A GUIDE TO A SHOP PLANNING PROGRAM
FOR OREGON SCHOOLS
by
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CHAPTER I

INTRODUCTION

With increasing concern for the "functional curriculum," and with renewed emphasis upon the consolidation of small schools into larger units capable of offering broader educational opportunities to rural as well as to urban communities, it is likely that Oregon's secondary schools will experience a development in the industrial arts area even greater within the next decade than in the past six years. While the recent surge of interest toward industrial arts is regarded as a healthy and hopeful sign, especially since it is everywhere recognized as a reaction against the false economy of educational retrenchment of the early depression years, it is now apparent that many schools established industrial arts programs prematurely and on a sub-standard basis. Discovering these errors, some schools have since strengthened their programs, some have discontinued industrial arts until proposed reorganization will allow the establishment of a program free from sub-standard classification by the State Department of Education, and others are still struggling along under
conditions unsatisfactory to both the local and the state school officials.

**Purposes of the Study**

The purposes of this study are:

1. To bring together in condensed, usable form concise data and statements of opinions concerning national trends in school shop planning.

2. To compare the situation in Oregon with the provisions for and results of shop planning in other states.

3. To suggest guiding principles of school shop planning that schools with sub-standard programs may be aided in improving the faulty conditions, and that others contemplating industrial arts programs may avoid some of the errors invariably apparent in hastily conceived and ill-advised provisions for industrial arts.

**Terminology and Definitions**

Since this study will require the use of some terms not in altogether familiar usage, it seems appropriate to define the less commonly used terms. Such definitions seem more than ever necessary since many terms used in the field of education carry radically different meanings under different circumstances, and especially since neither the terminology nor the methods of education have yet been reduced to the exactness of a science. If definitions
given herewith seem to be at variance with usage in other circles, the author disclaims any desire to confuse or to be different merely for the sake of differing. The purpose here is to clarify the meaning of certain terms as they apply to this study.

**Area** - A zone, region, or field of learning. May be applied to major or to relatively minor divisions. Example: the social studies area; the practical arts area; or, within the industrial arts field, the woodworking area; the metals area.

**Experience** - The process of feeling, observing, encountering, undergoing, or "experiencing" things and processes, as they occur in reasonably normal settings. Refers particularly to an educational setting.

**Experience Areas** - Examples: woodworking, electricity, metal work, transportation, drawing, design, and graphic arts; or social studies and science.

**Trade** - Some line of skilled mechanical work requiring vocational competency. May be confused in educational circles with certain of the "experience areas" defined previously, especially when those experience areas involve names equivalent to certain trade fields. As applied to a learning situation, the word "trade" usually implies the objectives of vocational proficiency and skill. "Experience area" implies no
particular vocational objectives.

**Industrial Arts** - Variously defined but now generally accepted as a study of the 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.

**General Shop** - A type of shop organization in which instruction is given in the informational and the manipulative content of several "experience areas." The number of such areas may vary from three to six or more, usually taught simultaneously and, in the small schools, all under the immediate supervision of one teacher. A few large schools conduct "general shops" with two or more teachers functioning simultaneously in one large room, instructing a larger number of students than could be handled by one teacher.

**Composite General Shop** - A "general shop" in which the experience areas have no particular relation, one to another. Woodwork, metal work, electricity, drafting, printing, and other experience areas may all be housed in one "composite" shop.

**Related Activities Shop** - A "general shop" type of organization in which the "experience areas" are selected in
terms of some organic or functional relationship.
Example: general wood shop, general metal shop, and
graphic arts, each containing only those activities
which are related to the functions or to the materials
indicated.

Multiple Unit Shop - A "general shop" organized about major
and minor divisions of characteristic units or "experience areas." Equipment is so planned that the whole
class may receive instruction in the same experience
area at the same time. When the class has completed
instruction in one major unit, say woodworking, the
special equipment for that area is put away and the
entire class begins another unit. To a considerable
extent the units or areas selected for such a shop must
permit the duplicate use of major equipment items
(benches, etc.). The several experience areas are not
taught simultaneously as in the "composite" shop.

Laboratory or Industries - A composite and highly diversi-
ified general shop in which emphasis is placed upon
exploration and orientation through pseudo-laboratory
techniques and personnel organization. Sometimes given
to extreme diversification.

Vocational - Any experience, educational or practical,
which contributes directly to the specific skills or
information required for vocational competency in a
specific trade, occupation or pursuit. Vocational values can seldom be realized from any instruction except as that instruction is pointed specifically and intentionally toward application in a particular occupation or trade.

Sources of Data for this Study

Data for this study have been gathered from the following sources:

1. Oregon school directories.

2. Oregon Course of Study for Industrial Arts.


4. The American School and University - an annual compilation of school building plans and specifications designed especially for the use of architects and school administrators.


6. Publications and professional literature noted throughout the study and in the bibliography.

Limitations of the Study

No apology need be made for pointing this study specifically toward the improvement of school shop conditions in the state of Oregon. Even a superficial examination of the physical plants of Industrial Arts departments in Oregon
will furnish sufficient justification for the study and for the limit suggested previously under "purposes of the study."

The author claims no infallibility, no supernatural powers which will dictate the correct solution to each and every problem. The only qualifications are those which may be associated with a sustained interest in school shop planning and some experience in executing such plans during twenty-five years of teaching industrial arts subjects, nine years of which were in junior and senior high schools.
CHAPTER II

INDUSTRIAL ARTS IN MODERN EDUCATION

One unfamiliar with the objectives and services of modern education may ask, "What is industrial arts?" This question is not at all uncommon, usually coming from the layman who has had no opportunity to keep abreast of educational progress. The answer most frequently given to the layman would be, "manual training" or "shop work." Few educators, even industrial arts teachers themselves, take occasion to explain further and the average layman would be completely satisfied in so far as the definition is concerned. With that as the only definition there is too often the residual question, "Why pay taxes to support shop work in schools? The schools of my day contented themselves with the fundamentals of education."

To the person reasoning in that fashion, industrial arts and all of the other practical art subjects are likely to be looked upon as "frills and fads" which the modern school has multiplied unduly as a means of stimulating enrollment, giving soft pedagogy to youngsters, and running up taxes. While there is always a tendency for every tax payer to consider his tax apportionment excessive, those who view the problem of public education today in the full light of the differences between the social,
economic, industrial and home environments of 1940 as compared with the days of their own youth are likely to be more tolerant of the immense problems confronting modern education.

No detailed definition of industrial arts and its service in the schools will be attempted at this point of the study. Our present concern is with the influences which have brought industrial arts into its present development, and with the objectives or purposes of industrial arts in education. The following chapter will give definitions and a brief historical resume.

**Industrial Arts — A Product of Changing Social, Economic and Industrial Conditions**

Early American schools included only reading, writing, arithmetic and possibly history. All other functions of education, except those required for the ministry, and somewhat later for the medical profession, were functions of the home, the farm, and the factory. Parents were largely responsible for teaching their children the art of self-sufficiency. The "three R's" were considered, therefore, to be the "fundamentals" of education. Society readily delegated these "fundamentals" to the school because teachers could be employed to instruct groups of children more economically and more satisfactorily than instruction could be given in the individual home.
The history of education is replete with illustrations of many other functions of education which have been relinquished by the home and turned over to the school. As society has become more complex, the system of public schools has been called upon to do more and more of that which was formerly a function of the home. Just as the corner bakery and the canning industry, the laundry and the textile industry have been called upon to take over services formerly a part of home industry, so have the schools been called upon to do vastly more than the original "3-R's." Such changes are progressive, have been in operation for untold centuries, and will continue so long as society wishes the benefits of organization for specialized functions.

Industry was born when prehistoric man learned that two individuals rarely developed the same skill in making weapons, fishhooks, or whatever else the mode of life required. Then followed the simple process of barter and trade as a means of exchanging the fishhook, the specialty of one individual, for the arrow-head which another could produce more satisfactorily. From that day until this, there has been a steady advance of specialization in the manufacture of articles, accompanied of course by a rapid increase in the necessities and wants of mankind in comparison with the necessities of primitive man.
In the early colonial period, each household was practically self-sufficient. The garden, the farm, the livestock, the spinning wheel, and the kitchen fireplace accounted for all of the family needs except a few simple cooking utensils, firearms, gunpowder, and possibly a few agricultural implements. These, and only these, were the products of factories, invariably small individual enterprises rather than the large industrial organizations of the present era.

It is only within comparatively modern times that the individual family enterprise or home factory has been replaced by large industrial organizations. The development of rapid and low-cost transportation, of large and expensive machines for the rapid duplication of parts, and of highly organized personnel have all contributed to this rapid industrial growth. In turn, home industry and the opportunity for a father to pass his trade knowledge to his sons is almost completely a thing of the past.

Trade unions and labor organizations developed as instruments of society and acted as a check against some abuses which early industrial organizers had allowed to develop. Under the combined attack of trade unionism and specialized industrial operations, the apprenticeship system broke down. The result forced upon schools the problem of educating youth in the industrial pursuits as
well as in the so-called "fundamentals" of colonial times. Industry, labor, and even society itself would otherwise have been in serious straits.

The change from home industry to the factory system and large industrial operations has been gradual but nevertheless positive. With the breakdown of the apprentice system, there came a realization, even by the Federal government, that schools must take up the problem of training skilled labor. Congress, in 1917, passed the Smith-Hughes bill, creating the Federal Board for Vocational Education, and appropriating funds to encourage the development of vocational education below the college level, in agriculture, homemaking, and the trade and industrial pursuits.

It will be shown in the historical sketch of the following chapter that practical instruction in the industrial pursuits, and in agriculture, has been a function of certain European schools since the sixteenth century; and of selected American schools since 1876. This early program developed under the heading of "manual training." There were those in 1917 who felt that the passage of the Smith-Hughes Act would eliminate the necessity for manual training and that all the students who previously were enrolled in those classes would thereafter be cared for in the vocational classes. The early proponents of vocational-
industrial (trade and industrial) education saw no need for what was then referred to as "pre-vocational" training.

**Industrial Arts — The Non-Vocational Phase of Industrial Education — A Necessary Adjunct to Vocational Training**

Contrary to the belief of many vocational educators, "manual training" continued to flourish. Since the development of the vocational-industrial program relieved it of any need to claim vocational objectives, there was a gradual shift of emphasis to "the artistic" rather than to vocational applications. Even the name was changed and "manual arts" was accepted as more descriptive of the program, which soon was welcomed by educators as a valuable instrument of general education.

Still further specializations within industry and industrial organization, and the growth of unemployment through rapid technological changes, were instrumental in a broadening of the "manual arts" program to embrace the field of service now referred to as "industrial arts." Further reference to these eras will be a part of Chapter III.

Today, industrial arts is accepted by school men as the non-vocational phases of industrial education, an instrument of general education, but nevertheless a necessary prerequisite to the development of the broadest and fullest possibilities of the vocational-industrial education program.
Directors of trade and industrial education, from the Chief of the vocational division of the United States Office of Education to the lowliest of city directors for vocational education, have discovered that the exploratory opportunities afforded by industrial arts, and the broad fund of industrial information, the experiences with the basic materials of industry, and the elemental skills developed in the industrial arts program, constitute the best sort of "pre-vocational" training for those who later enter the vocational-industrial schools. This recognition has been so strong that, in those few communities supporting trade and industrial education programs without the benefit of industrial arts in the preceding years of the junior or senior high school, vocational directors have found it necessary to set up so-called "exploratory" or "pre-vocational" programs for the trade and industrial education students. In all cases these exploratory or "general industrial" classes have been conducted along strictly industrial arts lines of approach.

Objectives of Industrial Arts

Much has been written concerning the objectives of all forms of education. Stated in simplest terms, the objective of all education in a democracy is that the individual members of society may be capable of acting
wisely, tolerantly, effectively, and always with due regard for the welfare of society as a whole, regardless of the circumstances. While stated in relatively few words, this objective involves much and has many subdivisions. Educators have long since realized that the three-R's were only fundamental tools of education, the necessary keys to the door of learning, but that education itself was a much broader and more fundamental thing than merely the possession of the tools. One must learn to use these tools. Use implies action, application — application to real situations of many kinds that the learner may interpret human experiences and be better equipped for the selection of that field for which he is best fitted, by interest and aptitude, to make some creative contribution to society.

Because of the many aspects of the problem, the whole field of education is usually divided into smaller units or areas, each with specific functions and purposes. Industrial arts is that subdivision or area of education concerned especially with information about and experiences in industrial occupations. Until comparatively recent times, these experiences came to youth by virtue of employment at juvenile tasks in small factories and family enterprises. Industrial arts today must take over that job because industry and the home can no longer perform these services.
In the main, the function of industrial arts in the schools is strictly non-vocational. For some there may be vocational implications. For the masses, however, there can be no specific vocational values. Only a small percentage of the many who take industrial arts will follow occupations directly related to the industrial arts experiences. Furthermore, neither the age of the recipient nor the time devoted to a study of industrial arts experiences will permit the development of vocational competency.

The following summary of objectives claimed most widely for industrial arts is the result of a study conducted by a committee of the American Vocational Association on "Standards of Attainment in Industrial Arts Teaching" (1:12).*

**Summary of Objectives**

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.

* First number refers to the correspondingly numbered item in the bibliography. The second number refers to the page of the reference.
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 (cooperation).

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.

A number of refinements have taken place in the objectives and the methods of industrial arts since this summary of objectives was formulated by the committee in 1934. In the main, however, these statements cover the general objectives of industrial arts as well today as when they were first published. There have been other
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statements of objectives by different individuals, with
different word patterns, but always with the same general
thought and always in full agreement that industrial arts
cannot and should not make any claim toward the specific
vocational preparation of its recipients.

**Industrial Arts — Essential to Modern Secondary Education**

The objectives of industrial arts and the services
performed are everywhere and always in conformity with
the ideals expressed by the Educational Policies Commissi­
ion in "The Unique Function of Education in American
Democracy" (12); they are likewise in agreement with the
"Purposes of Education in American Democracy" (11). It
seems quite certain that the objectives, methods and con­
tent of industrial arts are in full agreement with and
make significant contributions to numerous concepts of
the National Policies Commission as discussed in their
latest publication, "Education and Economic Well-being in
American Democracy" (10: Ch. III). The more important
points therein enumerated, to which industrial arts makes
definite and significant contributions, are as follows:

Education should -

1. Aim at better understanding of industrial
relations (p. 36).

2. Develop cooperative attitudes (p. 37).
3. Further raise the level of general mechanical competency (p. 39).

4. Encourage scientific competency (p. 40).

5. Give greater attention to education of the consumer -
   (a) General expenditures (p. 44-54).
   (b) Housing and furnishings (p. 59-62).
   (c) Avocational expenditures (p. 64).
   (d) Technical expenditures (p. 70-72).

