trends of metal work as taught in the industrial-arts programs of the secondary schools of Oregon. So long as the objectives of industrial arts center largely about exploratory, developmental, and appreciational values, it seems doubtful if so important a phase of industry as the metal trades should continue to be unrepresented in the public school program.

There is possible unmeasured evidence that the schools are lagging behind industrial development in the use of metals. It is the purpose of this study to determine the extent and kinds of metal work taught in Oregon's secondary schools; the extent of the metalworking tools and equipment available in the school shops; the attitude of industrial-arts teachers toward metal work as an experience area in the industrial-arts program; the direction of the trend to include more or less metal work in the schools; and to make available any information that may be of assistance to educators and others interested in the industrial-arts program.

In this study only those schools having some phase of industrial-arts shop work are considred. High school shop courses for which vocational aims were claimed, or which are reimbursible under the Smith-Hughes or George-Dean Acts, were excluded. Schools offering mechanical drawing only were excluded from the survey and only those junior high schools having a ninth grade were included. The need for the study is apparent in the present shortage of skilled workers in the defense industries. The question arises as to what the schools are doing to assist in the program.

Rich in the heritage of the past, industrial arts is the modern version of manual training. It traces its ancestry from Socrates to John Dewey, through Rousseau, Pestalozzi and Forebel. It has passed through two well defined periods--manual training and manual arts--and is now in the midst of a third.

The objectives of industrial arts may be summarized as follows: To develop in each pupil an interest in industrial life, consumer appreciation, appreciation of good design and workmanship, pride in good workmanship, cooperation, self-reliance and confidence, self-discipline, orderly habits, ability to interpret mechanical drawing and to express one's self by means of a drawing, and to develop elementary skills in the use of the more common tools. The trends seem to be toward a still more comprehensive program, with more emphasis on metal work, and the crafts, and with a falling off of auto-mechanics due to highly specialized character of present day auto repair.

Small schools predominate in Oregon. Many are not able to offer a diversified program of which industrial arts is a part. Of the total of 287 secondary schools in Oregon, 169 (58.9%) offer industrial arts of some kind. In addition, 10 schools offer mechanical drawing only. It is generally conceded that industrial arts will not have much chance to succeed in a school system with less than five teachers. In the small school the teacher will be able to devote only part of his time to industrial arts. As reported by Nee, less than a majority of industrial-arts teachers (45% in 1940) had included industrial arts as either a major or a minor field of study in preparation for teaching.

Many of the Oregon schools fall far below the normal pupil-teacher ratio, which was shown by Ericson's study, to be one teacher for each 200 to 300 average daily attendance, or for each 100 to 150 boys enrolled. In general, the schools employing from two to 12 teachers (inclusive) seem to conform better than those employing over 12 teachers. As the size of the schools increase the less they conform.

The junior high schools of the state offer industrial arts in all but two cases. They average only .5 full-time equivalent teacher whereas Ericson's ratio indicates the need of an average of one full-time teacher per school.

In the survey of teacher's opinions concerning the importance of metal work in general it is found that 93.1% favor metal work as an experience area in the industrial-arts program. Practically 100% believed that metal work contributes to the objectives of industrial arts. Concerning auto-mechanics, 77.8% believed that some form of metalworking experience might serve the objectives of industrial arts as well or better, while 22.2% believed auto-mechanics was superior.

In comparing metal work with the other traditional industrial-arts subjects it is found that only 11% ranked metal work more important than woodworking; that 87.9% of the teachers ranked woodworking of equal or more important. Drafting was ranked more important than metal work by 34.5%, equal by 45.8%, and less important by 19.7%. Auto-mechanics was ranked more important than metal work by 11.6%, equal by 43.8%, and less important by 44.6%. Electricity was ranked more important than metal work by 17.4%, equal by 57.4%, and less by 25.2%. Printing was considered more important than metal work by 20.5%, equal by 13.4%, and less by 66.1%. Craft work was ranked more important than metal work by only 12.4%, equal by 43.4%, and less important by 44.2%. Only 8% considered concrete work more important than metal work, 16.8% considered it equal, and 75.2% considered it less important.

From 112 to 116 teachers responded to these questions. Of the 169 secondary schools in Oregon offering industrial arts, 119, or 70.4%, returned the questionnaire. The apparent discrepency between the number of teachers responding and the number of schools reporting is due to the fact that one teacher represented two schools in several cases.

The distribution map shows three counties with no industrial arts in their schools. Four counties failed to report. This makes a total of seven counties not reporting.

Of the 119 schools reporting, 44, or 37%, indicated they offer some kind of metal work in the industrial-arts programs. Slightly less than a majority, 21 of the 44 reporting, offer metal work as a supplement to their regular woodworking course, 16 as an experience area in some type of general-shop organization, and four in multiple-shop organization. Nine of the 44 schools reporting metal work are junior high schools. This is 56.3% of the total as compared with only 34% of the senior high schools.

In reporting equipment, 81.8% indicated it to be entirely inadequate, two fairly adequate, and only five reported equipment adequate for their particular program. The power grinder and drill press were the two pieces of equipment most often reported.

All the units of metal work show an increase over the three-year period of 1938-39 to 1940-41. Arc welding, sheet metal, and art-metal show the greatest increase. Bench metal, with 23 in 1940-41, led in the number of courses reported. Art-metal and sheet metal were next, with 14 courses reported in each. Other units range from 11 courses reported in forging and welding to two courses reported in jewelry.

In conclusion it may be observed that metal work, in comparison to its place of importance in modern industry, is very inadequate in the secondary schools of Oregon. Although an overwhelming majority of the industrial teachers responding consider metal work a valuable experience area, expansion toward a more diversified program is slow. This is due partly to the large number of small schools, and the lack of teacher preparation, financial difficulties, and other factors. In general the equipment is either very obsolete or entirely absent. Of all the metal work units reported, art-metal, welding, and sheet metal work show the greatest increase. Foundry and machine shop practice seem to be the slowest to expand.

It is hoped that this study will contribute to the expansion of the industrial-arts program, and show the need of the cooperation between all phases of the teaching profession to make the educational programs of our schools more effective.

A STUDY OF TRENDS IN THE INDUSTRIAL-ARTS METALS AREA IN OREGON SECONDARY SCHOOLS

by

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A STUDY OF TRENDS IN THE INDUSTRIAL-ARTS METALS AREA OF OREGON SECONDARY SCHOOLS

CHAPTER I

INTRODUCTION

Industrial arts today has assumed a definite place in the secondary school curriculum. It has developed from the older concept of "manual training" which consisted almost entirely of woodworking. With the development of modern industry and its multitude of new materials and processes, "shop work" in the schools has taken on a new significance.

Whereas manual training emphasized the development of skill of hand and the training of the mind according to the traditional educational philosophy of mental discipline, industrial arts sets up the broader aims of the complete training of the individual. According to Payne (24:26)*

> Industrial arts education includes those forms of training and study based upon industrial pursuits and designed to enhance general intelligence and give vocational guidance in the field of industrial occupations.

An industrial arts program limited to woodworking and perhaps unrelated "mechanical drawing" only, is merely manual training disguised under a modern name.

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* The first number indicates the reference in the bibliography; the second number refers to the page of the reference.

Purpose of the Study

Because of the great developments in the metals industries, and the extent to which metals are used in everyday life, there is reason to determine the extent and trends of metal work as taught in the industrial arts programs of the secondary schools of Oregon. There is possibly unmeasured evidence that the schools are lagging behind industrial development in the use of metals.

With this in mind the purposes of this study are:

1. To determine the kind and extent of the metal work taught in Oregon's secondary schools.

2. To determine the extent of the metal work tools and equipment available and used in the schools.

3. To determine the attitude of the industrial arts teachers toward metal work as an experience area in the industrial arts program.

4. To determine whether the trend is toward including more or less metal work in the industrial arts programs of Oregon secondary schools.

5. To make any information available that may be of assistance to educators and others interested in the industrial arts programs of our schools.

<u>Scope and Aims</u>

This study has as its primary aim the survey of industrial arts metal work in Oregon's secondary schools. This includes all junior and senior high schools in the state having any type of industrial arts, whether listed as "manual training", "manual arts", "shop", or by some other term. Only those junior high schools including the ninth grade will be considered as secondary schools.

Only schools having an industrial arts* program will be considered. The Benson Polytechnic and the Edison High School of Portland, the Eugene Vocational School and the Salem High School are excluded. Also excluded from this survey are any high school shop courses which are reimbursible under the Smith-Hughes or George-Dean Acts, or which are specifically part of the program of national defense training. All such courses have been considered purely vocational in character.

Schools offering only mechanical drawing are not included in the survey as it is intended that this study consider only the type of industrial arts program of which active shop work is a part. However, it is granted that mechanical drawing is an integral part of an integrated industrial arts program.

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* See page 8 for a definition of "Industrial Arts".

Need for the Study

In this day of national emergency the shortage of skilled industrial workers is all too apparent. Furthermore, the shortage is most apparent in the metal trades and metal industries. To meet this emergency the national government is sponsoring the establishment of vocational schools and defense training courses.

The question arises as to what the public schools are doing and what they ought to do to assist in the program. Although industrial arts is not considered to be specifically vocational, surely the outcomes of the industrial arts program will make a contribution to the total training of those individuals following industrial pursuits. Struck (33:180) says:

> By the time students have completed their work in industrial arts they will have built up a background of insights, understandings, and skills that form a relatively broad background for more specialized trade training. . . . . . .

To further illustrate the part industrial arts is playing in the training of industrial workers, Proffitt (26:238-239) in a recent article points out:

> . . . . .Such courses will provide a background of experience with common materials and tools of construction that will serve the needs of some for a foundation upon which there may be erected a superstructure of vocational-industrial training and the needs of others for basic qualifications conditioning efficient work in low skilled jobs in industry.

Furthermore, industrial arts training may be specifically applicable to many semi-skilled operations. In this category Proffitt continues:

> In this connection it is pointed out that not all workers in industrial fields of our defense-preparation program are either highly skilled workers or just non-skill common laborers. Between these two extremes is a large number--probably much greater than the number of skilled workers--who are now engaged in a wide range of low-skilled jobs in the broad field of trade and industrial work. They help to keep the supplies rolling by the contribution they make to repair and maintenance jobs, to erect temporary headquarters and supply depots, to run a line of pipe for a temporary water supply, to string a line of wire for communication or lighting purposes, to build concrete and frame foundations that are substantial, to dissemble and assemble parts of machines and equipment for the purpose of making repairs, etc. In these jobs they perform such operations as cutting lumber to length, nailing, threading, and coupling galvanized pipe, making simple electrical splices, cutting and splicing wire, making and driving wooden stakes, tieing and splicing rope, hand drilling and riveting, cutting and soldering sheet metal for simple jobs, mixing concrete, leveling with spirit level, sharpening common tools by grinding, etc. Training for the necessary abilities to perform such a wide variety of low skilled jobs, so common in the field of industrial activities and so much needed in the defensive and offensive war activities where emergencies arise and personnel needs to be shifted from one job to another quickly, can be given effectively through the medium of industrial arts in our high schools.

To meet the needs of the student entering industry or who will enter upon more specialized trade training after high school, as well as the needs of the high school student who makes no direct use of the instruction other than as a more intelligent consumer of the products of industry, the industrial arts program should be as comprehensive as possible. In order to determine how well the secondary schools of Oregon are meeting these objectives there is need to know more about the industrial arts programs of these schools.

Definition of Terms

The following definition of terms used in this study are offered to clarify their meaning and connotations:

1. Area: A zone or principal section in the educational set-up. Examples are metal-work area; woodworking area; crafts area; graphic-arts area; English and social science area.

2. Art metal work: Refers to the type of articles commonly made by the silversmith. These products range from flat work such as trays, plates, etc., to round objects produced by "spinning", including sugar bowls, cream pitchers, coffee servers, etc. It is not to be confused with jewelry-making and usually utilizes semi-precious and base metals, such as pewter, gar-alloy,

aluminum, brass, copper, and other similar alloys.

3. Avocation: Any activity, pursuit, or hobby engaged in as a diversion from one's vocation.

4. Bench metal work: Usually any type of metal work performed at the bench with the use of vises, jigs, and hand tools and in which such hand operations as filing, drilling, bending, riveting, etc., are employed.

5. Forging and welding: Refers to the operations performed at the forge and anvil, which includes open fire welding, upsetting, drawing out, forming, etc. It also includes the more elementary welding operations performed with the arc welder and the oxyacetylene torch. This rather inclusive term is used particularly as it applies to a unit or area in the industrial arts program.

6. Foundry practice: The making of sand molds and cores, and the melting and pouring of ferrous and non-ferrous metals for the production of castings of machinery parts, household articles, novelties, etc. In most high school industrial arts laboratories it will be limited to low melting-point, non-ferrous metals such as aluminum and antimonial lead largely because of the high installation cost of equipment for handling ferrous and high melting point non-ferrous metals.