Since the concept and functions of industrial arts agree with modern educational policies and purposes, and since educational philosophers from Rousseau to John Dewey have stressed the value of "learning by doing," particularly the values of broad cultural backgrounds developed in realistic problem-solving situations, it appears that modern educators are correct in assigning industrial arts an important place in secondary education.

Bonser (4:22), points to the important relationship between industrial arts and many other subjects in the elementary school; and (4:61, 78), to the extremely close relationship between industrial arts, educational guidance, and vocational counseling.

Summarizing these various services and objectives, with consideration for the more recent developments in industrial arts and in industry itself, it seems that industrial arts is essential to the program of modern secondary education because:
1. **It Provides Youth with a Background for Understanding the Social and Economic Problems Common to an Industrial Era.**

In this respect industrial arts gives youth an opportunity:

(a) To explore typical experience areas in school, contacting some of life's realities now denied them (youth) in highly organized industrial establishments.

(b) To "learn by doing" and to gain from experience a knowledge of the characteristics, the working qualities, and the applications of the new and the traditional materials of industry.

(c) To lay a foundation for a better understanding of the skills required in making things, and of the problems of laboring men in acquiring and safeguarding those skills.

(d) To appreciate the problems of both labor and capital, recognizing the mutual and the conflicting interests of each.

2. **It Provides Youth with a Wealth of Technical Information and Some Degree of Skill in the Basic Industrial Occupations.**

In this respect industrial arts safeguards youth against:

(a) The danger of unemployment developing from rapid technological shifts. The broad base of operations of industrial arts reduces the dependence upon just one occupation and assists in making quicker adaptations to new conditions of industrial employment.
(b) The problem of the worthy use of leisure time. In recent years, craft work at home has enabled thousands to enjoy and often gainfully employ leisure hours. The skills and information gained in schools is transferred readily to home workshops and is useful both in the adolescent stage and in later years.

(c) The expense of complete dependence upon outside help, and of indifference or delay in making simple repairs about the home.

3. It Encourages the Evaluation of Materials, Workmanship, and Quality of Commercial Articles, and Develops a Higher Regard for the Proper Care and Use of Industrial Products.

In this respect a boy is likely to be:

(a) A more intelligent purchaser, more fully appreciative of quality merchandise, and more able to judge practical values.

(b) A more intelligent user, knowing the values of articles purchased, and how to care for them to better advantage.

4. It Creates a Socializing Atmosphere in a Realistic Setting.

Individual and group demonstrations, the project method of instruction, reports by classroom committees, and the delegation to class officers of certain responsibilities parallel to those found in an industrial organization, makes for self-reliance and group cooperation. The shop provides real opportunities for the fulfillment of real responsibilities.

At this point it seems especially appropriate to quote again from Bonser's works (5:105-106):

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

With all of its tested possibilities for elementary and junior high school years, with all of the permanent values reaching through all of the years beyond school life, the place of industrial arts in an efficient education can be estimated as nothing less than of the highest importance. So fundamental are the values derived from the work that little progress can be expected until its content and method are recognized and included in the common education of our whole people.
In the beginning all education was practical. "Learning" came only through the school of experience and hard knocks. The ability to learn from experience and the power to reason things through to logical conclusions have been the principal reasons for man's mastery of the animal kingdom. Aboriginal man was concerned primarily with food, with shelter from the elements, and with protection from animals stronger than himself. Progress was slow so long as man was dependent upon his own physical strength, aided only by sticks and stones as weapons. It became more rapid after fire, wind, and wave were brought under some degree of control to assist in the preparation of his food, to pierce the darkness and scare away wild animals at night, and to carry him to distant lands in sail boats.

With the further advance of time came the development of tools, crude at first but constantly improved to meet the practical problems of life and to release mankind from some of his fears and drudgery. The bow and arrow, the spear, and other weapons made life considerably easier and more certain. Agricultural implements and an increasing knowledge of soil, plant life, and the utilization of the
products of nature added immeasurably to man's mastery of the elements and to his sense of security. Within more recent times gunpowder, firearms, the steam engine, electricity and all the millions of inventions, devices, and applications of these and other discoveries have added so rapidly to man's progress that we of the modern age, taking much of this for granted, have sometimes lost sight of the fact that real learning and real progress are still largely dependent upon material things and a practical knowledge of those things.

Relieved of the necessity to think constantly of personal safety and of the struggle for existence, mankind has made rapid progress. In some cases learning has been divorced from the practical realities of life.

The Four Ages of Education

Looking back over the progress of education through the ages, it seems that four major divisions are recognizable. Each is a product of the time and conditions surrounding that period. Distinguished by their principal characteristics, these ages might be labeled as follows:

1. The practical age - Education was only incidental, passed on within the family or tribal limits. Primarily it was concerned with providing food, shelter and safety for members of the family or tribe.
2. The classical age - Education for church life and for the ruling classes. Serfs and servants provided the necessities of life for the overlords. All education was classical and anything of a practical flavor was considered degrading.

3. The irrational age - Free public education for the masses, but conducted along classical lines borrowed from the preceding age. While overlordship and serfdom were no longer the rule, most forms of practical education were considered degrading.

4. The rational age - Education for all, within the ability level, the aptitudes and the interest range of each individual. Integration of the practical, the scientific and the classical, each supporting and reinforcing the other.

Roughly, these four ages coincide with the ancient, the medieval, and the modern periods of history, both the third and the fourth falling well within the modern history period. The "irrational age" probably had its beginning about the time of the colonization of the Americas, and extended well within the memory of living educators. The "rational age" is even now in the formative stage, having yet developed no further than adolescence.

Early Examples of Practical Arts in Education

History could be cited, from Plato and Aristotle to the present, to show a slowly expanding consciousness of the value of practical experiences as a part of the educative process. Martin Luther (1483-1546) was one of the first educators and statesmen of the "irrational age" to
say that education must apply to the realities of life.

In protesting against the extremely narrow teachings of
the church he is quoted (3:31) as saying:

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

Rebelais (1483-1553), a contemporary French novelist,
saw the advantage of approaching the abstract and remote
through the concrete and near at hand. He is quoted (3:33)
as having a great concern that all children acquire a
knowledge of the handicrafts through observation and as a
means of recreation.

They went likewise to see the drawing of metals, or
the casting of great ordinance: how the lapidaries
did work, as also the goldsmiths and cutters of
precious stones. Nor did they omit to visit the
alchymists, money-coiners, upholsterers, weavers,
velvet-workers, watchmakers, looking glass framers,
printers, organists and other such kind of artificers
and did learn and consider the industry and invention
of the trades.

Sir William Petty, an English scholar (3:46), recom-
mended in 1647, that:

All children, though of the highest rank, should be
taught some "genteel manufacture in their minority."

Continuing, Petty defined "genteel manufacture" as the
making of mathematical instruments and learning to use
them in astronomical observations; the carrying out of
such other practical activities as making watches, painting
on glass, engraving, etching, carving, embossing, cutting and setting stones and jewels, turning curious figures, making musical instruments, making ship models, mariner's compasses, globes and other magnetic devices; also the study of chemistry, the refining of metals and counterfeiting jewels.

Petty's reasons for these recommendations are rather enlightening. From the following list it will be noted that several reasons are closely related to current objectives of secondary education.

1. They will be less liable to be cheated by artificers.

2. They will become more industrious in general.

3. They will certainly do most excellent work, being gentlemen, ambitious to excel ordinary workmen.

4. They, being able to make experiments themselves, may do it with less cost, and more care than others will do it for them.

5. The arts will be much advanced when such as are rich and able are also willing to make enlightening experiments.

6. It may engage them to be Patrons of Arts.

7. As it (the worthy use of leisure) will be a great ornament in prosperity, so it will be a great refuge and save in adversity and common calamity.

"They" in the preceding quotation refers to the children of well-to-do parents of Petty's day. With few exceptions the same reasons might hold almost equally well for the children of today, but perhaps the most poignant
advice given by Petty (3:45) was the following:

That since few children have need of reading before they know or can be acquainted with the things they read of, or of writing before their thoughts are worth the recording or they are able to put them into any form, that these be deferred a while and "in the order of nature", children be taught first to observe and remember all principal objects and actions, whether they be natural or artificial.

There can be little doubt then that many of the early educators even in the "classical" and the "irrational" ages of education, possessed a well-founded belief that children would learn better if the learning process gave an opportunity for experience with practical things "in the order of nature" as a background upon which they and their teachers could develop a broader and a more functional education. It is through that same philosophy that the practical arts subjects of secondary education today occupy an even more important place than in former years. Since knowledge of all kinds has been so vastly increased over the sum total of knowledge in Petty's day, it follows that young people today need more than ever before to pursue a rational program of education wherein the practical arts, the sciences, the social studies, and the language arts will mutually reinforce each other.

The Nature and Function of Industrial Arts

While Martin Luther and Sir William Petty had made
certain very appropriate observations, it remained for Jean Jacques Rousseau (1712-1778), a Swiss-born Frenchman, and John Henry Pestalozzi (1746-1827), the son of a Swiss physician and himself a student of law, to lay the real foundation for all modern practical arts education. To Rousseau goes the honor of establishing the basic philosophy of practical arts education, so well portrayed in his "Emile", and the distinction of being the first person to recognize that "The manual arts may be a means of mental training", thereby marking the beginning of a new era in education (1:81).

To Pestalozzi, however, belongs the honor and distinction of making the first practical application of Rousseau's philosophy. It was he who first demonstrated that children learn better through actual experiences with things, and from actual contact with realities, than by the reverse order. Said Pestalozzi, "There are two ways of instructing; either we go from words to things, or from things to words. Mine is the second method" (3:119). This philosophy, with rather complete methods for carrying it out, was established by Pestalozzi in a combined agricultural and industrial school near Berne, Switzerland, in 1776.

With the early foundations of practical arts education laid in Europe, and with the American republic in its
infancy at the time, it is readily understandable why none of these philosophies or educational movements of the European countries bore fruit in the schools of the American frontier. It was not until the exhibits of "Swedish Sloyd" and "Russian Manual Training" at the Philadelphia Centennial Exposition of 1876 that American educators gave serious consideration to any form of practical arts education. Following those exhibits there appeared in this country, in several widely separated localities, the more or less formalized program of "manual training" which to this day casts considerable influence on all practical arts education in American schools.

The first American application of manual training was for engineering students, at the Massachusetts Institute of Technology. It was patterned after the Russian plan. Dr. C. M. Woodward established a similar program at Washington University, St. Louis. Soon thereafter the movement spread to the secondary schools. By 1880 the St. Louis Manual Training School and the Boston School of Mechanic Arts were well under way. The first publicly supported manual training high school opened in Baltimore, in 1884.

Since these early beginnings of realism in American education, the realistic approach has spread to other areas and now includes the household arts, the commercial arts, the agricultural arts, and the applied arts, as well
as the industrial arts, all of which are included in the present usage of the term, "the practical arts."

It is natural that there should have been considerable change in the field of practical arts education, and especially in the industrial phases of the practical arts program, since its introduction in 1876. According to Collicott* and Skinner** (21:4):

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 was on hand skill, chiefly in woodworking. The second was "manual arts", where the emphasis, while still on skill, was expanded to include the making of both useful and well-designed 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 limitations 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.

While this description of the third "period" of industrial arts is still essentially accurate, there are signs which point to a further broadening influence, largely the result of a tendency to spread the manipulative content — the "doing" phase of the program — over an ever-widening group of experience areas. The introduction of many new materials and processes has given to the

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* Collicott, J. R., President, Ohio Education Association.
** Skinner, B. O., Director, Ohio State Department of Education.
program a vastly greater diversity than ever before. This
trend is emphasized by a statement from the 1933 REVIEW
(13:23), as follows:

Going back 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
the 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, more­
over, changes in the relative significance of
materials. Wood, long 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.

The statement above was written in 1933. To the
enormous expansion here indicated should be added the
great array of synthetics, plastics, and alloys already put into commercial production since then, and the host of new materials "just around the corner." This amazing increase of material resources, and the almost endless variety of mechanical processes and industrial products resulting therefrom, compel recognition of a changing world. Small wonder that the early "manual training" program shifted successively to an emphasis on art and design (manual arts), and more recently to a very greatly broadened influence covering the whole field of "industrial arts."

From the foregoing it is evident that continued change is in prospect; that industrial arts is relatively in its infancy; that the expanding philosophy of education, with the corresponding development of new techniques of instruction and the new social and economic problems related to the changes in industry growing out of new materials and processes, can but result in continued evolution in the whole field of practical arts education. It is devoutly to be hoped that industrial arts will become neither confused and dissipated in the rapid expansion of new "experience areas", nor absorbed and devitalized in the movement toward that misguided variety of "integration" which insists that all school experiences should center about a "core area" itself devoid of realities and action. Too wide a spread over a large number of experience areas, in
a limited period of school time, would give such super­
ificial and insignificant contact with any single material,
craft, or experience area that the learning element might
be valueless. The second possibility — absorption through
so-called "integration" with the social studies — would
make the industrial arts experiences, along with science
and the other practical arts subjects, mere puppets to the
otherwise passive social studies and the language arts.
Such a proposal is but a hang-over of the early philosophy
of education which clings to the "stupid tradition and
assumption that such obviously minor techniques as learning
to read, write, and figure are the fundamentals in public
education" (3:15-16).

Instead, might it not be that the "core" of an inte­
grated program could well grow out of the realities of the
practical arts subjects? Correlation could as well be made
in one direction as in the other. A truly integrated
program would result if, in the minds of the students
affected, the abstractions of history and the social
studies, of the member sciences, and of all other phases
of school life could be presented in relation to the
realities of life (science and the practical arts) rather
than in the reverse order.
Present Trends in Industrial Arts Education

A careful analysis of numerous surveys and forecasts, reinforced by personal observations and by the results of a nation-wide survey reported by John Claude, associate editor of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION (8), furnished the background for the following statements of significant trends in industrial arts in the American public schools.