7. General shop: An industrial arts shop organized with several "areas" under one or two instructors. As an example, there might be units in the four areas or drawing, woodworking, metal-work and crafts. The students rotate from one unit to another at specified intervals. This type of organization provides for a wider range of experiences with a more limited equipment outlay than the conventional single unit shot, or a series of such shops.

8. Industrial arts: There are many and varied definitions of this term, depending upon the philosophy of the educational authority who does the defining. The following definitions are offered as more nearly summarizing current concepts of industrial arts.

Speaking of industrial arts in the secondary school, Cox (11:3) says it is:

> Variously defined but now generally accepted as a study of materials, processes, products, and problems of industry, including the social problems and consumer values as well as the technical processes, all for non-vocational purposes and as a definite part of the program of general education.

In supplement it seems that although industrial arts is pre-vocational it has vocational guidance objectives. According to Snedden (29:549):

> Industrial arts education includes those forms of training and study based upon industrial pursuits and designed to enhance general intelligence and give vocational guidance in the field of industrial occupations.

9. Machine shop practice: Here again is a very inclusive term as it is used to designate all the operations performed in the machine shop with its various machines and equipment. As applied to industrial arts it refers to operation of the machine lathe, milling machine, shaper, drill press, grinder, boring machine, etc., and would be limited only to the equipment available.

10. Metal craft work: This term is usually used synonymous with art metal work.

11. Metal work: This term as used herein refers to any type of activity in which any of the numerous types of metals are used to produce articles of metal; or in which some knowledge of the use of metals; and some skill in their use is developed in the student.

12. Ornamental iron work: This type of metal work is concerned with the artistic applications of the fundamentals of forging and welding and in the production of articles such as fireplace sets and screens, railings, grills, porch lanterns, etc. of mild steel. The term "wrought iron work" is out of favor because of the fact

that mild steel is easier to work and has almost replaced wrought iron in this type of work.

13. Prevocational: Used in connection with education, the term applies to the type of program designed to give the individual some contact with a wide variety of experiences to enable him to choose an occupation more wisely. It might be thought of as a program of occupational guidance which has produced positive results. All such training received previous to entry into a specific vocation could be considered prevocational.

14. Trade: Refers to a particular vocational calling of a skilled, highly specialized, mechanical character; it usually requires some sort of specialized and intensive training.

15. Unit: Refers to a "unit of work" in some "area". It may be of greater or lesser length, depending upon the material to be covered. This term is similar to a "unit of learning" in which a certain body of related facts are grouped into a specific, correlated part of a "course" (of study).

16. Vocational: As applied to education, any activity or training that has for its purpose the fitting of the individual for some specific trade or occupation.

Materials and Procedure

This study is made largely from a survey of industrial-arts shops and opinions of shop teachers. Data were secured from two sources: 1) The Oregon School Directory (30:63-104) and, 2) a questionnaire* sent to each shop teacher of industrial arts in the secondary schools of Oregon.

The questionnaire was sent only to those teachers who were listed in the Oregon School Directory as teaching some phase of industrial arts shop work. Full recognition is given to those who supplemented the information contained in the questionnaire with accompanying notes and suggestions. These are a valuable contribution to the study and are indicative of the amount of interest manifested in the study. This interest is further indicated by the number of questionnaires returned. Of the 169 questionnaires sent out to as many different schools, 119, or 70.4 percent, were returned.

Limitations of the Study

The study is limited by the percent of returns of the questionnaire. A return of 100 percent would have given a truer picture of the program. Naturally the

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* A copy of the questionnaire is included in the appendix.

adequacy of interpretation of the raw data as received will constitute a limitation for which the author must assume full responsibility.

Obviously the survey would be more complete and the study more objective if time and circumstances would have permitted personal interview of industrial arts instructors and visits to their shops. However, it is believed that the data are ample and sufficiently valid that the study will throw some light upon the trends and problems of industrial arts in Oregon.

CHAPTER II

HISTORICAL BACKGROUND OF INDUSTRIAL ARTS IN SECONDARY EDUCATION

Awakening of the Philosophy of Practical Education (1500-1700)

The philosophy of industrial arts in education had its beginnings in Europe coincident with the Protestant Reformation movement. This was the beginning of the breaking away from the church and its exclusive control of education of a dogmatic and almost purely classical type. Thinking men of that time (16th century) saw the need for broader and more comprehensive education for every class of people. Martin Luther (1483-1546) specifically advocated occupational training in conjunction with their regular schooling for older children and youth. He is quoted as saying (2:31):

> My opinion is that we must send boys to school one or two hours a day, and have them learn a trade at home for the rest of the time. It is desirable that these two occupations march side by side.

Francis Bacon (1561-1626), the Englishman, often called the father of modern experimental science, realized the significance of nature and the arts of daily life as a basis for new learning. He recommended (3:35) to scholars:

> Be not wrapped up in the past; there is an actual present lying all about you; look up and behold it in its grandeur. Turn away from the broken cisterns of traditional science, and quaff the pure waters that flow sparkling and fresh forever from the unfathomable fountain of creation. Go to nature and listen to her many voices, consider her ways and learn her doings; so shall ye bend her to your will. For knowledge is power.

The most outstanding educational thinker and writer of the seventeenth century was the Morovian Protestant, Comenius (1592-1670). Like Luther, he believed in universal education for both sexes and like Bacon he believed in the application of nature and art in order to make education more meaningful and more enjoyable to the learner. Concerning the mechanical arts he advocated (3:38):

> They should learn the most important principles of mechanical arts, both that they may not be too ignorant of what goes on in the world around them, and that any special inclination toward things of this kind may assert itself with greater ease later on.

Comenius would have the mechanical arts learned from a book prepared for the purpose but there was no indication that he advocated teaching them through formal shop work in the school.

Sir William Petty, an English contemporary of Comenius, proposed a literary work-house in which, among other things, children would be taught "some genteel manufacture in their minority" (3:46). He also proposed a college or guild of tradesmen and in which he would have written a book laying open the "mysteries of the trades."

However, like his predecessors, Petty never put his plan into practice although he would go farther in connecting handwork with the school and make it an integral part of the school program.

Progressive thinking continued more toward the practical phase of education coincident with the development of scientific discovery during the latter part of the seventeenth century. John Locke (1632-1704), an English philosopher, essayist and leading educational writer of his time, advocated "that education should fit a boy for practical life" (3:61). He proposed learning of the manual trades (a) because they afford good physical exercise; (b) because the skill gained is worth having--it may be useful; (c) because they provide diversions and recreations (3:62).

The "Practical Arts" in Education (1700-1870)

The greatest upheaval in educational thinking was caused by the writings of Jean Jacques Rousseau (1712-1778), a Swiss of French ancestry. Although a ne'er-do-well and wanderer this author was largely responsible for later developments of practical arts education. His work <u>The Social Contact</u> is blamed for the French Revolution and his <u>Emile</u> was no less responsible for a revolution in education.

Rousseau maintained that education should be natural and spontaneous and he saw learning a trade not only as a necessity for earning a living but also as a vital process in education. He is quoted (3:80) as saying:

> If, instead of making a child stick to his books, I employ him in a workshop his hands labor to the profit of his mind, he becomes a philosopher but fancies he is only a workman....
>
> It is necessary that he work like a peasant and think like a philosopher, lest he become idle as a savage. The great secret of education is to make the exercise of the body and the mind serve as a relaxation to each other.

Of Rousseau, Bennett (3:81) says:

> These statements concerning the value of manual arts in education place Rousseau ahead of his predecessors and many of those who came after him. <u>His recognition of the fact that the manual arts may be a means of mental training marked the beginning of a new era in education</u>.

The first really successful application of Rousseau's educational philosophy was made by John Henry Pestalozzi (1746-1827), the Swiss educator who established a succession of manual agriculture schools for the poor children of Switzerland. Although he has been called the "father of manual training", this is only partly true. He put into practice new methods of teaching as well, which have been more fully developed under the influence of modern psychology.

Of Pestallozi's methods the most outstanding was "his repeated successful use of objects and manual labor, both skilled and unskilled, as a means of teaching the traditional school subjects" (3:118). He is quoted (3:119) as saying: "There are two ways of instructing; either we go from words to things or from things to words. Mine is the second method."

It was for a contemporary of Pestalozzi, Philip Emanual von Fellenberg (1771-1844), another Swiss, to make a more financial and perhaps practical application of his plan. His was an agricultural and industrial type of school in which boys and girls, while learning, would support the institution by working in the fields and shops. At the Fellenberg school rich boys paid for their schooling while poor boys indentured themselves until their twenty-first birthday. During this time they had an opportunity to learn a trade by the imitative method of apprenticeship. This type of farm and trade school was a forerunner to the future development of the industrial reform school.

Another great educational philosopher, Herbart (1776-1841), was once a teacher of the school at Hofwyl (Fellenberg School). Although he is reported as looking upon manual arts as a means of discipline, in his writings (3:16) he said:

> Every growing boy and youth should learn to handle the recognized tools of carpentry as well as the ruler and compass. Mechanical dexterity would often be more useful than ability in gymnastics. The one helps the spirit, the other the body. Elementary schools should have workshops, though they should not actually be technical schools. And every man should learn to use his hands. The hand holds the place of honor at the side of the power of speech in raising man above the beasts.

Credited with more directly developing Pestalozzi's idea of organic growth was Wilhelm Augustus Froebel (1783-1852) who came into close contact with Pestallozi as a teacher in his school at Yverdun. His doctrine of self-activity placed handwork at the very center of his educational system. This was evident in his writings in The Education of Man, and in his Kindergarten, a model school at Keilhau, Germany.

Growth of the "Sloyd" and Manual Training Movements (1870-1880)

Modern manual training, the immediate predecessor of "industrial arts" in the development of industrial education, is a direct descendant of the Russian system and

Swedish "Sloyd" plan of teaching the mechanical arts.

The Russian system was developed in 1868, at the Imperial Technical School in Moscow, under the direction of Victor Della Vos. The fundamentals of the system were briefly these: The most important aspect was that instruction was graduated and progressed from the simplest to the most difficult. Instruction was given through a series of exercises of increasing difficulty. Exercises or models were made from drawings first made by the student in a drawing class; there were separate shops for each art as woodworking, metalwork, etc. Instruction was individual so far as possible but progressed toward making the student increasingly self-reliant.

This system was new in method of instruction and organization but it applied only to trade and technical training. It was applied to general education by the Swede, Otto Salomon, in 1877. Salomon modified the Russian system as developed by Della Vos to the extent that he combined his exercises into useful articles. Concerning this, he maintained (4:65) that:

> The so-called 'Naas Method' is grounded upon the exercises which occur in wood-sloyd, but in such a manner that, by making practically useful articles and not abstract preparatory exercises, the pupil gains his skill and experience.

The term "sloyd" refers to a type of homecraft in Sweden. With the advent of machinery it tended to die out but was revived in the schools. Educational sloyd, as developed by Salomon, had three outstanding characteristics: 1) making useful objects, 2) analysis of processes, and 3) educational method (4:64). He limited his efforts to "wood-sloyd" because: 1) that material was easily available; 2) many things made of wood were useful in the homes of Sweden; 3) working in wood was cleanly; 4) the processes and materials were sufficiently varied to permit of the use of a variety of tools and many forms of construction, thus providing superior educational possibilities (4:65-66).

The Sloyd idea spread to the rest of Scandinavia, Germany, France, and England. Outside Scandinavia it became known as "manual training", and was recognized as an integral part of the educational system in the training of the mind through the skill of the hand. Current thought of the time was expressed by Sir John Lubback (1834-1913), the famous English naturalist, who in 1886 observed (4:239):

> The introduction of manual work in our schools is important, not merely from the advantage which would result to health, not merely from the training of hand as an instrument but also from its effect upon the mind itself.
>
> There have been two very different points of view from which manual instruction have been recommended. The first looks at the problem from a specifically economical point of view. The school is arranged so as to elicit the special aptitudes of the pupils; to prepare and develop the children as quickly and as completely as possible for some definite trade or handicraft, so as to, if possible, assure them, when leaving school, the material requisite for existence. In this way it is maintained that the wealth and comfort of the nation can be best promoted.
>
> The second theory regards the manual instruction as a form of education; the object is to give to the hand, not so much a special as a general aptitude, suitable to the varied circumstances of practical life, and calculated to develop a healthy love of labor, to exercise the facilities of attention, perception and intuition. The one treats the school as a subordinate to the workshop, and the other takes the workshop and makes it a part of the school. The one seeks to make a work man, the other to train up a man.

This new concept of the mechanic arts as applied to education was further emphasized by Sir Philip Magnus (1842-1933), director of the City and Guilds of London Institute, who is quoted (4:239) as saying:

> It cannot be too often repeated that the object of workshop practices, as a part of general education, is not to teach a boy a trade, but to develop his facilities and give him manual skill; that, although the carpenter's bench and the turner's lathe are employed as instruments of such training, the object of the instruction is not to create carpenters or jointers, but to familiarize the pupil with the

> properties of such common substances as wood and iron, to teach the hand and the eye to work in unison, to accustom the pupil to exact measurements, and to enable him by the use of tools to produce actual things from drawings that represent them.

In the United States Professor Calvin Milton Woodward (1837-1914), the great American champion of manual training, as professor of mathematics and applied mechanics at Washington University, was a pioneer in the development of shop work in general education. His ideas as to organization approached the modern concept of industrial arts education. He is quoted (4:319), in outlining his ideas, as saying:

> But the acquisition of this desirable manual skill requires workshops and tools and teachers; and as such essentials are not in general to be had at home or at a common school, the work must be done at a polytechnic school. Hence, at the earliest possible moment, in the lowest class, students must enter the workshop. From the bench of the carpenter, they should go to the lathe. Wood turning is an art requiring great judgment and skill, and anyone accomplished in it will testify to its great practical value. After wood comes brass, iron, and steel turning, fitting and finishing; then the forge, where each should learn welding and tempering. This is the alphabet of tools. Next will come their legitimate use in the manufacture of patterns for castings, in the construction of model frames, trusses, bridges, and roofs; in the cutting of screws and nuts with threads of various pitch; and in the manufacture of spur and bevel wheels with epicycloidal and involute teeth. This shop work should extend through the entire course of four years varying somewhat according to the professional course selected.

Perhaps the greatest impetus to the manual training movement in the United States resulted from the impressions made on American educators by the exhibit of the Russian system of tool instruction at the Centennial Exposition at Philadelphia in 1846.

The first American course developed on the Russian plan was the "School of Mechanical Arts" as a shopwork department of the Massachusetts Institute of Technology. Dr. John D. Runkle (1822-1902), then president of the Institute, was largely responsible for its development as a result of his impressions at the Exposition. Dr. Runkle and his associates believed that training in the mechanical arts should be made available to boys of the secondary school level.

Development of Manual Training in the Secondary Schools of the United States (1800-1900)

After about 1800 the most distinctive aspect of the manual training movement in America was the appearance of manual training high schools. The first of these schools was the Manual Training School of Washington University in St. Louis. It was similar to our modern polytechnic high schools, offering a variety of courses in tool instruction in wood and metals. As time went on manual training was introduced into increasingly more public high schools until by 1900 the number exceeded

100 in the United States. During this period there was a conflict among educational thinkers over the place mechanic arts should occupy in the public high school. Dr. Woodward defended manual training as part of the general educational program. His philosophy may be summarized in his oft-quoted (4:367) epigram about educating the whole boy, "My educational creed I put into six words: Put the whole boy to school."

Dr. Nicholas Murry Butler, President of New York College for the Training of Teachers in 1886, presented the "mental training" viewpoint of manual training. He maintained (4:360):

> We are not now discussing the philosophy of manual training. That day has passed. It has been incontestably established that the powers of thought, expression by delineation and construction, the judgment and the executive faculty, must be trained as well as the observation, the memory and the power to learn.... If shopwork is used as a means of manual training, it is because of its disciplinary value, not because of its utility. It is only a means, not an end. It will be discarded whenever anything better adapted to accomplish the end in view is discovered, just as an old geography is thrown away when a better one is made.... That part of the training of the expressive faculties which is included in the terms "drawing" and construction work is what is meant now-a-days by manual training. If the term manual training is used in antithesis to mental training, it is wrongly understood. Manual training, as I use the term, is mental training. It is mental training, by means of manual training. It is included in the psychologically determined course of study because it reaches important mental faculties which no other studies reach. It is also a most valuable and important stimulus to

the receptive faculty of observation. The child can neither draw accurately nor construct correctly until he observes acutely.

In general, the aims of manual training during this period can be stated thus (4:389):

(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 in perception; to train the judgment; to render memory exact and reliable.

(5) To turn the pent-up energies of the boy into channels of usefulness.

Manual training during this period and following was organized for woodworking and in many cases accompanied by work in mechanical drawing, with courses in blacksmithing (forging or forging and open-fire welding) and perhaps machine shop practice added as the mechanical arts program increased in popularity. Thus some of the schools became polytechnical in character where manual training was broadly expanded. Such a high school developed in the city of Washington, D. C., from 1885-1888.

Growth of the New Philosophy of Industrial Arts from 1900

The new philosophy of "industrial arts" has resulted from and developed with progressive educational thinking and practice. John Dewey, the foremost American educator, accepted manual training for the elementary school and placed industrial occupations at the very center of the elementary school curriculum. He would make them part of the child's school experience. He has been quoted (23:50) as saying: "We must conceive of work in wood and metal, of weaving, sewing, and cooking as methods of life, not as distinct studies; ... as instrumentalities through which the school itself shall be made a genuine form of active community life."

The term "industrial arts" resulted partly from Dewey's writings. It was first suggested in 1904 as a substitute for the term "manual training" by Professor Richards in an editorial in the <u>Manual Training Magazine</u>. According to Bennett (4:453) Richards contended that, owing to a change of viewpoint:

> We are rapidly leaving behind the pure disciplinary thought of manual training.... Now we are beginning to see that the scope of this work is nothing short of the elements of the industries fundamental to modern civilization.

Specifically, industrial arts may be said to be a broadening of the "manual arts" movement which itself developed from manual training. Nelson (21:55) points out:

> 'Manual training', as it was taught at the turn of the century, sought to teach a few manual skills and to develop general manipulative dexterity. This was expanded by the 'manual arts' movement which included training in design and an appreciation of art and beauty in the products of industry. 'Industrial arts' has now broadened its program to include training for industrial and social needs. The following are some of the general aims and objectives which the modern instructor of industrial arts includes in his program of student training:
>
> (1) Character development.
> (2) Development of democratic ideals.
> (3) Ability to think and plan.
> (4) Manipulative abilities.
> (5) Constructive tendencies.
> (6) Ability to earn a living.
> (7) Training in good design.
> (8) Knowledge of industrial processes.
> (9) Appreciation of the work of others.
> (10) Maintenance of health.
> (11) Avocational interests.

Commenting on the industrial arts movement Callicott* and Skinner** point out (23:4):

> Industrial arts has had its greatest development on secondary-school levels. Here it has passed through two somewhat well-defined periods of professional growth and is now in the midst of a third. The first was 'manual training,' where the emphasis

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* Callicott: President, Ohio Education Association.
**Skinner: Director, State Department of Education, OhiO.

> was on <u>hand</u> skill, chiefly in woodworking. The second was 'manual arts', where the emphasis, while still on skill, was extended to include the <u>making</u> of both <u>useful</u> and <u>well-designed</u> articles. The third is now 'Industrial Arts', where the intent is to include all of the old that was good, but to broaden out from the limitation of an emphasis upon manual skill alone to an enriched conception where more of the child's interests and environment, and certainly many of the other school subjects, are involved.

Perhaps the most widely accepted objectives of industrial arts in modern education are those resulting from a study conducted by a committee of the American Vocational Association on "Standards of Attainment in Industrial Arts Teaching" (1:12). They say:

> Our purpose in general education is to provide experiences which will develop the individual into a useful, happy, and successful citizen. It is the function of the industrial-arts work to supplement and aid general education in realizing its aims, by providing experiences which will fit the individual through his knowledge, skills, attitudes, and accomplishments to be more useful as a producer, more appreciative and happier as a consumer, and more valuable as a citizen. The things for which the industrial arts teacher should assume a large measure of responsibility may be stated as follows:

Summary of Objectives (1:12)

1. To develop in each pupil an active interest in industrial life and in the methods of production and distribution.

2. To develop in each pupil the ability to select wisely, care for, and use properly the things he buys or uses.

3. To develop in each pupil an appreciation of good workmanship and good design.

4. To develop in each pupil an attitude of pride or interest in his ability to do useful things.

5. To develop in each pupil a feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation.

6. To develop in each pupil the habit of an orderly method of procedure in the performance of any task.

7. To develop in each pupil the habit of self-discipline which requires one to do a thing when it should be done, whether it is a pleasant task or not.

8. To develop in each pupil the habit of careful, thoughtful work without loitering or wasting time (industry).

9. To develop in each pupil an attitude of readiness to assist others when they need help and to join in group undertakings (occupation).

10. To develop in each pupil a thoughtful attitude in the matter of making things easy and pleasant for others.

11. To develop in each pupil a knowledge and understanding of mechanical drawing, the interpretation of the conventions in drawings and working diagrams, and the ability to express his ideas by means of a drawing.

12. To develop in each pupil elementary skills in the use of the more common tools and machines in modifying and handling materials, and an understanding of some of the more common construction problems.

This summary of the objectives and aims of the industrial arts indicates their broadening influence in education.

Furthermore, the expansion of industry during the last quarter century with its diversity of materials and processes has stimulated the expansion of industrial arts education. This trend is brought out by the following excerpt from the 1933 REVIEW (13:23):

> Going back our thirty years we find very few industrial materials. Cast iron was universally used. Wrought iron was preferred, but mild steel was just entering. Rubber was being used for pencil erasers and was just entering the bicycle and automobile tire era. Aluminum was a rare metal. In all, the engineer and Industrial Arts teacher of that era had some six or seven materials to work from. Count them--brass, bronze, tin, wrought iron, cast iron, copper, and woods of various kinds. Today there are some 500 materials from which to choose. There are nearly 100 varieties and alloys of steel; there are innumerable alloys of aluminum; magnesium has entered the field, with iridium and tungsten. Rubber is a king of materials, and so on it goes. Chromium used in plating is a by-word, thanks to the automotive industry. We find, moreover, changes along the most inexpensive and the most prevalent of all materials, is rapidly being displaced by steel and even by aluminum. We have seen in the last few years the rise of the steel bedstead, the steel tubular handle for the vacuum cleaner, even the steel spade handle, and the steel golf club. And today we see the increase in the aluminum chair, the aluminum desk, and there are

> already signs that steel girders will be displaced by aluminum girders of equal strength but of much less weight. There are reasons for such things. The Industrial Arts teacher still largely thinks in terms of wood, but should his students not be taught that there are other materials and reasons for their use? They are not too young to grasp the why of things and they can easily get elementary instruction in this branch of economics.

Here is brought out the increasing uses of metals in industry. To the materials listed must be added the new alloys and metals just coming into use; the new synthetics and plastics.

Certainly this change in industry has stimulated the change in manual training with its emphasis on woodworking. The result has been the development of the present day comprehensive industrial arts program.

Recent Trends in the Development of Industrial Arts Education

To provide experience in as many as possible of the increasing number of areas in industrial arts new experiments have been made in shop planning and organization. Probably the most outstanding new development is the "general shop"*. This is particularly true in the smaller schools which usually have been limited to one activity, when the program was of the older manual training type.

* See page 8 for definition of "general shop".

Under the "general shop" plan it is possible for one instructor to present several--as many as six--experience areas, with the pupil rotating from one to another. Under this plan, little vocational competency can be claimed, but by offering broader contacts it will more nearly meet the aims and objectives of industrial arts. Neither is it claimed that the general shop organization will be as desirable as a series of unit shops which would be possible in the large school organizations.

The general shop has had its greatest development in the junior high school. Concerning this John Claude (10:9-10), Associate Editor of the Industrial Arts and Vocational Education Magazine, points out:

> The junior high school was just about coming into its own in 1924. It is on this level that the general shop has had its greatest growth.

Claude, in his survey, gives a graphic comparison of the increase of the several shop subjects from 1924 to 1938. He continues:

> Figure 6 shows the progress of shop subjects in the junior high school. Hidden in the metalworking graph is the story of the growth of the machine shop as against the sheet metal shop; the growth of bench metal as against the old tinsmithing of former years; the decrease in the number of forge shops as such, which are now utilized as only a portion of an activity rather than a major activity itself.