1. There has been a rapid increase in the number of school shops throughout the country, halted only briefly during the early depression years. For every school shop discontinued between 1930 and 1934, several new shops have arisen. Industrial arts shops increased, from 1924 to 1938, as follows:

   Senior high school shops — approximately 120%
   Junior high school shops — approximately 700%

2. The variety of experience areas included in the industrial arts program has increased at least 300% for the country as a whole, and perhaps 500% for the smaller schools.

3. The tendency is now to include at least four, and quite commonly five or six, experience areas in the industrial arts program of each school, particularly at the junior high school level.

   For the smaller schools, this means a one-teacher general shop, with four to six experience areas. For the larger schools, able to support two or more teachers, this means a series of related-activities general shops; or a group of "unit" shops, each embracing a single experience area.
4. A considerable expansion of industrial arts into the elementary schools is now under way. This is logical because psychologically and by natural inclination the child of elementary school age depends more upon natural interests, and experiences with realities, than upon learning from the printed page.

5. The major experience areas of industrial arts are: woodworking, drawing (with emphasis upon general drawing, planning, and design, instead of upon "mechanical drafting"), metal working, electricity, printing, and automobile mechanics.

Printing is increasing rapidly. Automobile mechanics, however, is definitely on the decrease. The newer experience areas include work in plastics, ceramics, art-metal work, and miscellaneous crafts, including leathercraft.

Forging, as such, is giving way to oxy-acetylene welding and ornamental iron work; sheet-metal is giving way rapidly to metal spinning and art-metal; plumbing, which was never more than pipe fitting and faucet repair, is apparently dead except in a few cases of "home mechanics" applications. Such trade-labeled subjects as carpentry, pattern making, cabinet making have given way to "general woodworking." Similarly, in the metals area there has been a considerable growth in the application of machine shop practice and certain other metal working experiences, usually under the heading of "general metal work."

6. The trend in "methods" shows the following developments:

a. A considerable increase in the use of printed instructional material — textbooks, references, etc. Instruction sheets continue to play an important part in the program. These may be of a commercial nature or written by the teacher himself. Pamphlets, leaflets, charts and diagrams published and distributed by manufacturers and industrial concerns, in cooperation with schools, are finding wide usage.
b. Visual aids show an especially rapid increase in usefulness, and teachers generally are accepting them with a great deal of enthusiasm. Several departments have instituted instruction in photography, while many teachers not presuming to include photography as a part of their teaching program, have adopted it as a hobby and are using it as a tool in the development of their own visual aids.

Some "advanced amateurs" have ventured to include motion pictures as a medium for the development of visual aids of their own, although most teachers who use motion pictures rely upon industrial films.

c. Improved methods of organization, coupled with the use of written and visual teaching aids, make possible either more effective instruction with classes of the usual size, or an extension of class size to numbers somewhat larger than a few years ago.

d. Class size varies from less than 20 in the smaller schools to 40 in some of the large cities. As a national average 24 seems to be about the optimum figure.

Even with the highest development of organization and the best use of written and visual aids, it is recognized that one teacher can seldom teach efficiently with more than 24 pupils. Numbers greater than that can be handled only at the sacrifice of personal contact between the teacher and the individual pupil, and with a greater danger element in the use of tools and machines.

e. Project trends seem to be toward the making of smaller objects, involving the use of the newer materials in interesting and artistic applications.

Trends in Shop Planning

The trends reported in the preceding section of this
study indicating the inclusion of a greater number of experience areas, the use of smaller and more artistic projects, the increasing use of new materials, and the employment of written and visual teaching aids, will suggest corresponding trends in the selection and organization of the machines, tools and auxiliary equipment which make up the physical plant of the school shop.

The more noticeable and particularly the more important trends in the planning of industrial arts shops are summarized as follows:

1. Greater attention is given to the architectural requirements and to the aesthetic effect of the shop building or rooms. Industrial arts has definitely outgrown its "basement days." Educators and school administrators universally recognize industrial arts is entitled to pleasant and appropriate surroundings, the effect of which will have as much influence upon the ideals and reactions of students, and upon their general response to the subject, as those same factors would have upon the reaction of students in any other area of learning.

2. There is a greater degree of cooperation between architects, school administrators and industrial arts teachers than heretofore, all in recognition of the fact that school shop planning is a specialized procedure in which the trained teacher can and should serve as a capable adviser.

3. Equipment manufacturers recognize the industrial arts program deserves their cooperation and their specific attention to the design and manufacture of appropriate machines and tools. Schools are no longer forced to purchase heavy, inappropriate industrial equipment. Machines are now lighter, more appropriate for school use, designed for greater safety and better appearance, and at the same time cost less than the heavy industrial machines.
4. The size of school shops is definitely on the increase. It is not possible to design and install a "general shop", embracing several different experience areas, in the same space and with the same minimum number of architectural features formerly provided for a single-activity "unit" shop.

5. Auxiliary services, including provisions for a reading and planning area, a finishing room, storage facilities of appropriate size and kind, display areas, showcases, bulletin boards, and facilities for the projection of still and motion pictures, are demanding greater consideration. These services are increasingly important because of the increased diversification of the program, and especially because of the increased effectiveness they give to a modern general shop program.
CHAPTER IV

THE STATUS OF INDUSTRIAL ARTS IN OREGON SCHOOLS

Small Schools Predominate

Oregon is predominantly rural. With a total population of slightly more than a million people, approximately one-third of whom are residents of the city of Portland, and with the remainder distributed through the valleys, plateaus and mountain ranges of the state, it is only natural that the public school system of Oregon is made up of many small units. There are 2027 elementary schools, with average daily attendance varying from one student in several instances to approximately 2000 in the larger elementary schools of Portland. In the field of secondary education, Oregon has 33 junior high schools and 264 standard high schools, mostly of the four-year type.

Enrollments in the standard high schools vary from a minimum of six to a maximum of 2418 average daily attendance. Table 1 shows the number of high schools falling within various brackets of average daily attendance.

A further indication of the rural nature of Oregon's population, and the large number of small schools, is the fact that only one of the four largest high schools is outside of the city of Portland; also, that only three
schools of the second largest group are outside of Portland — one in Salem, one in Eugene, and one in Klamath Falls.

### TABLE 1

**Number of Oregon High Schools Falling in Various Brackets of Average Daily Attendance**

<table>
<thead>
<tr>
<th>Attendance Bracket</th>
<th>Number of Standard High Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 75</td>
<td>136</td>
</tr>
<tr>
<td>76 - 150</td>
<td>55</td>
</tr>
<tr>
<td>151 - 300</td>
<td>23</td>
</tr>
<tr>
<td>301 - 600</td>
<td>28</td>
</tr>
<tr>
<td>601 - 1000</td>
<td>12</td>
</tr>
<tr>
<td>1001 - 2000</td>
<td>7</td>
</tr>
<tr>
<td>Over 2000</td>
<td>4</td>
</tr>
</tbody>
</table>

Interpretation: There are 136 Oregon high schools in which the average daily attendance is less than 75; fifty-five in which the average daily attendance is between 76 and 150 - only four in which the attendance exceeds 2000.
Industrial Arts in Oregon Schools

With more than two-thirds of Oregon's high schools below 150 average daily attendance, and with considerably more than half of them falling sharply below 75 average daily attendance, it follows that the opportunities for a fully enriched high school program is denied a great number of schools. Such small enrollments do not justify an expanded program, nor can the communities support the number of teachers sufficient to offer more than the traditional requirements for graduation. Philosophically speaking the practical arts objectives and functions are just as desirable for children of the small communities as for those of the larger ones, yet practically speaking there is little opportunity for the small school to realize that ideal.

Table 2 shows the number of industrial arts programs in relation to the number of schools, and the staff time devoted to instruction in industrial arts for the elementary, the junior high schools, and the senior high school groups. "Time" is rated on the basis of the number of full-time-equivalent instructors employed, a fraction thereof in cases where one instructor is assigned teaching duties in several fields. Data for these ratings were compiled from the Oregon School Directory for 1939-40 (22).
<table>
<thead>
<tr>
<th>Type of School</th>
<th>Number in State</th>
<th>Number with Ind. Arts</th>
<th>Number of Schools Employing Full- or Part-time Teachers. See note (a)</th>
<th>Number not offering Ind. Arts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Number with Ind. Arts</td>
<td>Number of Schools Employing Full- or Part-time Teachers. See note (a)</td>
</tr>
<tr>
<td>Elementary</td>
<td></td>
<td></td>
<td>Number with Ind. Arts</td>
<td>Number of Schools Employing Full- or Part-time Teachers. See note (a)</td>
</tr>
<tr>
<td>First class</td>
<td>153</td>
<td>60 (b)</td>
<td>10 (c)</td>
<td>43</td>
</tr>
<tr>
<td>Second class</td>
<td>121</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Third class</td>
<td>1753</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Junior High</td>
<td>33</td>
<td>28</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Senior High</td>
<td></td>
<td></td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td>Standard</td>
<td>259 (d)</td>
<td>138</td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td>Non-Standard</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(a) Column headings indicate fractional or full-time-equivalent instruction devoted to industrial arts.

(b) Fifty are in District No. 1, Portland, where 50 out of 53 elementary schools are equipped for industrial arts in the 7th and 8th grades (platoon system). Of these 50 schools, only 4 employ full-time industrial arts teachers; 43 half-time, and 3 have three-fourths-time teachers.

(c) No exact data on elementary programs outside of Portland. It is reasonably certain that not more than 10 offer industrial arts at all, none to exceed one-fourth the time of one teacher.

(d) Does not include the Jane Addams school (girls' polytechnic), Benson Polytechnic, and Edison Vocational schools of Portland, nor the Eugene Vocational school and the Salem Senior High School, all of which claim specific vocation objectives rather than industrial arts objectives, for their shop programs.

Interpretation: There are 153 first class elementary schools, 60 of which offer industrial arts; of these, 10 devote approximately one-fourth of the time of one teacher to industrial arts instruction; 43 - half time; three - 3/4 time; and only four employ full-time teachers for industrial arts.
While it has not been possible to secure complete statistics on the elementary schools of Oregon, one is at once aware of the extremely small number of industrial arts programs in the elementary field. Not more than 60 schools out of 2027 offer industrial arts instruction in the elementary field. Fifty of these 60 schools are in the city of Portland, in which the elementary schools are organized on a platoon basis with industrial arts in the seventh and eighth grades. The other ten cases are scattered widely through the state, with a sporadic case here and there of industrial arts in the seventh and eighth grades of an eight-year elementary school. In a few cases the upper elementary grades make use of adjoining high school facilities.

The very small number of junior high schools is shown in Table 2. With the one large city of the state organized on the platoon school basis for the first eight grades, "up state" Oregon schools were slow in adopting the junior high school movement. The first junior high school was organized in 1925. Since there are no junior high schools in Portland, the one large concentration of population in the state, one would expect to find a proportional effect in the total number for the state as a whole.
Although the number of junior high schools in the state is quite small, the high proportion of those schools offering industrial arts (28 out of 33) is much more nearly in keeping with the national trend in junior high school programs than is the relatively smaller proportion (138 out of 259) of industrial arts programs in the senior high schools. This proportion of industrial arts work in the junior high schools is even more striking when consideration is given to the number of full-time-equivalent industrial arts staff members in the junior high school area as compared to the full-time-equivalent staff in the several senior high schools. The total full-time-equivalent instructors in the junior high schools is 25, serving 28 schools out of 33. The total full-time-equivalent instructors in the senior high schools is 80, serving 138 schools out of 250. This then is a definite indication that the 25 equivalent instructors can serve the 28 junior high schools in a much more adequate manner than the 80 equivalent instructors can possibly serve the 138 high schools, to say nothing of the disparity between the ratio of schools served to those not served in each of these two groups.

The Small School and Industrial Arts

Perhaps one factor favoring industrial arts in the
junior high schools of Oregon is the matter of size of those schools. While the size of the complete teaching staffs in the senior high schools vary from one upward, there is no junior high school in the state with less than four full-time staff members, and there are only ten junior high schools with less than ten staff members. The largest has a total of 37 staff members, three of which are full-time industrial arts teachers.

Table 3 classifies all of the junior and senior high schools of the state, a total of 302 exclusive of the five special schools excepted by Note (d) of Table 2. Classified by size of school as indicated by the number of teachers employed, Table 3 shows the corresponding number of schools supporting industrial arts programs in each of the five size-groups. There appears to be a fairly definite relationship between the number of teachers employed and the ability of the school to support an industrial arts program.
<table>
<thead>
<tr>
<th>Number of Teachers Employed</th>
<th>Number of Schools in State</th>
<th>Number of Ind. Arts Programs</th>
<th>Percentage of Schools with I. A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>2</td>
<td>5.4</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>12</td>
<td>30.0</td>
</tr>
<tr>
<td>4</td>
<td>37</td>
<td>18</td>
<td>48.6</td>
</tr>
<tr>
<td>5</td>
<td>33</td>
<td>23</td>
<td>70.0</td>
</tr>
<tr>
<td>4 to 8</td>
<td>123</td>
<td>79</td>
<td>64.2</td>
</tr>
<tr>
<td>9 to 19</td>
<td>57</td>
<td>43</td>
<td>75.4</td>
</tr>
<tr>
<td>20 and more</td>
<td>41</td>
<td>36</td>
<td>88.0</td>
</tr>
<tr>
<td>All Jr. and Sr. High Schools</td>
<td>302</td>
<td>172</td>
<td>57.0</td>
</tr>
</tbody>
</table>

The very low percentage of industrial arts programs in schools with less than three teachers and the large number of subject-matter combinations required for these two teachers to cover even the traditional requirements is sufficient indication that those schools cannot be expected to develop satisfactory practical arts programs. If statistics alone are not sufficient evidence of the fact, an examination of the extremely limited facilities and the
invariably poor condition of the physical plants of those few three-teacher schools which attempt industrial arts will dispel any doubt whatever that such schools should rarely undertake industrial arts as a part of the curriculum program.