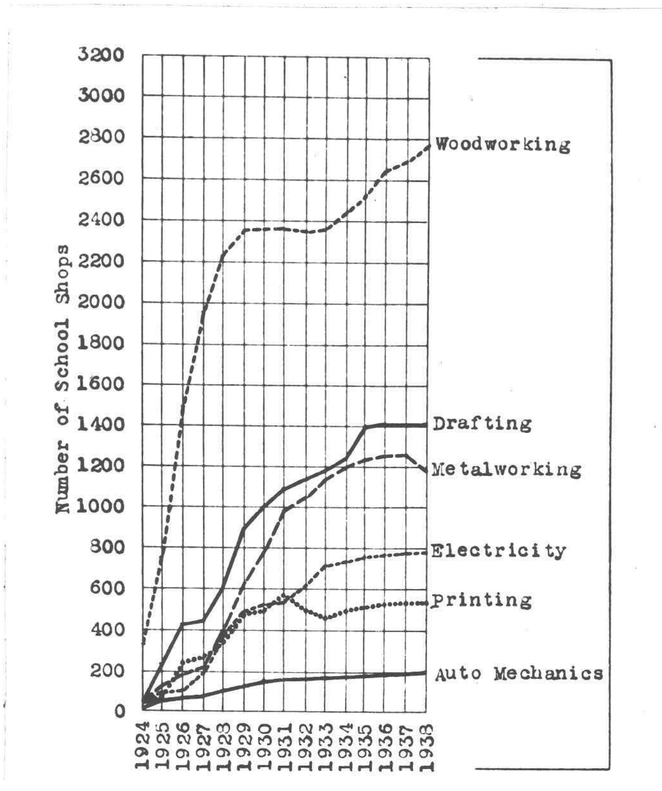

Fig. 6. Diagram Showing the Development of Shop Subjects in Junior High School

Relative to the increase in the several shop subjects in high school, Claude continues:

> Figure 5 shows the progress of shop subjects in the high school. It is in this level of education that the school shop enjoys its greatest spread. It was originally started on this level, and then spread into the upper elementary grades which now embrace the junior high school.

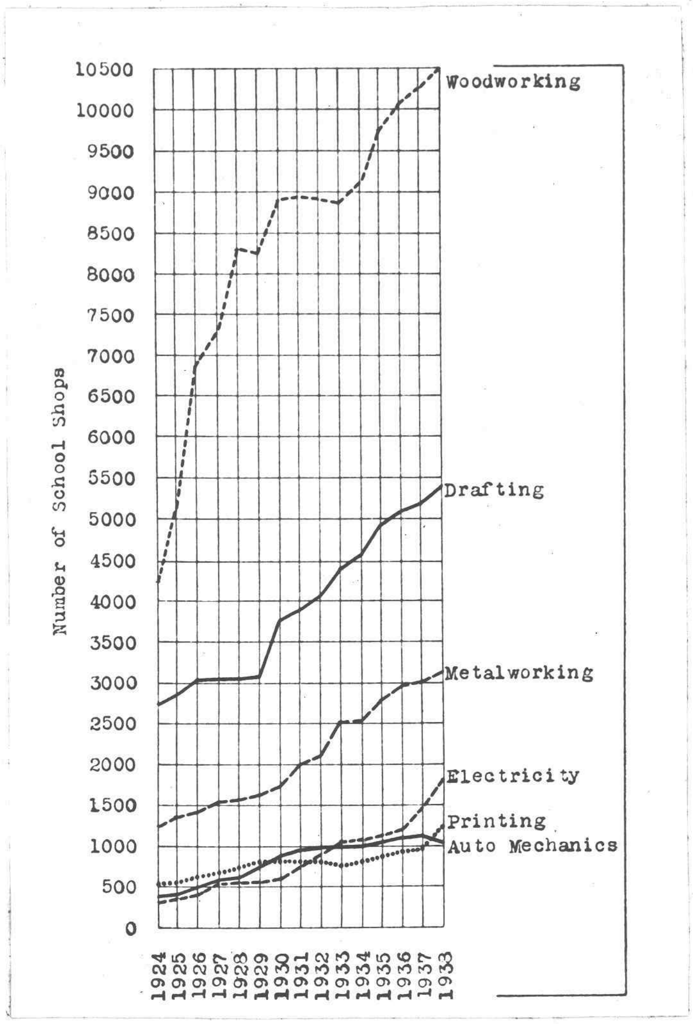

Fig. 5. Diagram Showing the Development of Shop Subjects in High School

In this survey Claude points out a definite trend toward a greater variety of experience areas for the industrial-arts program in secondary schools. Although the greatest growth in school shops has been in the woodworking area, drafting and metal working have also been extensively expanded. Electricity and printing are next in popularity with auto-mechanics showing little growth in junior high school and a decrease in high school shops. This may be due to the fact that auto-mechanics has recently become too highly specialized and vocational in character for the average high school.

In the larger city school systems the idea of the general shop is being applied to the various experience areas. For example, the metal work area becomes a "general metal" shop. Here will be covered the more common phases of metal work. Concerning "general metal work", Frank C. Moore* (18:8), who is in a position to survey current trends and predict future developments, says:

> In our general metal, we must be sure that we emphasize all the phases of metalwork which the boy should know today. We must have in our general metal shop: Bench metal, foundry, forge, sheet metal, simple machine-shop practice, simple heat treating, welding, spinning, and novelty metal. All these phases of metal work are part of the secondary industrial-arts field and must be included in the metal curriculum if the boy is going to have the right background for future industrial interpretation.

Moore (18:8-24; 19:15-19) also predicts that this trend away from specialization and toward a more general and comprehensive type of program is evident in the subject matter in the various other experience areas of industrial arts. It is his belief that there will be a

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* Moore, Frank C., Director Industrial Arts, Cleveland, Ohio.

reorganization of woodworking to make it more general. There will be included some simple pattern making for consumer appreciation and for better understanding of industrial methods. There will be some building construction approached for the same reason. Furniture finishing will be emphasized as furniture will be a permanent necessity of life. The craft and hobby possibilities of wood carving will be given consideration.

In drawing, according to Moore, there will be less stress on "mechanical drawing" and a leaning toward pictorial drawing such as isometric, perspective, and cabinet drawing, both freehand and straight-edge. There will be more blueprint reading and drawing interpretation. Inking will be largely eliminated except for those who plan to specialize in some type of drafting.

In printing there will be less emphasis upon composition and press work and more upon design and layout in the direction of artistic printing because of its great consumer values. The term "graphic arts" would be more appropriate for this type of printing program.

Electricity will be approached from the "general" viewpoint and not from the exercise method such as bell wiring and splicing. There will be more projects using wood and metal correlated with the fundamentals of electricity.

Auto mechanics will probably tend to decrease in importance as an industrial arts shop course. Where it is taught the emphasis will be upon body and fender work, touching up, servicing, and general maintenance. The practice of replacement of worn parts makes old-fashioned repair and rebuilding too slow and costly.

Although rather expensive, plastics are fast becoming a popular medium to be used in industrial arts. For both boys and girls they have great craft possibilities, lending themselves to artistic design for useful projects.

Concerning trends in organization and method, Moore predicts (19:19) a greater use of instructional material rather than that which the instructor himself works out. For each instructor to make his own is a time consuming practice and the product may often be inferior to instruction sheets to be had at a reasonable price.

Text books will be used more extensively, and there is a trend toward more emphasis upon related information. Students will be encouraged to keep notebooks for this information which could be used as a supplement to regular instruction.

Although visual aids are now accepted as an integral part of the industrial arts instructional material, it seems that there should be a better understanding of their use. Field trips, charts and graphs, magazines, slides, and movies, and other types of visual aids are all available and often free of charge. There will be more use of the field trip, but it must be handled properly, with a definite purpose in view, to be of any value to the instructional unit under consideration. Otherwise it becomes an excursion for amusement only. Altogether there will be more and better plans for teaching shop work.

With the more comprehensive program and larger classes, organization is of increasing importance. The shop program should be so organized that the teacher will be relieved of routine duties in which he may become merely a "checker". The opportunity for real teaching must be available.

The solution of this problem seems to be a trend toward a better organized pupil personnel, perhaps through the use of foremen with previous shop experience, whose new training would include foremanship principles for which regular school credit would be given.

In conclusion, Moore points out (19:19) another trend in method will be toward better means of evaluation. This may be through progress charts, methods of grading, testing, or some combination of these factors.

Something of this nature will be necessary if industrial arts progress is going to have a real meaning to either the student or the teacher.

Another important trend in industrial arts education is the teaching of socio-economic principles, both directly and indirectly, as related information. Ray Stombaugh* (31:16) in a recent article, observes:

> At the present time there appears to be a growing sentiment that the industrial arts is a natural medium for teaching economic and social principles. The work in the school shops offers opportunity for pupils to become sensitive to significant problems of the worker in the industrial world. The pupil-personnel organization being used in many shops naturally involves pupils in a democratic scheme requiring social contacts and social behavior. Since pupils in this area are participating in a realistic industrial group, industrial arts may play an important role in helping youth adjust themselves to an industrial society in which they will soon be plunged.

In teacher preparation for industrial arts there is undoubtedly a trend toward more thorough training both in the major field and in educational philosophy and methods. With the raising of the certification requirements teachers are being trained better and are becoming more professionally minded. The movement toward consolidation of small schools and the desire of educational leaders to raise the level of the teaching

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* Stombaugh, Ray, Head of Department of Industrial Arts, Illinois State Normal University.

profession are helping to bring this about. Concerning teacher preparation in recent trends in industrial arts, Bawden (7:247) says:

> The tendency to raise the standards of qualifications of teachers continues, and appears likely to continue for some time. The number of cities calling for industrial arts teachers holding the Master's degree is increasing. At least two or three states have enacted certification laws* which permit a teacher to teach only the subject (or subjects) named in the certificate, this subject being only the one in which the holder has completed a 'major' consisting of a specified minimum number of semester hours of work, at an approved teacher-training institution.

There is also a trend in industrial arts toward shop work for girls and perhaps home economics for boys. Girls are becoming increasingly interested in the "craft" phase of shop work. Concerning this, Bawden continues:

> There appears to be a growing demand for teachers who can handle a program of craft work in high school, including some attention to the new plastics, especially to book binding, leather tooling, art metal, photography and others. These crafts appear in many schools as "club" or extra curricular activities, rather than part of the industrial arts program....
>
> There is a trend in the direction of requiring certain minimum amounts of industrial arts of all boys in junior and senior high school; also of permitting girls to take certain industrial arts courses, and permitting boys to take certain courses in home economics.

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* As of 1939.

CHAPTER III

STATUS OF INDUSTRIAL ARTS IN OREGON SECONDARY SCHOOLS

Classification of Oregon Secondary Schools

This study is concerned with the public secondary schools of Oregon, both junior and senior high schools. As previously stated (page 2) only those junior high schools incorporating a ninth grade are considered. It seems self-evident that the size of the school will have much to do with the type of industrial-arts program, or whether there is a program at all; the equipment available; and the qualifications and training of the industrial arts teacher for that particular school.

Relation of the Adequacy of Oregon Industrial Arts Programs to the Size of the School

Small schools predominate in Oregon. Although the trend seems to be away from the small school in the one- to four-teacher class, the movement is slow to get underway. However, the one-teacher school has now disappeared and, as the movement toward consolidation continues, it is hoped that the near future will see the end of the two- and three-teacher high schools except where transportation difficulties make consolidation impractical. Many small communities will resist this movement because it necessitates loss of identity as far as a high school is concerned. On the other hand, they must be educated to see the added advantages of an enriched curriculum, more specialized teachers, and better teaching facilities and equipment usually possible in the larger systems. Coincident with the other advantages of the larger school is a much lower per pupil cost. In writing of consolidation, Richard E. Jaggers* (16:172) observes:

> In view of the limitations of the small school from the standpoint of the program, and in view of the high pupil cost, it is a point of good business administration if the superintendent emphasizes a program of elimination of the smaller school enterprise as rapidly as road conditions and public sentiment will permit.
>
> Economy and efficiency will result when a program of consolidation of schools takes place.

Table I shows a classification of schools according to the number of teachers employed. Here it is found that the three-teacher high school leads the number, with 38, and that the two, four, and five-teacher classes are close in number. It is also found that, as the number of teachers increase in each class, the number of schools decrease. Collectively, there are 108 schools in the 1-4 teacher group, 98 in the 5-10 teacher group, and only 81 in the group with more than 10 teachers.

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* State Supervisor of Rural Schools, Kentucky State Department of Education.

TABLE I

Showing Classification of Schools by the Number of Teachers Employed, and the Number of Schools Offering Industrial Arts

Number of teachers employed (inclusive)	Number of schools in each class	Percent in each class	Number of schools offering Industrial Arts shop subjects	Percent in each class	Number of schools offering mechanical drawing only (not included in the preceding column
1	1	.004	0	00.0	0
2	32	11.2	4	12.5	1
3	38	13.2	17	44.7	1
4	37	12.9	17	46.0	1
5	35	12.2	24	69.0	1
6	23	8.0	16	69.5	0
7	13	4.5	10	77.0	0
8	11	3.8	9	81.8	0
9	5	1.7	2	40.0	0
10	11	3.8	7	63.6	0
11-15	24	8.4	17	70.8	4
16-20	20	7.0	16	80.0	1
21-25	12	4.2	11	92.5	0
26-30	11	3.8	9	90.9	0
31-40	3	1.1	3	100.0	0
Over 40	11	3.8	7	63.6	1
Total	287	100.0	169	58.9	10

Read: There are 32 schools employing 2 teachers, which is 11.2% of the total; of this group 4, or 12.5%, offer industrial arts shop subjects; one school offers mechanical drawing only.

Furthermore, with the increase in the size of the schools, as indicated by the number of teachers employed, there is a corresponding increase in the percent of schools offering industrial arts. Note that, of the 32 two-teacher high schools (see Table I) only 4, or 12.5%, offer industrial arts. On the other hand, of the five-teacher class, 24 of 35, or 69% of the high schools offer industrial arts.

Mechanical drawing only is offered in ten high schools. Although this study surveyed only schools with work shops, it seems necessary to mention this, because drawing of some nature should be one of the "experience areas" of any industrial arts program. However, since these schools teach "mechanical drawing" as a separate, unrelated course, it seems probable that they would not satisfy the newer conception of drawing as exemplified by the terms "applied drawing", "related drawing", and "non-technical drawing".

It is generally conceded that it is reasonable to expect the five-teacher school to be the smallest system in which an industrial arts program will have much chance of being successful. Concerning this assumption, Cox (11:42) observes:

A study of teaching subject-matter combinations, teaching loads, and financial support available for the average five-teacher school indicates that, for continued satisfactory instructional service, the five-teacher school is about the smallest unit in which one could expect to develop industrial arts on a satisfactory basis.

TABLE II

Showing the Ratio of Industrial Arts Instructors to the Average Daily Attendance in Each Class of Oregon Three and Four-year High Schools, as Compared with the Averages Indicated by Erickson's (14) Survey

Number of Teachers Employed	Number of Schools in each Class	Average Daily Attendance of Schools in each Class*	Average number of full-time equivalent industrial arts instructors employed (for all schools)**	Number of schools offering industrial arts in each class	Average number of industrial arts instructors employed (only in schools offering industrial arts)**	Number of full-time equivalent industrial arts instructors needed as indicated by Erickson's survey
2	32	19.7	.05	4	.19	.07
3	38	35.9	.08	17	.22	.12
4	37	57.0	.14	17	.25	.19
5	35	81.3	.3	24	.39	.27
6	23	104.1	.34	16	.49	.35
7	13	123.5	.34	9	.57	.42
8	11	143.9	.5	7	.7	.48
9	5	186.0	.41	2	.83	.62
10	11	216.5	.51	5	.72	.72
11	3	219.3	.99	2	1.00	.73
12	4	254.2	.75	3	.75	.85
13	4	310.5	.54	4	.54	1.04
14	5	323.1	.75	3	1.0	1.08
15	2	375.0	.67	1	1.0	1.09
16	3	390.2	.67	3	1.0	1.23
17	2	389.5	.13	2	.25	1.3
18	2	402.7	1.18	2	1.18	1.34
19	3	451.1	.67	2	1.0	1.50
20	2	451.9	1.0	2	1.0	1.51

Read: There are 32 teachers in the two-teacher class which collectively have an average daily attendance of 19.7; the average number of full time equivalent industrial arts instructors by this class is .05; the average number of full-time

* As recorded in the Oregon School Directory for 1940-41.

** Estimated by adding the number of full-time instructors shown in the Directory to one-half the number of part-time teachers shown.

> equivalent industrial arts instructors employed in the four schools of this class offering industrial arts is .19; the number of instructors needed as indicated by Erickson's survey is .07.

With this in mind it is questionable as to just how well developed and efficient are the industrial arts programs to be found in the total of 38 high schools in the two, three, and four-teacher classes in Oregon (see Table I). Because of the fact that industrial arts instructors in these two to four-teacher schools can devote only about 19 to 25 percent (see Table II) of their time to this part of their duties, it is obvious that they cannot make adequate preparation for their classes nor do necessary maintenance work in their shop.

Furthermore, since they are part-time industrial arts instructors, it is rather evident that in many cases this is neither their major nor their minor field. Nee (20:40), in a "Survey of Industrial Arts in the Public Schools of Oregon", reports (20:Table 14) that only 72 teachers of the 169 responding to his questionnaire* presented a major in industrial arts, and only 20 presented a minor. He further points out (20:41) that: "For the group of 169 industrial arts teachers responding to the questionnaire, seventy-seven or 45% are not prepared in the field with either a major or a minor."

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* Study conducted in 1940.

In an article, "Number of Industrial Arts Teachers Needed", E. E. Ericson (14:151) points out that he found, in a survey of city school systems, that the average for junior and senior high school instruction is one industrial arts teacher for every 150 boys in the total enrollment. This would mean one industrial arts teacher for every 300 <u>total</u> average daily attendance for both boys and girls in a given school. Assuming the enrollment of boys and girls to be approximately equal, Ericson's formula can be interpreted thus: $N/2 \div 150$.

In Table II the average number of industrial arts teachers for each class of three and four-year senior high schools from two to twenty is compared to the average daily attendance. For example, it was found that in the five-teacher class with an average daily attendance of 81.3, there was an average of .3 full-time equivalent industrial arts teachers employed. Of the 24 schools in this class offering industrial arts, there was an average of .39 full-time equivalent industrial arts teachers employed. In applying Ericson's formula, it was found that .27 full-time equivalent teachers were needed. This is lower than the existing estimated condition, but because of other factors, such as lack of teacher preparation, limitation of funds and equipment, and the narrow scope of the program, there is probably plenty of room for improvement in this class of schools.

On the other hand, as the size of the schools increase, the less they conform to the ratio found by Ericson. In the four schools of the 13-teacher class, with an average daily attendance of 310.5, there exists only an estimated .54 full-time equivalent teachers employed as compared to 1.04 in the national average.

The schools of over twenty teachers (not shown in Table II) are still farther from the national average. Although many of these larger city school systems, particularly Portland, claim vocational objectives, their industrial arts programs are woefully inadequate. For example, Grant High School (85 teachers and 2312 average daily attendance), and Jefferson High School, (84 teachers and 2157 average daily attendance) each have the equivalent of 2.0 industrial arts teachers, as against 7.71 and 7.19 shown by Ericson's survey to be the normal number.

In the junior high schools the situation shows much more promise. Although the Oregon School Directory does not give average daily attendance statistics, from the number of teachers employed as compared with the number of full-time equivalent industrial arts teachers, it is reasonable to believe that the junior high schools more nearly approach the national picture.

Table III further indicates that the larger the school the less adequate is the industrial arts teaching staff. By Ericson's formula the largest school shown (Parrish Junior High of Salem) with 36 teachers, should have at least 3.8 full-time equivalent industrial arts instructors. Some of the other large junior high schools conform even less to the national pattern.

Although the figures arrived at in these tables compiled from the Oregon School Directory are subject to error it is believed that this discourse may throw some light upon the adequacy of the industrial arts program in Oregon High Schools.

TABLE III

Showing the Ratio of Industrial Arts Instructors to the Number of Teachers Employed in the Junior High Schools* of Oregon

No. of teachers employed (inclusive)	No. of schools in each class	Estimated average No. of full-time equivalent industrial arts instructors	Estimated average No. of full-time equivalent industrial arts teachers needed as indicated by Ericson's (14) survey**
7	1	.5	.42
8	2	.5	.48
9	1	.0	.62
10	2	.9	.72
11	1	1.0	.73
12	1	1.0	.85
13	1	1.0	1.04
14	2	.5	1.08
15	1	1.0	1.09
16	3	1.0	1.23
17	2	1.0	1.3
21	2	1.3	1.8
22	2	1.0	1.8
25	1	2.0	1.9
26	1	1.0	2.8
29	1	1.0	2.1
36	1	3.0	3.8
Total	25	17.7	23.76

Read: One school in the 7-teacher class, has an estimated full-time equivalent industrial arts teacher; the estimated number of full-time equivalent industrial arts teachers needed as indicated by Ericson's survey is .42.

* Junior High Schools in this case are designated as those embracing the 7th, 8th, and 9th grades.

** Table II of this study and the attendance tables for senior high schools in the Oregon School Directory were used to estimate the average daily attendance as compared with the number of teachers employed. (The average daily attendance for junior high schools is not given in the Oregon School Directory.

CHAPTER IV

A SURVEY OF INDUSTRIAL-ARTS METAL WORK IN OREGON SECONDARY SCHOOLS

Teachers' Opinions Concerning the Place and Importance of Metal Work in the Industrial-Arts Program.

As a part of this study it was thought desirable to secure the opinions of industrial-arts instructors about the importance of metal work in general, as compared with the other more or less traditional industrial-arts subjects. Certainly the teacher's individual philosophy will condition to a great extent the type of program which may be developed in a particular shop.

It is entirely possible that many industrial-arts teachers will profess an opinion in favor of a more diversified, comprehensive program, of which metal work is a part, but make little or no effort to develop such a program. This could be due to: 1) Professional decay--teacher in a rut and prefers to let things go on as before; 2) Poor salesmanship--teacher has neither the ability nor the ambition to "sell" the idea of an expanded program; 3) Limitation of funds--allocation to industrial arts not in keeping with real needs; 4) Insufficient training--teacher insufficiently trained to develop new units or "areas".

Showing the Opinions of Industrial-Arts Teachers as Represented by Responses to the First Three Questions of the Questionnaire, and Giving Percentages for Each Answer.

Questions	Answers				
	Yes		No		Total Answers
	#	%	#	%	
1. Do you favor any type of metal work as an experience area in your industrial arts program?	108	93.1	8	6.9	116
2. Do you believe metal work contributes materially to the objectives of industrial arts?	115	99.1	1	.9	116
3. Considering the highly specialized requirements for automotive repair and maintenance, do you believe some form of metalworking experience might serve industrial-arts objectives as well or better than auto-mechanics?	84	77.8	24	22.2	108

Read: There were 108 industrial-arts teachers answering "yes" to question #1, which is 93.1%; 8 teachers answered "no", which is 6.9%; a total of 116 people answered this question.

Table IV gives a survey of the opinions of 116 industrial-arts teachers in Oregon in response to the first three questions of the questionnaire. Only one teacher professed a belief that metal work does not contribute to the objectives of industrial-arts (Question 2). On the other hand, 8 teachers did not favor metal work as an experience area for their programs (Question 1). Lack of training in metal work probably was the basic reason in these cases.

There was much more variance of opinion concerning the contribution of auto-mechanics to the objectives of industrial-arts as compared to the contribution made by metal work (Question 3). Eight teachers of the 116 responding did not answer this question. Several of these teachers indicated they were not well enough informed to give an opinion. Of the 108, however, 77.8% answered affirmatively--that is they were of the belief that some form of metal-working experience might serve industrial-arts objectives <u>as well</u> or <u>better</u> than auto-mechanics. Only 22.2% answered negatively.

This question is open to debate considering the rather high percent of teachers (22.2%) who apparently favor auto-mechanics over metal work as an experience area in industrial-arts. In that group (24 teachers) it is quite probable that auto-mechanics teachers and others with specific training or trade experience in the automotive field, were predominant.

Concerning trends in auto-mechanics, Frank C. Moore predicts (18:15):

> In the field of auto-mechanics, I am not very sure of the trend. I think that where auto-mechanics is taught, the emphasis will be on ignition, general maintenance, fender work, repairing, touching up, and servicing.
>
> Very little time in the future, as I see it, will be spent on the old-time long-unit auto-mechanics project. We must realize that in the field of auto-mechanics, adjustment and repair will be a part of the work, but replacement will be the big factor. Most companies are making it cheaper now to replace worn units rather than go through the longer and expensive repair unit involved. It is not necessary for me to suggest just what these long units are.

Table V summarizes the opinions of industrial-arts teachers of Oregon concerning the importance of metal work as compared with other traditional industrial-arts subjects. As might be expected in a wood producing area, a large majority (43.1%) ranked woodworking more important than metal work or of equal importance (45.8%). Only 11% of the 116 teachers responding to the questionnaire ranked metal work more important than woodworking.

In comparison to drafting, 34.5% ranked metal work less important, 45.8% equal, and 19.7% more important. The term "drafting", as interpreted by most of the teachers responding, probably meant "mechanical drawing".

It is still the common practice to teach this course separately as a prerequisite to regular shop courses. This is admittedly done quite often to keep down enrollment in otherwise overcrowded shop courses. Certainly some form of related or applied drawing should be a part of every industrial-arts program.

TABLE V

Showing the Opinions of Industrial-Arts Teachers Concerning the Comparative Importance of Metal Work, in Response to Question 4.

<u>Question</u>: Please rank metal work against the traditional industrial-arts subjects listed below. For example: If metal work is of more importance than concrete work, according to your appraisal, you should check the column "more" to the right of "concrete work".