While the percentage of inclusion of industrial arts in four-teacher schools is somewhat more favorable, it is rare indeed that a four-teacher school can continuously support industrial arts under normal conditions, either financially or from the point of view of practical teaching combinations. Under ideal conditions the traditional subjects required for graduation can be matched with the qualifications of the four staff members in a manner that will result in favorable subject-matter combinations and teaching loads. But since there is yet no standardization in the matter of subject combinations, either in the training of teachers or in the application of the training to the actual job of teaching, most four-teacher schools will eventually find themselves in difficulties, with no adequate provision for the instruction of other than the traditional subjects. Also, the extreme division of attention and interest necessary with the many subject combinations usually required in the four-teacher school leaves little opportunity for the industrial arts teacher to care for and develop the shop equipment and the more valuable curricular
phases of the program. The equipment and the whole program soon "go to pot" and the program is degraded in that community.

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. The same reasoning applies to the other practical arts subjects, because it is invariably desirable to establish a program for the girls as well as for the boys.

There is now a decided trend toward the giving of industrial arts instruction to girls as well as to boys, and certain phases of home economics instruction to boys as well as girls. There are several instances of such work in the state of Oregon, with many more examples of it in the larger cities of the Middle West and East. Practically speaking, however, neither of these programs is sufficient by itself and the tendency is to establish both industrial arts and home economics in a given school at about the same time. Such a practice gives a well-rounded practical arts program and the five-teacher school seems to be the minimum size of school unit in which such a program can be initiated.
In this respect a quotation from the Oregon Course of Study for Industrial Arts will be interesting (23:16).

With less than four teachers, the teaching combinations and the allotment for shop work can rarely be arranged to give conditions favorable to the development of industrial arts. There may be notable exceptions, but such exceptions are usually due to peculiar circumstances not apt to be duplicated in the general run of schools. Even four-teacher high schools have often found difficulty in maintaining a program that will meet desired requirements.

Perhaps it is not very consoling to the three-teacher schools ambitious to develop practical arts programs—home economics for girls and industrial arts for boys—but present conditions are such that those schools might better look forward to a non-curricular handicraft program than to a sub-standard curricular program including industrial arts. The rural setting of these smaller schools lends itself to 4-H handicraft and cooking clubs, embracing activities for both girls and boys. So long as industrial arts, as a curricular subject, is expected among other things to lay a technical background for those who will later follow a trade-vocational program, it is doubtful if sub-standard work should ever be on a curricular basis.

Adequacy of the Oregon Industrial Arts Program as Compared with the National Picture

From the foregoing statistical data and discussion, it is evident that the large number of small schools in Oregon offers a problem difficult to overcome except by eliminating from the programs of those small schools everything other than the traditional graduation requirements, or eliminating the schools themselves through a consolidation program. While the Legislature has provided for com-
solidations and the State Department is encouraging the small schools to join in the formation of larger units, geographic difficulties and local jealousies have operated to hold consolidation to a minimum. The result is that Oregon, with so many small schools, is considerably behind the national pattern in the proportion of practical arts subjects now a functional part of the curricular program of the public schools.

Table 3 shows that 64 per cent of the schools in the brackets of four to eight teachers included industrial arts as a part of the curricular program; that 75 per cent of the schools in the nine to nineteen-teacher brackets offered industrial arts, and that in 88 per cent of the cases industrial arts was a part of the program in schools with 20 or more teachers. These percentages alone seem quite encouraging, when compared with the percentage of industrial arts programs offered in the still smaller schools (three to five teachers). The fact is, however, that the situation is somewhat misleading when it is compared with the number of full-time-equivalent teachers employed in those various schools.

In a survey conducted by Ericson (14:151) it is reported that the average for junior and senior high school industrial arts instruction is one industrial arts teacher for each 150 boys included in the total school enrollment.
Assuming that the registration or average daily attendance of boys and girls is equal, this would mean one industrial arts instructor for each 300 (approximately) average daily attendance in a given school.

It should be noted this does not imply that one industrial arts teacher should handle 150 boys in the shop enrollment. Ericson's survey sought to determine the number of industrial arts teachers employed in proportion to the total enrollment of boys. If the ratio found by Ericson—150 boys or 300 pupils average daily attendance for each industrial arts teacher—is applied to Oregon schools, it is at once apparent that the larger schools of the state are decidedly below the general average of schools in the number of industrial arts teachers employed, and hence below the national pattern in the number of industrial arts experiences provided for their student bodies. Table 4 shows the deficiencies in this respect.
TABLE 4

Ratio of Industrial Arts Instructors to Average Daily Attendance in Selected Oregon High Schools, as Compared with Average Reported by Ericson (14)

<table>
<thead>
<tr>
<th>Selected Oregon School</th>
<th>No. of school years included in high school</th>
<th>Average daily attendance</th>
<th>Total number of full-time-equivalent instructors employed</th>
<th>Number of full-time-equivalent Industrial Arts instructors employed</th>
<th>Number of Industrial Arts instructors indicated by Ericson's survey</th>
<th>Vocational agriculture - *** programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland High Schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Franklin</td>
<td>4</td>
<td>1758</td>
<td>68.5</td>
<td>2.0</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Grant</td>
<td>4</td>
<td>2413</td>
<td>89.0</td>
<td>2.0</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>Commerce</td>
<td>4</td>
<td>1508</td>
<td>60.0</td>
<td>0.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Jefferson</td>
<td>4</td>
<td>2196</td>
<td>84.0</td>
<td>2.0</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>Lincoln</td>
<td>4</td>
<td>1481</td>
<td>59.0</td>
<td>0.25</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Roosevelt</td>
<td>4</td>
<td>724</td>
<td>31.5</td>
<td>1.0</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Washington</td>
<td>4</td>
<td>1642</td>
<td>63.5</td>
<td>1.0</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Baker High</td>
<td>3</td>
<td>573</td>
<td>27.0</td>
<td>1.0</td>
<td>2.0</td>
<td>***</td>
</tr>
<tr>
<td>Corvallis High</td>
<td>3</td>
<td>760</td>
<td>31.0</td>
<td>1.0</td>
<td>2.5</td>
<td>***</td>
</tr>
<tr>
<td>Milwaukie</td>
<td>4</td>
<td>706</td>
<td>27.5</td>
<td>1.5</td>
<td>2.5</td>
<td>***</td>
</tr>
<tr>
<td>Molalla</td>
<td>4</td>
<td>272</td>
<td>11.0</td>
<td>0.25</td>
<td>0.75</td>
<td>***</td>
</tr>
<tr>
<td>Oregon City</td>
<td>3</td>
<td>726</td>
<td>30.5</td>
<td>1.5</td>
<td>2.75</td>
<td>***</td>
</tr>
<tr>
<td>Canby</td>
<td>4</td>
<td>280</td>
<td>12.0</td>
<td>0.5</td>
<td>1.0</td>
<td>***</td>
</tr>
<tr>
<td>Selected Oregon School</td>
<td>No. of school years included in high school</td>
<td>Average daily attendance</td>
<td>Total full-time-equivalent instructors employed</td>
<td>Number of full-time-equivalent Industrial Arts instructors employed</td>
<td>Number of Industrial Arts instructors indicated by district survey</td>
<td>Vocational Agriculture - ** projects</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>West Linn</td>
<td>4</td>
<td>447</td>
<td>20.5</td>
<td>1.0</td>
<td>1.5</td>
<td>***</td>
</tr>
<tr>
<td>Astoria Sr. High</td>
<td>3</td>
<td>648</td>
<td>20.0</td>
<td>1.0</td>
<td>2.0</td>
<td>**</td>
</tr>
<tr>
<td>Rainier</td>
<td>4</td>
<td>242</td>
<td>10.0</td>
<td>0.0</td>
<td>0.75</td>
<td>***</td>
</tr>
<tr>
<td>Scappoose</td>
<td>4</td>
<td>224</td>
<td>9.0</td>
<td>0.0</td>
<td>0.75</td>
<td>***</td>
</tr>
<tr>
<td>Myrtle Point</td>
<td>4</td>
<td>239</td>
<td>10.0</td>
<td>0.0</td>
<td>0.75</td>
<td>***</td>
</tr>
<tr>
<td>Bend</td>
<td>4</td>
<td>614</td>
<td>23.0</td>
<td>1.5</td>
<td>2.0</td>
<td>**</td>
</tr>
<tr>
<td>Redmond</td>
<td>4</td>
<td>301</td>
<td>13.0</td>
<td>0.25</td>
<td>1.0</td>
<td>***</td>
</tr>
<tr>
<td>Roseburg</td>
<td>3</td>
<td>441</td>
<td>18.0</td>
<td>0.25</td>
<td>1.5</td>
<td>***</td>
</tr>
<tr>
<td>Grant Union</td>
<td>4</td>
<td>107</td>
<td>6.0</td>
<td>0.0</td>
<td>0.5</td>
<td>**</td>
</tr>
<tr>
<td>Hood River</td>
<td>3</td>
<td>463</td>
<td>14.5</td>
<td>0.0</td>
<td>1.5</td>
<td>**</td>
</tr>
<tr>
<td>Ashland</td>
<td>3</td>
<td>360</td>
<td>13.0</td>
<td>0.25</td>
<td>1.25</td>
<td>**</td>
</tr>
<tr>
<td>Central Point</td>
<td>4</td>
<td>143</td>
<td>7.0</td>
<td>0.25</td>
<td>0.5</td>
<td>**</td>
</tr>
<tr>
<td>Medford</td>
<td>3</td>
<td>887</td>
<td>37.5</td>
<td>0.5</td>
<td>2.75</td>
<td>**</td>
</tr>
<tr>
<td>Grants Pass</td>
<td>4</td>
<td>686</td>
<td>28.5</td>
<td>1.5</td>
<td>2.25</td>
<td>***</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>4</td>
<td>1023</td>
<td>40.0</td>
<td>2.25</td>
<td>3.5</td>
<td>**</td>
</tr>
<tr>
<td>Lakeview</td>
<td>4</td>
<td>230</td>
<td>11.0</td>
<td>0.0</td>
<td>0.75</td>
<td>***</td>
</tr>
<tr>
<td>Selected Oregon School</td>
<td>No. of school years included in high school</td>
<td>Average daily attendance</td>
<td>Total # of full-time-equivalent instructors employed</td>
<td>Number of full-time-equivalent Industrial Arts indicated by Ericson's survey</td>
<td>Vocational - agriculture programs</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------</td>
<td></td>
</tr>
<tr>
<td>Cottage Grove</td>
<td>4</td>
<td>352</td>
<td>15.5</td>
<td>0.5</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Eugene Sr. High</td>
<td>3</td>
<td>1581</td>
<td>56.0</td>
<td>2.5</td>
<td>3.25</td>
<td></td>
</tr>
<tr>
<td>Junction City</td>
<td>4</td>
<td>203</td>
<td>8.0</td>
<td>0.0</td>
<td>0.67</td>
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<tr>
<td>Newport</td>
<td>4</td>
<td>134</td>
<td>6.0</td>
<td>0.25</td>
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<td></td>
</tr>
<tr>
<td>Albany</td>
<td>3</td>
<td>647</td>
<td>20.0</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>4</td>
<td>405</td>
<td>15.0</td>
<td>0.25</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Nyssa</td>
<td>4</td>
<td>304</td>
<td>9.0</td>
<td>0.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>3</td>
<td>448</td>
<td>18.0</td>
<td>0.25</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Silverton</td>
<td>3</td>
<td>552</td>
<td>18.0</td>
<td>1.0</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>Woodburn</td>
<td>4</td>
<td>304</td>
<td>11.5</td>
<td>0.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Gresham</td>
<td>4</td>
<td>702</td>
<td>23.0</td>
<td>0.0</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>Dallas</td>
<td>4</td>
<td>364</td>
<td>17.0</td>
<td>0.75</td>
<td>1.25</td>
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</tr>
<tr>
<td>Independence</td>
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<td>183</td>
<td>9.0</td>
<td>0.0</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Pendleton</td>
<td>3</td>
<td>464</td>
<td>18.5</td>
<td>0.5</td>
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<td></td>
</tr>
<tr>
<td>La Grande</td>
<td>3</td>
<td>707</td>
<td>20.5</td>
<td>1.5</td>
<td>2.25</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Selected Oregon School</th>
<th>No. of school years included in high school</th>
<th>Average daily attendance</th>
<th>Total* number of full-time-equivalent instructors employed</th>
<th>Number of full-time-equivalent Industrial Arts instructors employed</th>
<th>Number of Industrial Arts instructors indicated by Ericson’s survey</th>
<th>Vocational agriculture programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaverton</td>
<td>4</td>
<td>438</td>
<td>15.5</td>
<td>1.0</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Forest Grove</td>
<td>4</td>
<td>423</td>
<td>19.0</td>
<td>1.0</td>
<td>1.5</td>
<td>***</td>
</tr>
<tr>
<td>McMinnville</td>
<td>3</td>
<td>405</td>
<td>16.0</td>
<td>1.0</td>
<td>1.25</td>
<td>***</td>
</tr>
</tbody>
</table>

Total full-time-equivalent industrial arts instructors employed in these 47 schools: 32.90

Total number of instructors needed, as indicated by Ericson’s ratio: 97.83

Deficiency indicated: 64.93, or approximately 65 instructors

* As recorded in the Oregon School Directory for 1939-40.
** Estimated by adding to the number of full-time instructors shown in the Directory, one-half the number of part-time teachers shown.
Table 2 brought out the fact that the larger schools are farther from the normal pattern than are the smaller schools of the state. While Table 4 shows only the schools deficient in the number of industrial arts teachers employed, there is an approximately equal number in which the ratio of industrial arts teaching staff to the average daily attendance agrees with the normal pattern. Those in agreement in this respect are usually the schools of intermediate or small size. Only four of the schools with adequate teacher-to-student ratios should be classified as of major importance in size of enrollment. These are Salem, with an average daily attendance of 2269; Hillsboro Union High School, with an average daily attendance of 613; The Dalles, with an attendance of 526; and Marshfield, with an average daily attendance of 428. All other schools conforming with the normal ratio of industrial arts teachers to average daily attendance are in the small-school class, with enrollments of 350 or less.

The larger high schools of Portland seem to be the most flagrant violators of the national picture. Grant High School, with two industrial arts instructors employed full time, show a distinct deficiency when compared with the eight industrial arts instructors indicated by the application of Ericson's formula. Likewise, Lincoln High School, with an attendance of 1481 and a full-time-equiva-
lent of 0.25 of an industrial arts instructor compares quite unfavorably with the indicated need of five full-time industrial arts teachers. Jefferson, with two employed against a need for seven, Franklin High, with two as against a need of six, Roosevelt, with one against a need of two and a half, and Washington, with one against a need of three and a half, do not present a much better picture.