Answers (Tabulated)	Less		Equal		More		Total
	#	%	#	%	#	%	
Woodworking	50	43.1	53	45.8	13	11.1	116
Drafting	40	34.5	53	45.8	23	19.7	116
Auto mechanics	13	11.6	49	43.8	50	44.6	112
Electricity	20	17.4	66	57.4	29	25.2	115
Printing	23	20.5	15	13.4	74	66.1	112
Crafts	14	12.4	49	43.4	50	44.2	113
Concrete work	9	8.0	19	16.8	85	75.2	113

Read: There were 116 industrial-arts teachers who ranked metal work against woodworking; of these 50, or 43.1%, ranked auto-mechanics less important; 53, or 45.8%, ranked it of equal importance with woodworking; and 13, or 11.1%, ranked it more important than woodworking.

It is evident here that the emphasis placed on metal work, as shown by the tabulation of teachers' opinions, does not coincide with the actual existing conditions. Table V shows that 56.9% of the industrial-arts teachers responding would give metal work as much or more emphasis than woodworking, and 65.5% would do likewise when comparing metal work to drafting. However, as will be brought out later (Table VI), only 37% of the schools responding to the questionnaire reported metal work of any kind in their program.

In ranking auto-mechanics, 13, or 11.6% of the 112 industrial-arts teachers responding (Table V) considered metal work or less importance. Of the total, 44.6% ranked metal work more important than auto-mechanics, and 43.8% ranked it of equal importance.

Electricity shows more popularity than auto-mechanics. Of 115 teachers responding, 17.4% consider metal work less important; 57.4% consider it equal, and 25.2% consider metal work more important than electricity.

The response for printing deviates somewhat from the pattern of the other shopwork areas represented. Although 20.5% of the 112 teachers responding ranked metal work of less importance, and 66.1% ranked it more important than printing, only 13.4% ranked it of equal importance. It is probable that many teachers were not sure of the correct meaning of "printing" as it refers to industrial arts. Perhaps the term "graphic arts" would have been more appropriate although such a broadly inclusive term might have been even more misleading to Oregon teachers not familiar with this area. It seems highly probable that most of the teachers responding have had no training in printing or any of the graphic arts except "mechanical" drawing.

Metal work was ranked of equal or greater importance than crafts by 87.6% of the 113 teachers responding. However, 14, or 12.4% considered crafts more important than metal work. This group evidently would emphasize the avocational aspects of industrial arts, as "crafts" or "handicrafts" are usually considered "hobby" courses.

Concrete work was also considered to be less important than metal work by 75.2% of the teachers responding. It was considered equal by 16.8%, and only 9, or 8%, considered it more important than metal work. This small minority perhaps interpreted this term differently from its generally accepted meaning as applied to industrial arts. Those favoring concrete work over metal work perhaps saw it as connected with building construction, or as projects for the farm or rural community. In general industrial arts concrete work usually takes the form of ornamental projects, often coming under the heading of ceramics.

Summary of the Schools Reporting, and the Number Offering Some Type of Metal Work.

Of the 287 (public) secondary schools in Oregon, 169 (see Table VI) offer industrial arts. Of the questionnaires sent out to these 169 schools, 119, or 70.4%, were returned. The apparent discrepancy between the number of schools reporting and the number of teachers responding (Table V) is due to the fact that teachers in several cases handle the industrial-arts program in both junior and senior high schools (as at Baker). In another case the industrial-arts teacher conducts shop classes half-time in two different schools (Parksdale and Odell).

The map (Chart I, page 63) shows the distribution of the sampling throughout the state. As might be expected, the largest number of returns came from the western part of the state. The Willamette Valley and southwestern Oregon showed the highest percentage of returns. No returns were received from the schools of seven counties: three of these, Gilliam, Jefferson, and Sherman, have no industrial arts in their schools. None of the schools of the other four, Tillamook, Curry, Wheeler, and Wallowa reported. So far as could be ascertained from other sources, none of the schools in those counties include more than woodworking and drawing courses in their industrial-arts programs.

Of the 119 schools reporting, 44, or 37%, indicated they offer metal work of some kind (see Table VI). The percentage of return in the various classes of schools was conditioned somewhat by the existence, or non-existence, of metal work in their programs. Many industrial-arts teachers indicated, in response to follow-up letters, that they had not sent in the questionnaire because of the fact they offered no metal work in their program.

Table VI verifies the thought that the industrial-arts programs of the larger schools usually include metal work. When classified into size groups by number of teachers employed, no group up to and including eight-teacher schools reported over 20% offering any kind of metal work. Of the schools employing more than eight teachers, no class group reported less than one-third of the schools offering metal work. On the other hand, of the schools with eight or less teachers, only 12.9% offer metal work.

TABLE VI

Showing the Number of Schools Returning the Questionnaire and, of these, the Comparative Number Offering Metal Work

Number of teachers employed (inclusive)	Number of schools offering industrial arts	Number of schools returning questionnaire	Percent of return	Schools returning questionnaire offering metal work	Percent of each class
1	0	0	0	0	0
2	4	3	75.0	0	0
3	17	7	41.2	1	14.3
4	17	12	70.6	1	8.3
5	24	15	62.5	2	13.3
6	16	13	81.3	2	15.4
7	10	5	55.5	1	20.0
8	9	7	77.7	1	14.3
9	2	2	75.0	1	50.0
10	7	3	42.9	1	33.3
11-15	17	11	64.7	7	63.6
16-20	16	16	100.0	6	37.5
21-25	11	9	72.7	7	77.7
26-30	9	7	77.7	7	100.0
31-40	3	3	100.0	1	33.3
Over 40	7	6	85.7	6	100.0
Total	169	119	70.4	44	37.0

Read: Of the 17 schools in the 3-teacher class offering industrial arts, 7, or 41.2%, returned the questionnaire; one school of the 7 offer metal work, which is 14.3% of the return for that group.

CHART I Disbribution Map Showing Schools Reporting

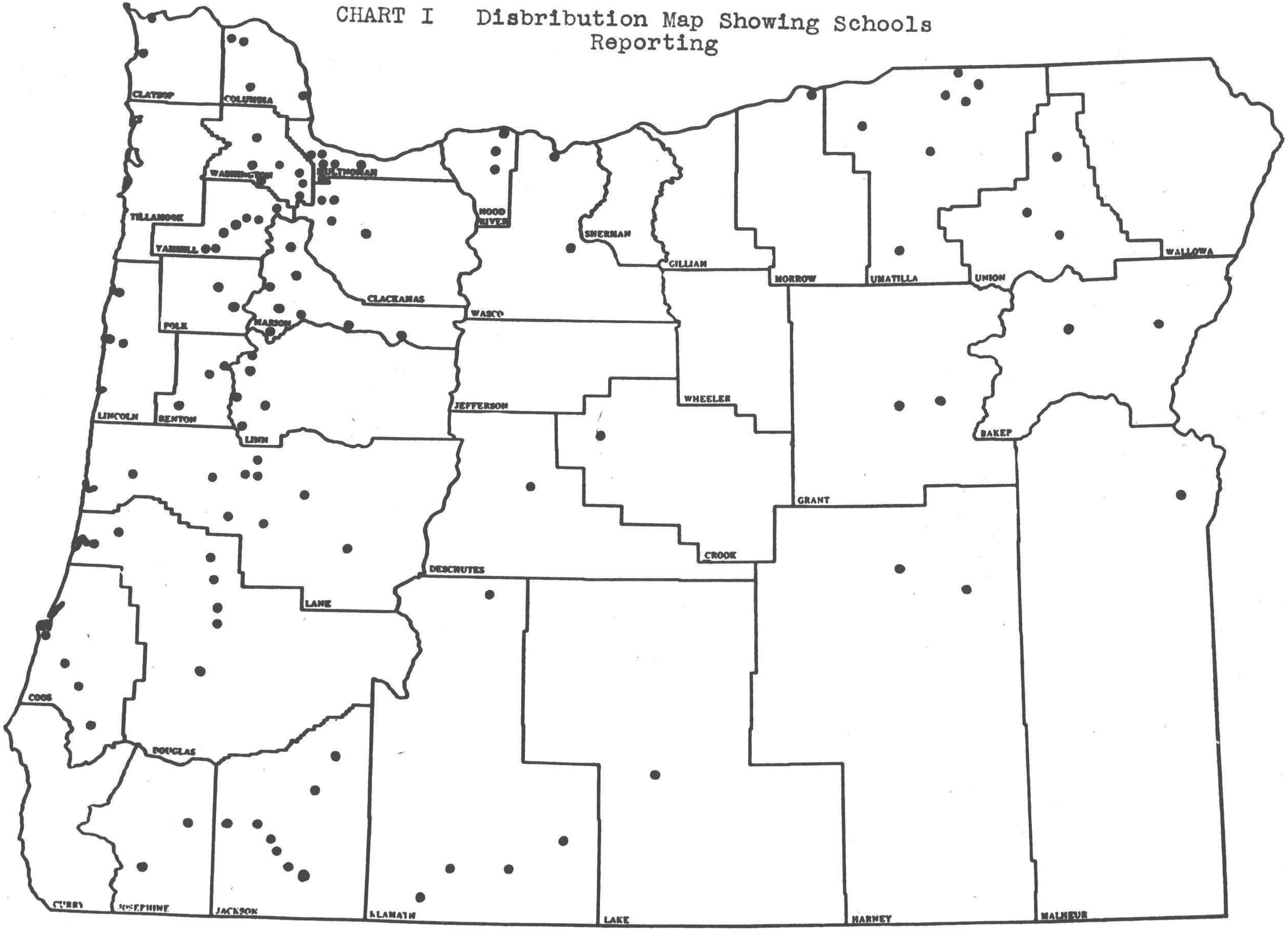
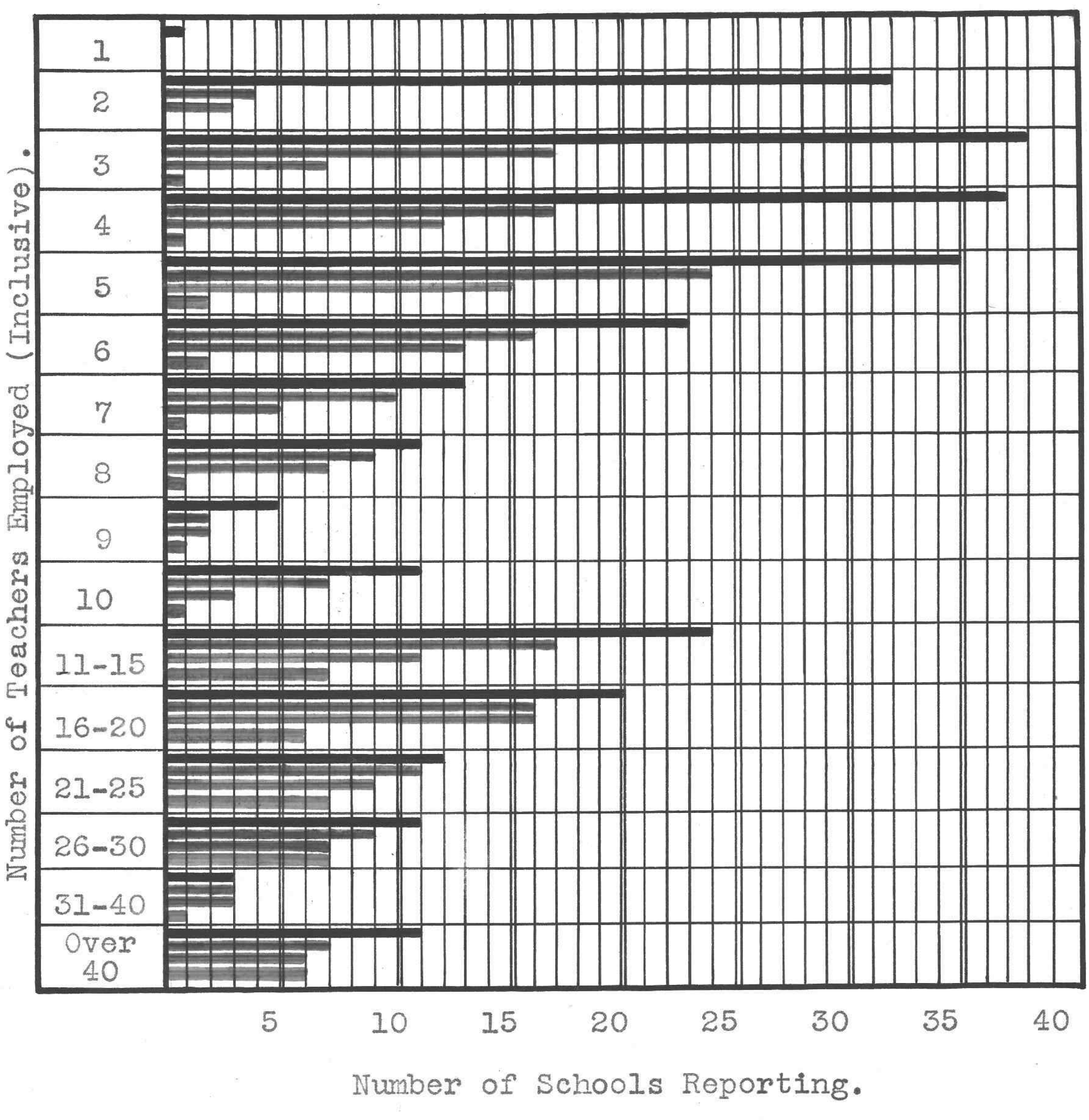


CHART II Composite Diagram of the Number of Oregon Secondary Schools; the Number Offering Industrial Arts; the Number Reporting, and of These, the Number Offering Metal Work.