It was pointed out previously (footnote (d), Table 2) that the Jane Addams School for Girls, and the Benson Polytechnic School for Boys, were omitted from this study because of the distinct vocational objectives claimed for those schools. For the same reason the Edison Vocational School was omitted. It will be noted, however, that the Commerce High School has been included in Table 4, showing a deficiency of five industrial arts instructors against none employed.

One might question the validity of including Commerce High School, the objectives for which are also vocational, when the others had been excluded. It should be recalled, however, that each of the other schools afford abundant opportunity for manipulative, constructive, industrial experiences which serve the objectives of industrial arts almost equally as well as if the work in those schools were on an industrial arts basis. Commerce High School, while
affording "manipulative" experience in typing, bookkeeping and related activities, might well consider the educational value of industrial arts as a developmental experience and as a general background for those in the commercial branches who will find employment in business or industrial establishments. The terminology, the broad fund of industrial information, the general knowledge of individual processes, materials, and methods resulting from a reasonable contact with industrial arts would seemingly become a valuable asset to the graduates of a commercial course. In other words, the general objectives of industrial arts would function as well for students of Commerce High School as for any other school. They might function even more directly for those graduates who find occupations in business and industrial fields related to production or to industrial sales.

Outside of the city of Portland one is impressed immediately, especially those at the College, with the deficiency in the industrial arts staff at the Corvallis High School. While enrollment figures for the junior high schools of the entire state are not available from the state directory, information supplied locally indicates a similar deficiency in the Corvallis Junior High School. While the vocational agriculture program at Corvallis helps to absorb some of the deficiency (because of the excellent
shop work in that program), the total deficiency is really more acute than is indicated by Table 4 because both the junior high school and the senior high school staff members are employed for part-time work at the College. In defense of the Corvallis public school administration and of the part-time college teaching by these staff members, mention should be made that the superintendent and all parties concerned are aware of the deficiency and anxious to cooperate with the College in remedying the situation at the earliest opportunity. Additional shop facilities are needed at each school, as well as additional staff members.

The Junior High School Picture

The statistics of Table 4 do not present the whole picture of those school systems in which junior high school work includes the seventh, eighth and ninth grades. Enrollment or average daily attendance figures in the state directory include the ninth grade in the senior high school figures, even though the actual instruction may be the responsibility of a separate junior high school organization. The situation at Corvallis has already been cited. In that case the major part of the deficiency of the combined junior and senior high school program is reflected in the deficiency shown by Table 4 for the senior high school alone. With no figures available to break down
these statistics in any other fashion, but with a personal knowledge of similar situations in a half-dozen cases, it is believed that the same reasoning applied to the Corvallis case would fit equally well the deficiencies shown for the senior high school programs of other systems in which the junior high school is a functional part of the whole secondary school program. It should be noted, however, that this would not apply in Portland, or in any other case where junior high schools are non-existent, or where they do not include a well-developed industrial arts program.

When commenting on Table 2, it was brought out that the industrial arts programs of Oregon junior high schools was much nearer to agreement with the national pattern than is the case with the senior high schools. Since no average-daily-attendance statistics are available for the 33 junior high schools of the state, no data comparable to those of Table 4 can be given for the junior high schools at this time. It appears that, while the deficiencies in industrial arts are not so acute in the junior high schools as in the three-year and the four-year senior high schools of the state, there are nevertheless some cases in which the junior high schools could well look to an increase in the ratio of full-time-equivalent staff members.
Vocational Agriculture and Industrial Arts in Oregon

In Oregon, vocational agriculture is always accompanied by farm shop work. While practices differ in different localities, it is customary in most instances for the vocational agriculture instructor to devote from 25 to 50 per cent of his time to instruction in farm shop work. It is apparent, therefore, that the farm shop program will, in many cases, supplement or take the place of the industrial arts program. While the instruction is applicable to the farm, if carried out according to the standards rightfully expected of the farm shop teacher, the manipulative work will serve much the same purposes — exploratory and developmental experiences which come with the solving of real problems in a realistic setting — as is true of the industrial arts program. For rural youth, "industrial information" and the other industrial arts objectives, not served by the farm shop program, are of lesser importance.

Since the agriculture program is typically rural, and the industrial arts program is more commonly associated with the industrial procedures of larger population centers, it is but natural that the Oregon program should look to vocational agriculture, with its accompanying farm shop program, as the primary practical arts experience for the smaller schools of the better agricultural sections of
the state. There are 17 such schools whose practical arts functions are now served exclusively by the vocational agriculture and farm shop program, served so adequately that there could be no criticism whatever so far as the sponsors of industrial arts are concerned. These communities are Pine Valley (Halfway), Coos River (Marshfield), Riverton, Arlington, Condon, Bonanza, Henley (Klamath Falls), Malin, Boardman, Heppner, Nestucca (Cloverdale), Cove, Imbler, Wallowa, Dufur, Amity, and Dayton. Griswold, Umatilla county, presents a similar situation, except in this instance the school authorities have supplemented the farm shop program by the addition of a very small amount of industrial arts instruction, amounting to approximately 25 per cent of a full-time instructor in that field. Apparently the industrial arts instruction is conducted in the same shop used by the vocational agriculture teacher.

An examination of agriculture and industrial arts programs listed by the Oregon School Directory for 1939-40 (22:65-118) shows that in eleven other cases where agriculture now serves alone, there should possibly be some arrangement similar to that which prevails at Griswold. At least it appears that the farm shop program alone may not be able to serve the needs of all boys in those schools. The communities in question are: Junction City, Independence, Enterprise, Nyssa, Scappoose, Myrtle Point, Woodburn,
Rainier, Redmond, Lakeview, and Gresham.

First, there should be no conflict between the agriculture program and the industrial arts program, nor between the teachers employed in any of the schools. There could be no friction in the first group mentioned — those 17 schools in which the vocational agriculture and farm shop programs were completely satisfactory for all purposes. Those cases are clear-cut. The small schools in the distinctly agricultural areas are served well by agriculture and the farm shop, alone. The schools of intermediate size, however, including those eleven cases just mentioned, introduce the element of "what to do for the boys who are not interested in the agricultural program, and who, not living on farms of the community, have no opportunity to practice the agriculture program even if they are interested in farm shop work.

Aside from the boys’ lack of interest in agriculture, the agriculture teacher is seldom interested in those whose objectives are not in agreement with the whole agriculture program. The result is that many boys in communities of intermediate size (schools with 8 to 12 teachers), supporting an agriculture program without any opportunity for industrial arts, find themselves eliminated from all phases of shop work. In that respect Gresham, with 23 teachers and no industrial arts work, deserves especial consideration.
It is doubtful if a school employing ten teachers or less would be justified in establishing two complete programs, each separate and distinct from the other in equipment, teaching personnel, and objectives. If the vocational agriculture program is already established and flourishing, there is certainly no reason to disturb that program. Proponents of industrial arts should have no thought of displacing agriculture but if industrial arts is to become a part of the school program in such a case it would be necessary to employ a part-time industrial arts instructor, utilizing the remainder of his time in other teaching fields, and developing shop facilities such as to allow the joint use of those facilities by both the agriculture and the industrial arts instructor. That should not be impossible since neither of those instructors could possibly use the shop through the full day in a school of the size represented in this group.

In some instances the same arrangement might be advantageous in reverse order; that is, where an industrial arts program is functioning, but where there is a definite need for vocational agriculture and the school is definitely too small to support two shops, arrangements should be made for the joint use of one shop. Boys of the community could have the advantage of both types of training, selecting in accordance with their individual interests.
Illustrations of this procedure are to be found at The Dalles and at the town of Union, although The Dalles school would seem to be sufficiently large to support two shops, each more perfectly suited to the needs and objectives of the separate program it serves.

In the development of shop equipment suitable for both industrial arts and vocational agriculture, it is but natural that the physical plant will need be somewhat more expanded than if it were to serve but one of the two programs. It is nevertheless true that the combined usage could be worked out with somewhat less expense than the school could equip two separate shops. Many of the physical features of the two coincide. Some features common to the vocational agriculture shop are not ordinarily found in the industrial arts plant and vice versa, but both would need be provided in a joint program. These problems are not incompatible although a satisfactory solution requires close cooperation between the industrial arts and the vocational agriculture instructors — cooperation in the initial planning and in the continued use of the facilities.

There are 52 vocational agriculture programs in Oregon schools. Seventeen of these were accounted for in the first group of small schools in which the program was entirely sufficient for all purposes. Eleven schools are
in that intermediate group just cited. Twenty-four other vocational agriculture programs are located in schools including both industrial arts and the farm shop, a few in the same shop, as at The Dalles, others duplicated in most instances, and working harmoniously in the majority of cases. These coincident programs are noted in Table 4. It will be noted that in 19 cases where the agriculture programs coincide with industrial arts, there is a deficiency in the industrial arts teaching staff. This fact does not imply that the vocational agriculture program is in any way responsible for the deficiency of the industrial arts staff. Instead, it is possible that the farm shop program may relieve the deficiency, or partially excuse it in some cases, because a portion of the boys of those schools are cared for in the farm shop program. Taking Corvallis as an example, it is reasonable to assume that the 41 boys registered in the vocational agriculture program would proportionally reduce the load which would otherwise be a part of the industrial arts instructor's responsibility, relieving the deficiency to that extent. If that be the case, and this assumption is only reasonable, the deficiency for Corvallis would be in the neighborhood of two full-time instructors rather than two and a half, as given by Ericson's formula and shown in Table 4. The same reasoning could apply to similar situations
elsewhere, although the agricultural enrollment of the other 18 cases is not available and could not be made a part of this study.

The Industrial Arts Teachers of Oregon — Their Education and Experience

Granting the importance of the teacher in any situation, especially in the planning and organizing stage of an industrial arts program, an examination of the training and qualifications of Oregon industrial arts teachers will be of interest at this stage in the study. Two sources of information will be used in presenting this particular part of the study: first, the Oregon School Directory (22), and second, Nee (20) "Survey of Industrial Arts in the Public Schools of Oregon." The directory lists 250 teachers of industrial arts subjects. Eliminating the 59 teachers of the five schools already excepted leaves a total of 191 teachers employed in the schools covered by this study. These 191 teachers are classified as follows, in so far as the training of a teacher can be determined from the information furnished by the Oregon School Directory.

1. Teachers who have completed technical and professional teaching requirements equivalent to a major teaching norm in industrial arts, or the professional curriculum for industrial arts education .............................................. 72
2. Teachers whose preparation is probably satisfactory for the special subjects assigned to them, but for whom the directory lists no evidence of technical or professional education comparable to either the industrial arts professional curriculum or an industrial arts teaching norm

The majority of the teachers in this classification have entered industrial arts teaching by virtue of trade experience. Several hold degrees, usually from liberal arts colleges or other schools with no facilities for either the technical or the professional industrial arts courses.

3. Teachers with very limited preparation in the field of industrial arts, not comparable to the usual requirements for certification in that field, but teaching industrial arts subjects by virtue of a general certificate

4. Teachers for whom the directory lists no evidence of either technical or professional preparation for teaching the industrial arts subjects

These, for the most part, are graduates of liberal arts schools and other institutions whose programs embrace no industrial arts in any form. A few may have presented industrial arts minors at still other schools, which evidence does not show in the directory. Personal knowledge of a great many of these cases disproves that possibility for at least 75 per cent of the group. Most teachers in this classification are teaching industrial arts on the basis of very meager "trade experience", and a general credential earned in some of the academic branches.

Recognizing the information listed by the Oregon School Directory (22) is neither complete nor comparable to a college transcript, Nee (20) undertook to contact
the teachers themselves, by the questionnaire method and by personal visitation, that his survey might be based upon a more complete study of the preparation claimed by the teachers. Since his study included the teachers' own statements of their backgrounds of experience and education, it is possibly more valid than a study based only upon the directory. A summary of Nee's findings (20: Table 13) gives the following information on the preparation claimed by industrial arts teachers of the Oregon public schools.

1. Only 72 teachers of the 169 included in Nee's study claim the completion of a program equivalent to an industrial arts major. Please note the exactness between this figure reported by Nee and the figure arrived at by an analysis of the Oregon School Directory, previously reported on page 59.

2. Only 20 more claimed preparation in industrial arts equivalent to a teaching minor.

3. While the 169 teachers responding to Nee's questionnaire is only 88 per cent of the industrial arts teachers of the Oregon schools (there are 191 total, as reported previously), it is reasonably certain that the 12 per cent who did not respond to the questionnaire would not have increased the number of majors reporting; and that a 100 per cent return would not have increased the number of minors by more than two or three cases.

4. A further analysis of Nee's study shows that, while only 42 per cent of all industrial arts teachers in Oregon have presented major teaching norms in the field in which they are employed, 51 per cent of these same teachers devote full time to industrial arts instruction.
5. Again, while only 42 per cent of the total industrial arts teachers claimed major preparation in that field, 65 per cent of the teaching time of the entire group is devoted to industrial arts subjects.

6. In view of the two points last cited, the deficiencies in the technical and the professional preparation of Oregon industrial arts teachers cannot be excused by the statement that most of these teachers devote very little time to industrial arts instruction, and could not therefore be expected to present special preparation for so minor a field of application.

Going further into the preparation of Oregon industrial arts teachers, Nee (20: Table 16) shows that in the smallest schools (one to three teachers) seven teachers out of thirteen had completed neither a "major" nor a "minor" in industrial arts; yet those same teachers were devoting from 5 to 12 periods a week to industrial arts instruction (20: Table 7). In the next larger group of schools (four to eight teachers) 41 out of 64 industrial arts teachers had completed neither a major nor a minor in industrial arts, while they were devoting from 6 to 22 periods a week to instruction in that field. Fifteen out of 40 industrial arts teachers in schools employing nine to nineteen teachers had completed neither a major nor a minor, and 14 out of 52 teachers in schools employing 20 or more teachers were without either a major or a minor in industrial arts.

In these last two groups (the 9 to 19-teacher schools and the 20-or-more-teacher schools), the industrial arts
teachers were employed for full-time industrial arts service 45 per cent and 54 per cent of the cases, respectively. From these data Nee concluded that Oregon schools are employing teachers whose professional preparation does not agree well with the jobs for which they are hired; and that the unsatisfactory condition in many industrial arts shops is logically traceable to the laxity of school boards and school officials in hiring teachers whose qualifications are below the minimum specified by the State Department of Education.