Key

Number of schools in each classification.

Number offering industrial arts.

Number returning questionaire.

Number offering metal work.

Chart II gives an overview of the number of schools in each class offering some type of metal work as compared with the number of schools offering industrial arts, the number returning the questionnaire, and the total number of schools in each group. It must be kept in mind that the number of schools offering metal work is true only for the number returning the questionnaire. However, the chart well illustrates the limited amount of metal work offered, especially in the smaller schools, as the returns were representative, well distributed, and sufficient in number to be authentic.

Table VII shows the distribution of metal work in the various types of shop organization. The types listed must be considered rather general in meaning, as it is probable that each industrial-arts teacher interprets these terms according to the needs of his community, the equipment available, the philosophy of his administrator, and the nature of his own training. As far as could be determined, 16 of the schools reporting metal work had some type of "general shop" organization. Twenty-one reported metal work as a supplementary unit in the regular woodworking course. Four schools reported a type of "multiple shop" in which metal work is taught as a separate unit to an entire class. Three Portland schools reported their metal work as optional units in conjunction with the regular woodworking course.

TABLE VII

Showing the Distribution of Metal Work in the Various Types of Shops as Reported by 44 Oregon Secondary Schools

Type of Shop	Number of Metal Work Courses Taught
1. Optional metal work as part of regular woodworking course	3
2. Metal work in some type of "general shop" organization	16
3. Metal work in supplement to the regular woodworking course	21
4. Metal work in "multiple unit" shop organization	4
Total	44

Of the 44 schools reporting metal work, 9 are junior high schools (See Table VIII). It is interesting to note that 56.3% of the junior high schools reporting show metal work offered, as compared with metal work in only 34% of the senior high schools reporting. This is further evidence of the trend to make the junior high school industrial-arts program more comprehensive and thus better able to meet its exploratory objectives: While these figures favor the junior high schools in this respect, it must be remembered that the majority of the

TABLE VIII

Showing the Distribution and Percent of Metal Work in the 44 Junior and Senior High Schools Reporting

Type of school	Total number of schools	Number offer-ing ind. arts	Number Report-ing	Number offer-ing metal work	Percent of schools reporting metal work offered
Junior High School	25	23	16	9	56.3%
Senior High School	262	146	103	35	34.0%
TOTAL	287	169	119	44	37.0%

Read: There are 25 junior high schools; 23 offer industrial arts; of the 16 reporting, 9 offer metal work of some type; this is 56.3% of those reporting.

senior high schools are much smaller than the junior high schools and are unable to expand their programs. The financial problem is therefore the real barrier as many of the industrial-arts teachers in these schools have expressed a desire to expand the programs in keeping with present-day educational objectives and industrial processes.

A Survey of Metalworking Tools and Equipment Available in the 44 Secondary Schools Reporting Classes in Metal Work.

As might be expected, few schools reported that their metalworking tools and equipment are adequate. Of the 7 which reported affirmatively (Table IX), most qualified their answers by stating that they are adequate, considering their present program, which in itself might well be expanded.

TABLE IX

Showing the Adequacy of Metalworking Tools and Equipment in 44 Secondary Schools Offering Metal Work as Reported in Response to Question 6

Question: If your program includes metal work of some kind, is the equipment considered adequate?

Answers	Number	Percent
Yes	5	11.4
No	36	81.8
Fair	2	4.5
No answer	1	2.3
Total	44	100.0

Read: Of the 44 secondary schools offering metal work, 5 reported their metalworking tools and equipment adequate; this is 11.4%.

Furthermore, the great majority (81.8%) reported their tools and equipment inadequate for their program, and many reported them inadequate even for the most elementary metal work.

This is brought out in the summary of responses to the statement concerning the inadequacy of equipment (see Table X, page 71). Nineteen schools reported all equipment inadequate, and 11 reported hand tools are needed. Power equipment and machines were mentioned by nine schools and eight indicated a need for sheet metal equipment. Most of the other responses were scattered, indicating a variety of needs.

In response to the check list of power tools and other major equipment available in school shops for metal work, the 44 schools offering metal work reported the power grinder and drill press most widely used (see Table XI). This is probably largely because these tools, especially the power grinder, are used extensively in woodworking. Although the drill press is primarily a metalworking tool, there are many attachments that make it also very useful in woodworking. From the total of 41 power grinders in 36 schools, it is evident that eight schools do not have this essential power tool and either have no grinder at all or use one manually operated.

TABLE X

Summary of Responses to Item 7 of the Questionnaire Concerning the Inadequacy of Equipment

Statement: If the equipment is considered inadequate, please indicate in what way it is inadequate.

Responses	Number
1. All equipment insufficient	19
2. Hand tools needed	11
3. Power equipment and machines needed	9
4. Sheet metal equipment needed	8
5. Drill press needed	3
6. Forge needed	2
7. Bar folder needed	2
8. Arc welder needed	2
9. Floor area too small	2
10. Engine lathe needed	2
11. Inadequate equipment slows advancement	1
12. Hand tools and attachments for engine lathe inadequate even for elementary work	1
13. Equipment inadequate for present program	1
14. Equipment sufficient for elementary bench work only	1
15. Metal melting equipment needed	1
16. Foundry equipment needed	1
17. Molding equipment needed	1
18. Welding equipment needed	1
19. Sheet metal shears needed	1
20. Art metal equipment needed	1
21. Heating equipment needed	1
22. Heating equipment for art metal needed	1
23. Spinning equipment needed	1
24. Oxyacetylene torch needed	1

Of the power tools next in frequency for use in metalworking, buffing wheels lead with 31 reported in 18 schools. Even these tools may be used in connection with other units, such as polishing plastics or wood finishes. The so-called "spinning lathes" reported, 12 in 9 schools, are also probably mostly woodworking lathes with attachments for spinning.

The remaining tools listed are specifically limited to metalworking. Of these, the engine lathe leads in number reported, with 11 in 8 schools. Although only five schools reported foundry and melting equipment, the 10 schools reporting forging equipment could use the forge for melting low-melting-point metals if foundry practice were to be included as a unit in the metals area.

There seems to be a tendency to increase welding equipment as several schools reporting have indicated that this equipment has been added recently. Of the other equipment listed, none except sheet metal with four bar folders was reported in more than two school shops. No school reported as having a D.C. arc welder, shaper, milling machine or power machine hammer.

TABLE XI

Showing the Power Tools and Other Items of Major Equipment in the Shops of the 44 Secondary Schools Reporting as Offering Metal Work

		Number of Schools Reporting	Pieces of Equipment 1	2	3	8	Total
1.	Power grinder	36	34	2	1		41
2.	Drill press	34	33	3			39
3.	Buffing wheel	19	16	2	1	1	31
4.	Forging equipment	10	10				10
5.	Air compressor	7	7				7
6.	Engine lathe	8	7	2			11
7.	Spinning lathe	9	7	2	1		14
8.	Foundry and melting equipment	5	5				5
9.	A. C. arc welder	4	4				4
10.	Bar folder	4	4				4
11.	Oxyacetylene welder	5	5				5
12.	Speed lathe	2	2				2
13.	Boring bar	1	1				1
14.	Sheet metal shears	1	1				1
15.	Squaring shears	1	1				1
16.	D. C. arc welder	0	0				0
17.	Shaper	0	0				0
18.	Milling machine	0	0				0
19.	Power hack saw	1	1				1
20.	Plumbing equipment	1	1				1
21.	Power hammer	0	0				0

Read: Thirty-four schools each reported 1 power grinder; two reported two power grinders and 1 reported 3 power grinders; 36 schools reported a total of 41 power grinders.

TABLE XII

Showing the Growth over a Five-year Period of Units in the Various Phases of Metal Work as Reported by 44 Oregon Secondary Schools

	Number of courses taught			
	1936-1937	1938-1939	1940-1941	Percent of increase, 1940-1941 over 1938-1939
1. Bench metal work	7	13	23	76.9%
2. Forging and welding	1	5	11	120.0
a. Open fire welding	0	4	6	150.0
b. Oxyacetylene welding	1	3	6	100.0
c. Electric arc welding	0	2	4	300.0
d. Forging practice	1	5	10	100.0
e. Ornamental ironwork	3	3	8	166.6
3. Foundry practice		2	5	150.0
4. Machine shop practice	1	4	7	75.0
5. Art metal	3	4	14	250.0
a. Metal spinning	2	2	6	200.0
b. Piercing	3	3	6	100.0
c. Beating down	3	3	4	33.3
d. Raising or forming	3	4	8	100.3
e. Jewelry work	1	1	2	100.0
6. Sheet metal work	2	4	14	250.0
Total	31	61	134	116.4

Read: Seven schools offered bench metal work in 1936-1937; it was offered by 13 in 1938-1939; 23 offered bench metal work in 1940-1941.

A Survey of Trends in the Growth Over a Five-year Period of the Various Phases of Metal Work in 44 Oregon Secondary Schools.

Page two of the questionnaire was used in an attempt to survey the trends and scope in the amount and number of units taught in the metal work area of the industrial-arts programs of Oregon's secondary schools. Table XII is a summary of the responses from the 44 schools reporting. Because the limited number of courses listed for 1936-37 (Column 1) is not considered to be an accurate report the percent of increase from this year is not given. Undoubtedly there have been changes of personnel in school shops and records were not quickly available from which the present teachers could be sure of the courses offered six years back. It is reasonable to believe that the figures for the two more recent years, 1938-39 and 1940-41, more accurately portray the actual picture of conditions.

Every unit listed shows an increase over this three-year period. In general, this is objective evidence of the increasing popularity of metal work of any kind once it has been inaugurated in an industrial-arts program. Arc welding, art metal, and sheet metal show the greatest percent of increase.

Art metal was offered in four schools in 1938-39 and in 14 schools in 1940-41, an increase of 250 percent. This type of metal work seems to meet the objectives of industrial arts better than some of the other units such as machine shop practice, which have more of the vocational aspect. Since art-metal work is a craft type of activity, it not only presents many of the problems of metalworking common to other types, but it allows the making of useful and ornamental projects with a minimum of tools and equipment. Furthermore, the degree of skill required for the successful completion of art-metal projects is not as high as that required by some of the other units of metal work.

Sheet metal also showed an equal increase of 250 percent over this three-year period. Of the 44 schools reporting, 14 indicated they offered some kind of sheet metal. About 75 percent of this group reported definite courses in sheet-metal work. The rest reported "occasional sheet metal", "tin can craft", or "light sheet metal". This increase in sheet metal courses taught might probably be due to the influence of the national defense courses in "air-craft sheetmetal" throughout the state.

Foundry practice was reported by only five schools, but several instructors qualified their answers by expressing a desire to install this unit in their industrial-arts program. It should be said that foundry practice in the secondary schools does not embrace the ferrous group of metals. It is limited to the non-ferrous metals of lowest melting ranges.

Bench metal was reported by the largest number of schools. Although showing an increase of only 76.9 per-cent in 1940-41 over 1938-39, 23 schools of the total reported a course in this unit. In analyzing these reports, however, it is evident that this term is rather broadly inclusive. In it were included "cold iron work", "ornamental iron work", "sheet-metal work" and several phases of art-metal work.

Machine shop practice as such is quite limited, due principally to its more purely vocational aspects and the rather extensive equipment outlay necessary for a fully rounded course. As of the current year, seven schools reported courses in "machine shop practice". This is perhaps misleading because in most cases the only equip-ment available is comprised of old, small, and worn-out engine lathes. Where the equipment is such that it is possible to organize a complete unit in machine shop practice the objectives of industrial arts do not seem to justify the outlay except in large school systems, set up on the more specialized unit shop basis.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

Small schools predominate in Oregon. Of the 287 secondary schools (senior three-and four-year high schools and junior high schools including the ninth grade) in the state, 143 (49.8%) are in the one- to five-teacher group. In this group the percentage of schools offering industrial arts is comparatively low. As the size of the schools increase the number offering industrial-arts also increases. The one-teacher high school has now disappeared from the state (effective September 1941), but the movement toward consolidation of small schools progresses rather slowly.