While this condition seems to be slowly improving, and a gradually increasing percentage of Oregon teachers show technical and professional preparation in the fields which they are teaching, each year sees the introduction to industrial arts of several new teachers without adequate preparation for professional service in the field they serve. Nee (20: Tables 16, 17, 18) reports that, for 1940, Tables 16, 17 and 18 show a total of 16 teachers without previous industrial arts teaching experience, and 12 without general teaching experience. This means that four teachers are beginning instruction in industrial arts with a background of general teaching experience from which they have spread out to include industrial arts. Three of these teachers have had no technical or professional preparation in industrial arts, and no trade experience; the fourth is better off to the extent of four hours of drawing completed at a normal school.
Those reporting one year of industrial arts teaching experience include three with industrial arts majors, one industrial arts minor, one teaching in a special field with 23 years of trade experience, one teaching drawing with only two industrial arts credits, one with two credits of printing plus one year of trade experience, two with three years of trade experience, one each with three and four years respectively of trade experience, one with nine credits of industrial arts, and one with 20 years of trade experience. None of those reporting "trade experience" as the background for teaching industrial arts made any mention of further technical or professional preparation for teaching these subjects.

This wide diversity of preparation leads one to question if there can be any means of measuring the proficiency of the work. At present there is no standard measure and no means of administering one if it were available.

Concerning the probable value of "trade experience" as a preparation for industrial arts teaching, Nee (20:47) continues:

One can but question the value of trade experience as a preparation for industrial arts unless that experience is supplemented with professional training in the objectives and methods peculiar to industrial arts. One may well ask, "What trade?" and, "What type and quality of work is represented?" It is extremely doubtful if any adequate evaluation of the fitness of tradesmen to teach industrial arts can ever be made until one can apply a more objective vision to "trade" experience than just to label it by years. Especially is that true in the present highly diversified non-vocational program of secondary school industrial arts. Valuable as trade experience may be as an "adjunct", it can never replace professional courses dealing with the objectives, the content, and the special methods of industrial arts.

Most astonishing was the finding in Nee's study (20: Table 21) that 34 teachers (20 per cent of the 169 reporting) indicated their preparation (or the lack of it)
for teaching industrial arts was not taken into consideration by officers of the school or members of the school board responsible for employing them; that in all such cases these teachers were given the job of teaching industrial arts, often against their own wishes, after they had been employed upon the basis of other qualifications. Most flagrant violators in that respect were the smaller schools (one to three teachers) where seven out of 13 industrial arts teachers (54 per cent) reported that preparation for teaching industrial arts had never been questioned or considered by their boards.

In the larger schools this same practice of hiring without regard to preparation was reported by an astonishingly large percentage of the teachers in each group, as follows:

- In schools employing a total of four to eight teachers ........................................... 23%
- In schools employing a total of nine to 19 teachers ........................................... 12%
- In schools employing a total of 20 or more teachers ........................................... 13%

It may be that a few of the teachers reporting used this claim as a justification for their own recognized weaknesses in the preparation they have presented for
teaching industrial arts. It is doubtful, however, if such rationalizing would account for a very great number of the cases reporting. Instances are on record in which school boards and school officials have deliberately employed teachers under one set of qualifications, only to assign to them entirely different teaching responsibilities without serious regard for the fitness of those teachers to conduct the work assigned. The high percentage of such cases reported by the teachers responding to Nee's questionnaire was almost unbelievable.

Can it be that school boards and school officials recognize the seriousness of the problem and don't care? Or is this procedure followed by the smaller schools only as a last resort and as a means of covering market shortages when the teacher market cannot supply the odd and numerous subject-matter combinations sometimes required by them — at the very low salaries usually offered? That might be a logical conclusion except for the percentages of placement in the larger schools — placement of teachers without reference to technical or professional qualifications in industrial arts (their major teaching subject) — reported by the teachers covered in Nee's survey and summarized in the preceding paragraph. It is doubtful if such an excuse could be defended by the officials responsible for hiring or assigning duties to the 13 per cent of
the industrial arts teachers in schools employing 20 and more staff members.

Shop Planning and the Industrial Arts Teacher

The most important element in any teaching situation is the teacher. The most important element in shop planning is the teacher responsible for that planning. Even when building plans are the responsibility of an architect, a competent industrial arts teacher is still the key man in the planning of the industrial arts laboratory, its equipment, and the special features which should be a part of the physical plant. Architects are specialists in the field of architectural arrangement and architectural engineering. They could hardly be expected to have sufficient professional background in industrial arts to arrange all details without further aid. The selection of equipment, its exact placement in relation to major instructional areas and the flow of materials, and numerous other considerations affecting the efficiency of instruction in the school shop are proper functions of a teacher whose technical and professional training is adequate for such planning. Certainly the architect and the industrial arts teacher should work closely together on the planning of a new plant.
For every opportunity to assist in the building of a new physical plant, there are at least ten opportunities for industrial arts teachers to improve an existing plant by redesigning and rearranging the present facilities. Change is constant. New methods, new materials, new ideas may have given reason to revise a plant that, a few years ago, was adequate. In that case the teacher becomes primarily the engineer, the architect and designer, and the consultant. The whole job usually rests with the teacher in any situation requiring less than the erection of a new building. In many cases the whole job rests with the teacher even when a new building is required, particularly in the smaller schools.

Granted that the teacher's part in shop planning and reorganization is an important one, it then follows that the training of the teacher for that service is also important. Knowledge of a few manipulative processes — elementary woodworking, carpentry, mechanical drawing, and perhaps a small amount of practical experience at the carpenters' trade — are hardly sufficient prerequisites. One should at least know something of the philosophy, the objectives, the methods of instruction, the equipment most appropriate for the type of work to be conducted, space requirements for the several types of industrial experiences common to the program, and the nature of auxiliary
services to be included. Some ability in architectural drafting, while not a necessary prerequisite in all cases, is definitely a desirable background. Some knowledge of the procedure of laying out and organizing a school shop, gained either as an instructional course in a teacher-education program or by years of experience in teaching and in developing school shops, are most essential. In short, if there is ever any need for a teacher with professional training and superior qualifications, it is when a program is being planned and initiated. Ironically enough, that is often the time when the small school, struggling to meet the financial burden of providing space and equipment, decides to economize by hiring a teacher whose qualifications may not embrace the most desirable training and experience. Savings of that nature are usually expensive savings, resulting in the purchase of equipment unsuited to the job and the development of a program entirely out of line with current educational objectives. The mistakes perpetrated in the planning of school shops — mistakes which often can never be rectified within reasonable financial limits — stand for years as embarrassing memorials to those who follow, but make no dent in the conscience of those who, untrained and poorly prepared for the task, sail blithely through in total ignorance of the professional and financial butchery they have committed.
To the uninitiated, the foregoing language may seem a bit strong. To those who have been privileged to examine industrial arts shops and equipments over relatively large sections of the country, and particularly in the smaller schools, the preceding statements are mild and exactly descriptive of circumstances which prevail all too often. The trained teacher, in shop planning as in teaching, is the most important element of the whole program. Some provision should be made for safeguarding communities against the wanton expenditure of considerable sums of money in the installation of school shop programs by teachers totally unprepared for such service. This differs from malpractice of a surgeon only in that the patient is more apt to linger on as a perpetual ward of the community and as a blot on the record of the school against which it was perpetrated.

In fairness to all — the youth of an industrial democracy, taxpayers, the school administrators, the teachers — and in respect to a professional interest in the whole field of education, it is concluded that the evidence presented points unmistakably to laxity of school administrators and to a lack of appreciation on the part of school officials for the seriousness — financial and educational — of trusting to the untrained teacher the rather large expenditures necessary for the development of an industrial arts program. The seriousness of the situa-
tion is the more striking when the record shows so many industrial arts teachers with only liberal arts and/or trade experience to have been placed in positions requiring the planning and organization of a program the objectives of which, even the very nature of which, they do not understand. One is led to believe that the school administrators themselves do not understand, or are not informed of either the need for or the objectives of industrial arts; and, not knowing these, are ignorant also of the real difference between a program with only manipulative, "hammer and saw" objectives taught by the town "handy man", and a program in keeping with modern practice in secondary education.

These administrators should see some examples of the conditions of waste — waste in time, effort, money and educational value — resulting from cases of mistaken objectives and wrong procedures in shop planning. First, it is necessary to establish the need for a service. Broadly informed leaders in education have assigned to industrial arts a place of importance and a field of service in general education described by Campion* (7:234-235) as follows:

The contribution of industrial education to the general educational program has been most marked during the past 20 years. Out of our belief in "learning by doing" has come much of that which

* Assistant Superintendent of Schools, Los Angeles, Calif.
has motivated the so-called progressive education movement. As has already been pointed out, real life situations for many of our people will occur mainly in the industrial and mechanical world. Any experience properly directed toward industrial intelligence will aid the boy or girl in later making adjustments to the world in which he lives. Industrial education, whether it be industrial arts, industrial pre-vocational education, preparatory training, or extension training, presents the opportunity of tackling actual jobs as nearly as possible under life conditions.

Never before has industrial education presented so many challenges to the educators of America. New social conditions, new industrial demands, new types of ability, all give emphasis to the need of an industrial training that keeps abreast of the rapidly changing scene.

In view of Campion's appraisal of the service and function of industrial arts, in view of the broad objectives to be served, and in view of the rather highly specialized technical and professional knowledge required for the most effective matching of school finances against community needs and educational objectives — both general and specific — is it not perhaps a bit extreme to expect satisfaction from the organization of industrial arts programs and the planning of school shops by teachers whose only preparation for the job has been trade experience? Or by those whose preparation has been limited entirely to the liberal arts and academic branches, supplemented with minor trade experience, usually of the "pick up" variety? It is from a background of knowledge of these conditions — the training, qualifications and
professional preparation (or the lack of it) of many Oregon teachers, substantiated by the data leading to the presentation of this chapter, that the relatively "strong statements" opening this particular section — Shop Planning and the Industrial Arts Teacher — were made. The remaining portions of this study, setting up certain fundamental principles of school shop planning and giving examples of industrial arts shops suited to the specific environments and circumstances of the communities in which they are located, are submitted with the double purpose of:

(1) Presenting a background of information and suggested plans from which school officials may receive some aid in the determination of the type of industrial arts program most likely to apply in their particular communities.

(2) To furnish the teachers and school administrators with at least partially objective standards against which to weigh or evaluate present and future industrial arts shops in Oregon secondary schools.
CHAPTER V

PHILOSOPHICAL GUIDES TO SCHOOL SHOP PLANNING

Educators, school administrators, and industrial arts teachers have, through the years, evolved a philosophy and a set of criteria or guiding principles useful in determining the nature of the program likely to be most appropriate under a given set of circumstances, and useful in arranging specific details of the physical plant in keeping with the educational objectives and other factors controlling the program. The "philosophical" phases of these guiding principles constitute the policy-forming elements of the criteria by which the nature of the program may be judged, while the more specific elements apply to the details of actual shop planning and to the organization of equipment for effective teaching under the conditions postulated.

Policy-Forming or "Philosophical" Criteria

1. Plans for the physical plant of a school shop should reflect:

   a. Currently accepted educational objectives (general and specific), and anticipated objectives as indicated by the broader trends in education.

   b. The best professional practice in school shop planning, affecting the choice of equipment, its organization for efficient use, and provisions for adequate auxiliary services.
c. The type of school, the present enrollment, and the enrollment trend.

d. The financial support needed for a satisfactory program, as well as the ability of the community to pay.

e. The active interests of the community — industrial, general, and educational.

f. The national trend, and the accepted pattern of school shops in other schools of similar type.

2. Objectives will lead to desired outcomes only to the extent permitted by limitations of the physical plant and the teacher.

a. The "exploratory" objective indicates the need for multiple contacts. Modern industrial arts programs embrace more than 70 different experience areas. The trend is toward greater diversification, with an optimum of from 4 to 6 experience areas in one-teacher industrial arts departments, to 16 and more in the larger schools.

b. The "prevocational", the "ability to do useful things", and the "elementary skills" objectives imply the need for careful instruction in the basic manipulative processes, with tools, machines and equipment representative of actual industrial occupations.

c. The remaining objectives reflect these same principles, (a) and (b), and indicate the need for a rich background of experience with interesting industrial materials and processes, and with the practical realities of creative expression in several experience areas.

3. The more than seventy media and experience areas are normally grouped into five primary areas.

a. The Graphic Arts — drawing, printing and duplicating, book-binding, designing. The latter involves selecting, planning and evolving designs, usually for execution
in one of the other craft areas. Designing is often combined with the craft on which it is applied rather than taught in a separate class.


c. The Metal Working Arts — casting, forming, machining, fabricating metals of various kinds and compositions.

d. The Ceramic Arts — clay, plaster, cement and concrete work.

e. Miscellaneous industrial areas and crafts.

  Electricity — the principles of power, communication, and control devices. A study of household appliances and the servicing thereof.

  Automotive — principles of gas-engine operation; principles and practices of safe driving, and of unspecialized home-maintenance of the automobile.

  Leathercraft — particularly valuable as an effective medium for the application of design and craftsmanship, with little expenditure for equipment and with highly pleasing results.

  Plastics and other modern industrial materials.

4. Controlling factors in the trend toward greater diversification of experience areas.

a. Not more than six (preferably four or five) experience areas can be taught effectively by one teacher, and then only if that teacher is professional, able and alert.

b. The smaller schools should include the several experience areas in a "general shop" of the type appropriate to the nature of the experiences selected.
c. The larger schools, employing more than one industrial arts teacher, should segregate the experiences and provide a physical plant designed about either two or more "Related Activities" shops or a series of "Unit" shops. The greater the number of teachers, the more nearly the shops can approach the "Unit" or single experience type.

d. The "Unit shop" teacher can perform his duties more easily, which should mean greater efficiency, but he is more apt to put specialization ahead of the broader objectives of general education.

e. The ideal of the "general shop" can be reached by routing the student through several "unit" shops, on a schedule of shorter duration than a semester in each.

f. Rotating students through several unit shops allows the use of the same staff and shop equipment for both the exploratory objectives of the earlier years and the more specialized objectives of the later secondary school period. This allows more emphasis on vocational preparation for the vocationally inclined students.

g. The program, of whatever type, should provide some basic experiences in at least the graphic arts area, the woodworking area, and the metals area. Other areas can be included where space and staff will permit.

h. The number of students per class is limited by the space and the equipment available, and by the ability of the teacher.

i. The normal number is 20 to 24 students per class, varying somewhat with the nature of the work and the hazards involved. Efficiency falls rapidly as numbers exceed twenty, especially if the experience areas are highly diversified.

j. The greater the diversification expected of one teacher, the greater the difficulty of finding one competent to render satisfactory
service. Trade-trained teachers are seldom in sympathy with the general shop program.