Of the total of 287 secondary schools in Oregon, 169 (58.9%) offer industrial-arts of some kind. In addition, 10 schools offer mechanical drawing only; these were not considered in this study as only those schools having some phase of industrial-arts shop work are included in the survey.

It is generally conceded that it is reasonable to expect the five-teacher schools to be the smallest system in which an industrial-arts program will have much chance of success. In the smaller school the industrial-arts instructor will be able to devote only a small portion of his time to industrial arts. Furthermore, as pointed out by Nee (20), less than a majority of industrial-arts teachers in Oregon (45% in 1940), had included industrial arts as either a major or a minor field of study in preparation for teaching.

It is evident that many Oregon schools fall far below the average pupil-teacher ratio shown by Ericson's (14) study to be one teacher for each 300 average daily attendance, or for each 150 boys enrolled. The schools employing from two to 12 teachers (inclusive) seem to conform better than those employing over 12 teachers. However there is probably plenty of room for improvement in the both groups due to other factors, such as lack of teacher-preparation, limitation of funds and equipment, and the narrow scope of the program.

As the size of the school increases there is a marked tendency to conform less to the ratio found by Ericson. In the schools employing from 12 to 20 teachers, with an average daily attendance of over 300 in each case, there exists an average of only about one full-time equivalent industrial-arts teacher per school as compared with 1.3 to 1.5 teachers indicated by Ericson's survey.

By comparison the large high schools of Portland are woefully inadequate. Two with an average daily attendance of 2312 and 2157 have the equivalent of 2.0 industrial-arts teachers each, as against eight and seven respectively shown by Ericson's formula to be the normal number.

The junior high schools of the state employ from seven to 36 teachers each. All but two of the 26 junior high schools include industrial arts. They average about .5 full-time industrial-arts instructors each as compared to almost one each needed as indicated by Ericson's ratio. Here again the larger schools are the worst offenders. In only three cases does a junior high school employ more than one industrial-arts instructor. By Ericson's formula the largest junior high school, Parish, in Salem, should employ at least 3.8 full-time equivalent industrial-arts instructors. It employs three.

In the survey of teachers' opinions concerning the importance of metal work in general, as compared with the other traditional industrial-arts subjects, it must be realized that many teachers might express an opinion in favor of a more diversified, comprehensive program, but do little to develop such a program. This might be due to professional decay, poor salesmanship, insufficient funds, or inadequate preparation of the teacher.

Of 116 teachers responding to question one of the questionnaire, 108, or 93.1 percent favored metal work as an experience area in the industrial-arts program. Eight, or 6.9 percent did not.

In response to question two, 115 of 116 teachers responding believed that metal work contributes materially to the objectives of industrial arts.

Of the 108 teachers responding to question three, 84, or 77.8 percent believed that some form of metal-working experience might serve the objectives of industrial arts as well or better than auto-mechanics. Twenty-four, or 22.2 percent were of the opinion that it would not.

In comparing the importance of metal work with the other traditional industrial-arts subjects, it is found that 88.9 percent of the 116 teachers responding ranked woodworking equal to or more important than metal work. Only 11 percent ranked metal work more important, while 43.1 percent ranked it of less importance than woodwork.

In comparison to drafting, 34.5 percent ranked metal work less important, 45.8 percent equal, 19.7 percent more important. In ranking auto-mechanics, 11.6 percent of the 112 teachers responding considered metal work of less importance, 43.8 percent ranked it equal, and 44.6 percent more important than auto-mechanics.

Of the 115 teachers responding, 17.4 percent considered metal work less important, 57.4 percent equal, 25.2 percent more important than electricity. Printing is considered more important than metal work by 20.5 percent of the 112 teachers responding, equal by 13.4 percent, and of less importance by 66.1 percent. Metal work was ranked less important than crafts by only 12.4 percent of the 113 teachers responding, equal by 43.4 percent, and of more importance than crafts by 44.2 percent. Only 8 percent of the 113 teachers responding considered concrete work more important than metal work, 16.8 percent considered it equal, and 75.2 percent of less importance.

Of the 169 (public) secondary schools of Oregon offering industrial arts, 119, or 70.4 percent returned the questionnaire. The difference between the number of returns noted here and the responses indicated above is due to the fact that some teachers did not answer all the questions, and some handle the industrial-arts programs in both junior and senior high schools, or in more than one school.

The distribution map indicates the largest number of returns came from the Willamette Valley section and southwestern Oregon. Three counties, Gilliam, Jefferson, and Sherman have no industrial-arts work in their schools.

Four more, Tillamook, Curry, Wheeler, and Wallowa, did not report; this makes a total of seven counties not reporting.

Of the 119 schools reporting, 44, or 37 percent, indicated they offer metal work of some kind in their industrial-arts programs. No group of schools, up to and including those employing eight teachers, reported over 20 percent offering metal work. Of those employing more than eight teachers, no class group reported less than one-third offering metal work. In the latter group, an average of 63.1 percent offer instruction in some kind of metal work, as compared to 12.9 percent in the former group.

Slightly less than a majority, 21 of the 44 reporting, offer metal work as a supplement to the regular industrial-arts program. Three offer optional metal work as a part of the regular woodworking course; 16 offer metal work as an experience area in some type of general shop organization; four in multiple-unit-shop organization.

Of the 44 schools reporting, 9 are junior high schools and 35 are three- or four-year senior high schools. Only 34 percent of the senior high schools offer metal work, as compared with 56.3 percent of the junior high schools. However, it must be remembered that generally the senior high schools are much smaller than the junior high schools and, because of financial barriers, are unable to expand their programs, even though many of their industrial-arts instructors have expressed a desire to do so.

In reporting on equipment, 81.8 percent indicated it is entirely inadequate, two fairly adequate, and only five reported their equipment adequate. The power equipment reported consists mostly of tools used in conjunction with woodwork. The power grinder and the drill press lead in number reported. Not over 10 to 15 percent reported sufficient power equipment for a limited general metal work experience area. There seemed to be a tendency to increase art-metal and welding equipment.

All the units of metal work show an increase over the three-year period of 1938-1939 to 1940-1941. Arc welding, sheet metal, and art-metal work show the greatest increase. Bench metal, with 23 in 1940-41, led in the number of courses reported, although this term is rather inclusive. Art-metal and sheet metal are next, with 14 courses reported in each. Other units range from 11 courses reported in forging and welding (also an inclusive term), to two courses reported in jewelry work.

Conclusion

In conclusion it may be said that in comparison to the position of importance occupied in modern industry, the metal work as reported in the industrial-arts programs of Oregon secondary schools is very inadequate. An overwhelming majority of industrial-arts teachers responding to the questionnaire consider metal work a valuable experience area in the program. Due to the large number of small schools, lack of adequate teacher preparation, financial difficulties, and other factors, expansion toward a more diversified industrial-arts program is slow. Probably the greatest single factor responsible for this slow expansion is the lack of financial resources in the great majority of Oregon's school systems.

In general, the equipment available for metal work in the schools reporting is very limited or almost absent. Often that on hand is obsolete and worn out.

All of the metal work units reported show an increase over the six-year period just passed. Welding, art-metal work, and sheet metal work show the greatest increase. Foundry practice, as a single unit, seems to rank next to machine shop practice in slowness of development. This is probably due to the rather extensive outlay of equipment required for machine shop work as a unit, but such is certainly not the case with simple foundry work.

Implications

It is hoped that this study will throw some light upon the condition, extent and trends of metal work as taught in the industrial-arts programs of Oregon secondary schools. It seems certain that the schools are lagging far behind and that they are not meeting the needs of the youth, of whom the great majority will find it necessary to earn a livelihood in industry upon graduation from high school. If it is assumed that education on the secondary level is to be functional, certainly the schools should try to keep a breast of modern industrial developments and provide at least some exploratory content in the metals area. This has never been more forcibly brought to the attention of the public than in the present national emergency.

It seems only reasonable that all the departments of the secondary schools should work together to achieve the desired results. The academic teachers must recognize and actively support the industrial-arts and vocational educational programs; the industrial-arts teachers must contribute as much as possible to the vocational program. Needless to say, this recognition and support must be reciprocal in order to maintain an efficient and smoothly operating school system.

Every effort should be made to foster and bring about the consolidation of the smaller schools in order to make possible a more diversified and functional curriculum. Industrial-arts teachers should be required to have subject-matter certification adequate for a professional job of teaching. Thus with trained men on the job--men who have the support and cooperation of the rest of the teaching profession--advancement will be possible in this important phase of the secondary education program of Oregon.

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APPENDIX

OREGON STATE COLLEGE
SCHOOL OF EDUCATION
CORVALLIS, OREGON

DEPARTMENT OF
INDUSTRIAL EDUCATION

Owing to the great development in the metal industries and the extent to which metals are used in everyday life, there is reason to determine the extent and trends of metal work as taught in the industrial arts programs of the schools. There is possibly sufficient unmeasured evidence that the school is lagging behind industrial development in the use of metals but more objective evidence is desired.

With this in mind, a survey is proposed to determine the trends in the teaching of metal work in the secondary schools of Oregon. So far as possible, it would be desirable to find out what courses or areas of metal work are offered in the schools and whether the trend is toward including more or less metal work in the industrial arts program.

To make this survey as comprehensive as possible we wish a return from EVERY industrial arts shop instructor in the state. Your cooperation is very necessary. Because of your interest in shop work and a desire to add professionally to this field it is reasonable to believe that you will be interested in this study.

Please use the enclosed card to indicate that you will fill out and return the forms to be sent later.

Very truly yours,

Alex R. Dawson
Coordinator

OREGON STATE COLLEGE
SCHOOL OF EDUCATION
CORVALLIS, OREGON

DEPARTMENT OF
INDUSTRIAL EDUCATION

To the Shop Teachers of Oregon:

These are the questionnaire forms you expressed a willingness to fill out for the cooperative study of industrial arts metal work in Oregon secondary schools. Please supply the necessary information and return in the enclosed self-addressed envelope.

An extra copy of the questionnaire is attached for your files, and for reference when the summary of the study is made available. It is our plan to make this summary available to all who participate, either in a professional magazine of our field, or in a personal report.

We wish to express our appreciation and thanks to you for your cooperation in this survey.

Very truly yours,

Alex R. Dawson
Coordinator

RESPONSE FORM

A Study of Trends in the Industrial-Arts Metals Area
of Oregon Secondary Schools

Name ________________________ School ____________________ Type ____________________

Yes : No

1. Do you favor any type of metal work as an experience area in your industrial-arts program? ....
2. Do you believe metal work contributes materially to the objectives of industrial arts? ....
3. Considering the present highly specialized requirements for automotive repair and maintenance, do you believe some form of metal-working experience might serve industrial-arts objectives as well or better than auto-mechanics? ....
4. Please rank metal work against the traditional industrial-arts subjects listed below. For example: If metal work is of more importance than concrete work, according to your appraisal, you would check the column "more" to the right of "concrete work."

	Less	Equal	More
Woodworking			
Drafting			
Auto-mechanics			
Electricity			
Printing			
Crafts			
Concrete work			

Yes : No

5. Does your present program include metal work of any kind? ....
   If the answer is "yes," then please complete the remaining questions, including page 2. If "no," other portions of this questionnaire will not apply.

6. If your program includes metal work of some kind, is the equipment considered adequate? ....
7. If the equipment is considered inadequate, please indicate in what way it is inadequate.

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8. Please check the following list by indicating the number of each of the power tools and other major equipment items available in your shop.

	Number		Number
1. Drill press		9. Air compressor	
2. Power grinder		10. D.C Arc welding outfit	
3. Engine lathe		11. A.C. Arc welding outfit	
4. Buffing wheel		12. Power hammer	
5. Spinning lathe		13. Shaper	
6. Bar folder		14. Speed lathe	
7. Sheet metal shears		15. Boring bar	
8. Squaring shears		16. Milling machine	

TREND AND SCOPE OF METAL WORK

Check the course you teach by writing in the approximate hours per week, classes per day, and weeks per year.

	1936-1937			1938-1939			1940-1941		
	Hours per week	Classes per day	Weeks per year	Hours per week	Classes per day	Weeks per year	Hours per week	Classes per day	Weeks per year
1. Bench metal work									
2. Forging and welding									
a. Open fire welding									
b. Oxyacetylene welding									
c. Electric arc									
d. Forging practice									
e. Ornamental ironwork									
3. Foundry practice									
4. Machine Shop practice									
5. Art Metal									
a. Metal spinning									
b. Piercing									
c. Beating down									
d. Raising or forming									
e. Jewelry work									
6. Sheet metal									

Note: This rating omits 1937-38 and 1939-40 so that the total study covers the trends over a five-year period.