Since many of the policy-forming criteria just presented point rather specifically toward the "general shop" type of organization, and since the educational trends throughout the country are definitely in that direction, it will be in order to examine the general shop somewhat more closely than merely the reciting of these criteria would do. An earlier chapter gave definitions of several types of general shop organization, listed the accepted objectives of industrial arts and noted especially that those having to do with "exploration" and "a broad background of industrial information" pointed to diversification in the industrial arts program. It is appropriate now to turn to the services performed by the general shop.

The most succinct, and at the same time the most completely encompassing statement about the general shop is in a recent article by Ashley* (2), selected quotations from which will contribute materially to the outline of philosophical criteria submitted above.

Concerning the general forces at work in the whole field of education — forces instrumental in bringing to educators the concept of the "general" subjects in other

* Chief of the Division of Vocational Education, Yonkers, New York.
areas as well as in industrial arts, Ashley (2:177) opens his article with the following statement:

Financial depression and jobless years have cast suspicion on the schools. Up to now the layman has been fairly content with what was done in them. They were, to the average, unavoidable places for a sort of suspended animation to be referred to in afteryears in much the same spirit as one speaks of his operation. Now their cost is noticed, and with a more civic-minded public, curriculums and methods are in the limelight on social agenda.

The harangue of scholars in past decades has kept change imminent but a favorable period had to be awaited for general attention. Now great inventories are made and expert advice is being sought in the hope that a different school program can remedy a bad national crisis and forestall a similar one. The results are a change of emphasis on content and a curriculum keyed to the maturity levels of the children. Subject-matter areas are being leveled off and instead of botany, zoology, physics, and chemistry, adolescents are experiencing general science. Similarly in other fields, one sees a change to general mathematics, general history, general literature, and even general shop to supplant the more specialized manual training. This change from specific to general is one of the most significant educational moves in all time.

This period of "generals" in the field of secondary education is in reality a revolt against over-departmentalization and over-specialization. While the period of the "generals" preceded the recent wave of "integration", both movements have sprung from the same source and seek to accomplish similar ends.

Continuing, Ashley (2:178) indicates the difficulties involved in the transition from the older order of specialized subject matter to the new concept of the "general shop."
But what of attempts to initiate the program? Can one throw down a plan and presto! have a house? Materials at the site are not enough. One must have a builder—someone to coordinate, arrange, and set up — someone who visualizes the outcome. In the school situation the teacher is the builder. What has been his reaction to general courses such as one finds in the program of most secondary schools? While there is much to be said in favor of what is accomplished, it must be observed that teaching is half-hearted in too many cases. The instructor seems confused about what he is trying to do. The former physicist, now a "general science" teacher, too often exclaims, "The whole situation is a mess!" ...."Science can only be meaningful," he says, "when one's learning proceeds in sequential order from certain fundamental laws to large phenomena." He assures you that any method which begins with major outcomes and attempts to teach by working backward into the rules is ridiculous and with such teaching education must break down into a greater defeat than some taxpayers have already attributed to it.....

Is history a school subject the substance of which can be acquired by general reading? The historian says, "No." There is only one way to acquire history, and that is to start with the beginning of man's recorded endeavors and follow them in sequential order to the present. But so-called "social studies" in our schools do not have this approach.

Having addressed the article to shop teachers, and to teacher-educators in the field of industrial arts, Ashley has preferred to illustrate the basic considerations and the different points of view in other fields, that his audience may first have the benefit of impassioned appraisal. It is often easier to see the parallel in a field other than that of one's personal and professional interest — to see that parallel with less prejudice and with a clearer vision. Turning back to the industrial arts field, however, Ashley (2:178) admonishes —
Look at the "General Shop." The industrial-arts situations in our elementary and junior high schools are also undergoing a change. Educational philosophers have impressed school officials and patrons with a need for a greater spread of activity experience than was possible in manual-training woodwork and mechanical drawing, or even machine shop or auto mechanics. They say the industrial activities, materials, and processes are increasing in scope daily and the old routine is too narrow and abstract. It is out of step with present-day living. But what does the teacher say? Like the science instructor, he too is frequently a specialist, a carpenter, a cabinetmaker, a patternmaker, a draftsman, or a machinist. To him the "general" shop is also just a "mess." There is "no rhyme nor reason" to it. Everything is hodgepodge. Nothing is in order. No two pupils are working at the same thing at the same time and no real teaching nor results can attain because one does not go in some sequential manner to a predetermined goal.

The specialist in woodwork is certain that there is but one way to learn. Every boy must be put through a board squaring, planing, sawing, chiseling, boring, jointmaking period before he can even think of a major construction problem of any kind. One should not be concerned with the shape of a house until he can saw boards, drive nails, file saws, read blueprints, fit hinges and locks, etc. Nor should one be thinking of building a cabinet or even a box until he has learned the fundamental tool processes.

What about drawing? Can anyone be a draftsman by taking a course in "general drawing"? The journeyman professor says, "No! Nobody can draw until he knows the fundamental tool procedures. There are certain A, B, C steps that everyone must take, and certain elementary processes to be learned. Any other way is confusion and waste. The logical method is an orderly one in which all pupils begin at the same place at the same time and progress through the same daily assignments." Still educational authorities insist on the "general" in the methods by which children are taught and in the spread of subject matter. Obviously there is a hitch somewhere, and to get at the matter properly one needs to examine first, the objectives of education, second, the method most suited to attain the objectives, and third, the teaching staff. These need but a little scrutiny to show that the difficulty lies with all three.
Since objectives have been considered already, and since a detailed study of method is not within the scope of this study, we shall pass on with Ashley directly to the problem of the general shop teacher. Reference has already been made to the importance of the teacher in any teaching situation, particularly to his importance in the formative stage of any program. Ashley (2:178) continues —

Obviously a teacher who succeeds as a general teacher in any subject-matter area must have much more training than if he confined himself to but a phase of the area such as woodwork, if general shop, or algebra, if general mathematics. Such training cannot likely be had short of long study and experience. Sufficient courses must be taken to enable him to have such a grasp of the subject-matter areas in his field as will assure satisfactory knowledge and skill so pupils will not be frustrated. For example, a teacher of general shop should have had training in a half dozen or more industrial activities, and in addition should understand precisely what he is undertaking and just why his approach is proper. He should know how and why the work should differ from a series of short unit courses given intermittently in the same room to the same pupils at the same time. Further, he must be enthusiastic about the situation of which he has charge as if it were the one and only way to teach. The trouble arises where he doesn't and he isn't.

In developing the "philosophical" criteria, reference is made in Section 4 (d) and (j) on page 86 to the attitude of the trade-trained teacher toward the general shop program. Ashley (2:179) comments on this same phase of the problem as follows:
The word *general* makes the narrowly trained teacher see red. To him it means a breakdown of traditional values (whether proved or not) and a substitution of nothing. Why should he be molested or tolerate this so-called "general" who has appeared on the education front? The teacher has qualified as a subject-matter specialist. He has taught conscientiously and his pupils have mastered their lessons. What the teacher says is no doubt true but the difficulty is that his wares have been too often shelved because so many pupils found no immediate use for them, and worse than this, in too many cases they were of no future use.

As for the *general*, he is not a stranger. He has been with the subject-matter specialist under a different garb — that of method, and was used by him in all his best teaching. . . .

The appellation (general) is simply a reminder that subject matter be presented so as to be meaningful and that it be broad enough in scope to align with and relate to social needs. It implies simultaneous consideration of the several areas in a given field so that there is a greater opportunity for pupil stimulus and response and so that exploration of the various areas may be more possible than when each is considered separately.

Thus the teacher of general shop continues to teach shop subjects but these subjects are selected on the basis of their outcomes or functions in pupil development. They are determined not only in the light of social needs as explorational or prevocational training but as social background for any further study. They are considered for their practical, manipulative outcomes and for their recreational, physical, and avocational values. Various laboratory areas representing shop subjects are set up in a single room where a teacher presides over approximately twenty-five pupils (if a very large room then more pupils and more teachers). The areas are variously named but may be designated as textiles, woods, metals, graphic materials including bookmaking, drawing, and printing), ceramics, electrical automobiles and possibly photography.

Concerning the availability of teachers for the *general* shop program, and contrasting the fitness of
teachers trained under the trade regime or under the older plan of "manual-training", Ashley (2:178) continues --

But what of the instructor in the so-called general teaching? Assuming that he understands that the word background or the word basic may be substituted for the word general as an appellation for any subject area, and for method too, has he sufficient training to succeed with general subject matter? There may be some question about one whose college work antedates the world war. However, most teachers will have taken minors in certain areas of the field in which the major was completed and it will not be difficult for them to organize and teach a basic or general course. Obviously, the broader the teacher's training and experience, the broader he can make his teaching content. If he is truly interested, a summer at college can equip him for a greater spread. The principal criteria of the prewar teacher's success in general teaching are his interest in and desire to use the psychological (pupil-interest) method instead of the logical (curriculum-centered), A, B, C one he has been used to.

But need the prewar teacher be concerned with the psychological method? No, not if he can be shifted to a pupil maturity level where his subject is elected because it is essential in a chosen career. Here he can continue satisfactorily and effectively with the logical treatment of his material.

As for the 1940 graduate who chose to prepare for teaching, he will have had such direction in his college work that he will think in terms of basic course teaching from the beginning if adolescents are to be his concern. His undergraduate preparation will include work representing 50 per cent of his effort in the subject-matter areas of his field while his graduate work will make sure he understands philosophy and method. To him the "general" is the only way and anything else is ridiculous.

Is All Industrial Arts Teaching Henceforth to be of the "General Shop" Type?

Because of the emphasis here placed on industrial arts
as an exploratory medium, and particularly upon the general shop plan of organization as singularly appropriate for the smaller schools and for the earlier years of the secondary school program, it should not be assumed that all industrial arts instruction must henceforth be of the "general" type. Reference was made in Section 4 (c) of the philosophical criteria (page 86) to the possibility that larger schools, employing more than one industrial arts teacher, could organize their programs about either the "related activities" type of general shop, or a series of "unit" shops. The greater the number of teachers employed the smaller the number of experience areas need be included by each teacher. Theoretically at least, as the number of teachers is increased and the number of different responsibilities of each is reduced, the nearer will the various shops approach specialization in a single experience area.

A few of the larger cities pursue this plan rather thoroughly, either by means of the large technical high schools or through the medium of centrally and strategically located facilities for industrial arts and vocational-industrial instruction which serve the entire city. With transportation facilities available, and with the physical plant for the industrial program centrally located, there is no inherent reason why the students of a reasonably large community could not make use of a series of well-
equipped unit shops, each presided over by a competently trained teacher capable of teaching junior high school classes on a short-unit basis for exploratory objectives, and functioning during other hours of the day as a competent vocational instructor specializing in his own particular trade area. That, however, is more of a theoretical possibility than a practical reality, due partly to physical difficulties and principally to the difficulties suggested by Ashley's statements with reference to "specialist" and the prewar-trained teacher.

Concerning the problem of harmonizing the general shop type of instruction and the specific subject-matter type, Ashley (2:179) puts the question as follows —

But, one asks, "Is there no place for specific subject matter without having to mix it up with other areas?" The answer is decidedly yes. Obviously if one wants to be a machinist he should not have to bother with carpentry. If children came into the world with a predestined sphere to occupy as grownups there would be little use for the general in their development and much time could be saved by having all schooling point toward foreordained vocations. However, children are not so predestined. It takes them a long time to know what the world is like and what possibilities or interests society may have. Parents often make the mistake of forcing a vocational choice upon children who are not sufficiently mature for it to have meaning. However, there usually comes a time when the teen-age boy or girl decides to embark on a career. At that time specific subjects have meaning and may be pursued with the best possible results. Sometimes the end may not be reached short of many years of college study. Sometimes the choice leads through a trade or engineering school.
When specific subject-matter areas are chosen, the logical method prevails and the general is used only to the extent that comparisons and illustrations in other areas help to interpret what is being done.

In brief, the public has bought a new bill of fare for its elementary and secondary schools. It has had too many headaches, to say nothing of the stomachaches in sampling for its children the "bewildering a la carte" (credit Mr. Mursell in the December Atlantic) of physics, chemistry, biology, physiology, and so forth instead of a broad course in science; of carpentry, cabinetmaking, electricity, printing, mechanical drawing, textiles, and so forth, instead of a broad course in shopwork, or the "well planned table d'hote." But the chief cooks and waiters (the teachers) have not been properly instructed regarding the properties of what seems the principal ingredient — the general in everything. Consequently they have often shrunk from it as if it were a poison in the menu. As they come to see that general is but a descriptive term representing a quality of service and a blending of foods, it will no longer be formidable. In fact, as they are made aware that the table d'hote education menu contains more than is proper for the growing boy and girl, they will be its best advertisers.

The attempt in this section has been to present a reasonably accurate picture of the general shop program and its service to the field of secondary education. The first examples of the general shop were products of a few isolated teachers, dissatisfied with the results derived from the older form of unit shops, seeking to broaden the base of operations and to introduce more interesting projects as a means of motivating students to higher and broader accomplishments. These early cases were due entirely to the ingenuity and the untiring, devoted service of a few superior teachers. Others, notably the educational
administrators and the guidance experts, seeing the splendid service rendered by these outstanding teachers, began to promote the idea because of its direct contribution to guidance and because, administratively speaking, it was the only practical means available to the smaller schools in their effort to present as broad a range of experience areas as were to be found in the larger city schools.

This early hope of the general educator and the guidance expert was doomed to many years of disappointment before it began to bear fruit. While the outstanding teachers could make a success of the general shop, the main body of industrial arts teachers of that day had been trained under a system of teacher-education or in highly specialized trade pursuits quite contrary to the concepts and the methods of the general shop program. It is only in the past 10 years or less, that the general shop movement has made any pronounced headway. Within the past five years it has gained very rapidly. Much of this increase is due to the increasing attention given to the professional and technical preparation of industrial arts teachers for service in the general shop. Ashley's contrast between the training of the earlier teachers and the program of the 1940 graduates is a clear statement of the case.

Summarizing the concept and the field of service of the general shop, and commenting briefly with reference
to the problem of planning and equipping such a shop,

Ashley (2:180) continues —

The so-called "general" teacher in any area need but recognize that it is his purpose to select from the subject-matter areas of his field those materials which not only are interesting to the pupil, because his background of knowledge — his maturity level — permits him to understand, but which will be most useful to him as incentives and as bases for more knowledge in the field. The general science teacher, as with the teacher of general shop, might well conceive of a laboratory very different from the formal physics or chemistry laboratories which may have been largely dictated by equipment manufacturers. He, too, could have areas or pupil stations representing the various subjects of the whole field.....

The newly arisen general on the education front is seen then as a wise and kind leader who would have us ever realize that the proper bill of fare for children is one which will constantly stimulate their acumen and promote a healthy outlook. He would have us see that it is a carefully selected "table d'hote" of subject-matter areas and that service is kept in line with their abilities to digest. This does not decry the work of the subject-matter specialist. It simply explains that unless it is keyed to the right maturity level, much of it will be useless. The general brings to the pupil of teen age and younger an experience background so that subject-matter areas and the logical method will have meaning.

The General Shop in Action

A general shop, properly organized, and presided over by a competent teacher able to carry out the objectives, the philosophy and the methods of instruction implied, is a place of purposeful activity and vivid enthusiasm. The instruction is of a type suited to the interests and the ability level of the student group rather than of the tradi-
tional type in which each act of each boy must fit into
categorically classified sections, trade content, and trade
method of questionable interest and more questionable value
to the adolescent youth. At least it is the accepted edu-
cational belief that relationships and general background
are of greater value in early adolescence than specific
skills for which the boy is not ready physically, psycho-
logically or by reason of choice. A broad general back-
ground of industrial information, an understanding of indus-
trial relationships — relationships between materials,
between men and machines, between labor and capital, between
different occupations — these are contributions which a
functional general shop program should make to the cause of
society and to adolescent youth.

Ashley (2:179) paints a splendid word picture of the
general shop set-up and the general shop in action. Speak-
ing of the table d'hote concept as contrasted with the
a la carte plan of serving up trade units, he continues:

The general shop situation when similarly interpreted
need not appall the teacher, if he knows the skills
and requirements for the several areas which are set
up and equipped as individual shop units in a large
room. Each area will have from three to six pupil
stations, and all will be arranged in the light of
available literature on shop planning. Pupils will
be divided among the areas in accord with their
interests, abilities, and case histories.

A planning area with drawing boards, tables and ref-
erence materials is available where the projects will
originate under the teacher's guidance and so as to
cut across other areas than the one designated as the pupil's station at the outset. In this way and by constant observation of his fellow students he is initiated in other areas of work. As time goes on he becomes familiar with the materials, tools, machines, and processes to the extent that he has a very good understanding of what actually takes place in modern industrial society. At the same time he becomes better able to know whether or not to plan ahead for any extended training in a particular area with the intention of making it his lifetime vocation.

Perhaps the two greatest difficulties with the general shop program are:

1. The tendency of teachers unfamiliar with its real objectives and functions to consider it an end in itself rather than as merely the vestibule to the door of a highly specialized industrial era.

2. The difficulty of adapting a trade-trained teacher, or a teacher narrowly trained in one or two experience areas, to the philosophy and the methods required for success in the general shop.

It should not be thought that the general shop plan of instruction is a "hodge-podge"; nor that it breeds carelessness and slovenliness. True, these qualities are more apt to be evident if the teacher is not equal to the job; but the teacher whose preparation includes both the subject-matter content (skills, related information, and the ability to perform satisfactorily in the several areas represented) and the philosophy (objectives, field of service, methods) of the general shop, and who can assume any reasonable responsibilities of management and leadership, will do a superior job and render a real service to youth who otherwise have no opportunity to experience the important
industrial occupations and industrial problems of this era. The doors of the industries themselves are closed to youth. Where, except in the general shop, can the boys of the smaller communities gain these experiences?
CHAPTER VI

PRACTICAL GUIDES TO SCHOOL SHOP PLANNING

Floor Areas for Specific Purposes

Floor areas in school shops should be suited to the nature of the work to be done, and to the orderly arrange­
ment of the equipment necessary to accommodate the desired number of students. According to a study by Leaf (17), the average of 56 small general shops — planned and equipped within the five year period from 1934 to 1939, in com­
munities of 1000 to 10,000 population — provided 1600 square feet of floor space in the main shop and approxi­mately 300 square feet in auxiliary rooms. Auxiliary services included finishing rooms, storage rooms, office space, planning rooms, and demonstration-recitation rooms.

This same average shop provided for 22 students per class, or an average floor space per student (including the main shop and auxiliary services) of approximately 86 square feet. This is a conservative and altogether satisfactory figure as a general average, subject of course to modification in its application to shops of different types and for use in varying environments.

It is a safe assumption that the greater the number of experience areas — the greater the diversification — the higher must be the ratio of square feet of floor space
per student. Also the more advanced programs, providing for a more generous use of power equipment, will require a proportional increase in floor space.

Table 5 suggests maximum and minimum limits of floor areas for certain types of shops, consistent with good practice.
<table>
<thead>
<tr>
<th>Type of Service</th>
<th>Area per Student (square feet)</th>
<th>Kind of Floor Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>&quot;UNIT&quot; SHOPS - including main shop and all auxiliary services, storage, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceramics - clay modeling, plaster, cement and concrete</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Drafting</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Printing</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Metal Working</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General metal</td>
<td>65</td>
<td>85</td>
</tr>
<tr>
<td>Flat and art metal</td>
<td>55</td>
<td>80</td>
</tr>
<tr>
<td>Forging and welding</td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td>Foundry</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Machine shop</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Woodworking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bench work, no power mach.</td>
<td>50</td>
<td>75</td>
</tr>
<tr>
<td>With power machines</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Automobile Mechanics</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Electricity and Radio</td>
<td>35</td>
<td>60</td>
</tr>
<tr>
<td>General Crafts</td>
<td>35</td>
<td>60</td>
</tr>
<tr>
<td>&quot;GENERAL&quot; SHOPS - including main shop and auxiliary services, storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Composite&quot; - diversified</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>&quot;Related Activities&quot;</td>
<td>65</td>
<td>100</td>
</tr>
</tbody>
</table>
TABLE 5 (Continued)

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>Area per Student (square feet)</th>
<th>Kind of Floor Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Multiple Unit&quot;</td>
<td>Minimum 75</td>
<td>Maximum 100</td>
</tr>
<tr>
<td>&quot;Graphic Arts&quot;, including printing</td>
<td>Minimum 55</td>
<td>Maximum 100</td>
</tr>
</tbody>
</table>

These suggested ratios of floor space to class enrollment (square feet per student in class) will assist the architect and the industrial arts teacher in determining the major allocation of space required for a given set of conditions. While the suggested limits are not absolute, they reflect normal, average conditions for satisfactory service in the several different experience areas. The minimum limits can be used only for application to very elementary work, while the maximum limits are suggested as reasonable recommendations for the more advanced programs.

The difficulty of applying any absolute standard should be apparent. Conditions vary so widely — conditions of enrollment, of subject-matter combinations, of experience areas included, and countless others — that a truly standardized set of circumstances seldom prevails. Enrollment, for example, will materially increase the space
required, smaller enrollments per class tending to shift the space requirement toward the upper limits, and vice versa. This is recognizable from the fact that certain auxiliary services and certain pieces of general equipment require approximately as much space for a class of ten students as for a class of twenty. In woodworking, for example, the same miter-saw, the same glue bench, and the same circular saw will serve the larger class as well as the smaller group. The proportional floor area decreases therefore as the enrollment increases.

Auxiliary Rooms and Services

Practice varies greatly in the amount of space apportioned to auxiliary rooms and services. Apportionment between the several experience areas included in the main shop, or in sub-divisions of the main room, usually offers little difficulty. Many schools will prefer to give major emphasis to woodworking experiences, a fitting preference for Oregon schools in that Oregon is the center of the largest lumber producing area of the United States. So long as timber is a major product of the state, and so long as a relatively high percentage of the population is employed in the lumbering industry and related occupations, it is just as reasonable for Oregon schools to stress the use of this native raw material as for Detroit (Michigan) schools to stress metal work.
The proportional distribution of space between the various experience areas will, therefore, be suggested by the relative emphasis given to those experiences, and by the number of students to be accommodated by each. The greatest difficulty usually comes in the apportionment of space to the auxiliary services — wood finishing, library, office and planning areas, storage space, and other such necessary services. Whenever skimping occurs, it is usually these services that suffer most severely.

In his "Survey of Present Practices in School Shop Planning," Leaf (17:76) calculated the average floor space devoted to twenty different auxiliary services. Since several of these services were rather unusual, seldom found in any great number of shops, and since others were odd combinations of two or more services in one space, reference here will be confined to those auxiliary services of greater importance to the average school shop. Table 6 lists the usual auxiliary services showing both the average area provided for each and the average number of square feet per pupil. Since Leaf's findings were based upon an "average enrollment" of 22 pupils per class in his hypothetical "average shop", it should be remembered that a physical plant designed for a different number of students will need to make use of the area-pupil ratio rather than the total area shown for the average of the shop in Leaf's survey.
TABLE 6

Areas Devoted to Auxiliary Services

From a survey by Leaf (17:76) of 56 newly constructed general shops. These "averages" are based upon the areas in the shops, and upon an average enrollment of 22 students per class.

<table>
<thead>
<tr>
<th>Auxiliary Service</th>
<th>Average Area</th>
<th>Area per Pupil in Shop Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library-planning room - - -</td>
<td>321.2</td>
<td>14.6</td>
</tr>
<tr>
<td>Supplies in general - - - (including lumber)</td>
<td>228.3</td>
<td>10.4</td>
</tr>
<tr>
<td>Lumber, stored separately -</td>
<td>193.3</td>
<td>8.7</td>
</tr>
<tr>
<td>Project storage - - - - -</td>
<td>121.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Locker room - - - - - - -</td>
<td>110.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Finishing-project - - - - - -</td>
<td>221.0</td>
<td>10.0</td>
</tr>
<tr>
<td>(including drying room)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finishing (only) - - - -</td>
<td>106.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Tool room - - - - - - -</td>
<td>109.6</td>
<td>4.98</td>
</tr>
</tbody>
</table>

Like the average floor areas for the different services reported in Table 5, the "average area" per pupil for the auxiliary services reported in Table 6 will vary considerably according to the particular circumstances. Especially will they vary with the combination of services or experiences in a given shop.
Lighting the School Shop

Proper lighting of the school shop is too often left to chance, and too frequently judged in competition with darkness rather than in comparison with ideal lighting conditions.

Since the shop requires more space than a standard classroom, and is therefore likely to have some portions farther from the source of natural light (especially if windows are along one side only), it follows that the ceiling height should be about 12 feet and that the windows should extend entirely to the ceiling. The higher the windows the deeper the penetration of light into the room. To cut down the ceiling height or to lower the window top by dropping it below the ceiling, decreases the efficiency of natural lighting with extreme rapidity.

For natural lighting, the ratio of the area of glass to the floor area is the usual standard of measure. Here again the ratio alone is not a sufficient standard, as the depth of the room from the nearest light source, the ceiling height, the color of ceiling and walls, and many other factors help to determine the adequacy or inadequacy of light.

The ratio of glass area to floor area is covered by legislation in a number of states. In five states schools
are required to provide glass in the exterior walls in the ratio of 16.6% (one to six) of the floor area. Thirteen other states require 20% (one to five), two states 25% (one to four), while the remainder of the states leave the matter of natural lighting to the judgment of architects and school officials.

In the judgment of many architects, the ratio of one to five is ample for effective lighting and allows better architectural treatment than the extreme ratio of one to four. Much depends, however, upon the height of the ceiling, height of the windows, depth of the room, and color of the walls.

For efficient natural lighting, the height of the window sill is not so important as the height of the top of the window. Raising the window sill does not cut off light from the back of the room so rapidly as dropping the window top. Other things being equal, therefore, the window sill can be four feet from the floor, allowing a more efficient use of the space adjacent to the wall for the placing of cabinets, work benches, machines, and other items of equipment.

Artificial Lighting in the School Shop

While much progress has been made in the science of artificial lighting, schools have been notoriously slow
in changing present lighting equipment or in installing thoroughly modern equipment in new school buildings. Since most school work is traditionally a day-time job, and since tax payers are more conscious of costs than of efficiency, it is perhaps natural that lighting has been left to nature and to chance. The following editorial from the Architectural Forum (9) portrays the conditions of lighting in public schools. The editorial reads in part:

Five million U.S. school children — one out of every five — have defective vision.

Throughout the land, schools have been installing "sight-saving" class rooms, yet a survey of these showed that 185 out of 232 (79%) had lighting intensities below a minimum set by the Illuminating Engineering Society and the American Institute of Architects, and that minimum was approximately one-third of what it should have been...... Experts agree that the best possible light is that in the shade of a tree at noon on a clear June day. What are the characteristics of this illumination? It is evenly distributed, with no glare and no bright source visible. It has an intensity of more than 500 foot-candles.

Illumination engineers, through experiments carried out in industry, have long since proved that fatigue comes as readily from eye-strain as from physical effort associated with more vigorous labor, that industrial workers are much less subject to accidents, and that the efficiency of their work is greatly increased by an improvement in illumination designed to give light of a quantity and quality to eliminate eye-strain. The larger industries
have recognized that "human beings operate as human seeing-machines" (18), that, while the human eye is a marvelous instrument for making adaptations to varying conditions of light, the greatest efficiency can be had when the eyes of workmen are not under constant muscular strain necessary when these adjustments must be made over unreasonable limits. If industry finds better light productive of more and better work, may it not be that schools would find a similar situation? This would seem to be of especial importance since school work requires so much of the eyes for fine concentrated work over periods as long as those required of factory workers. Reading fine print for any length of time is more tiring than many types of industrial employment.

This belief is borne out by the report of an experiment in school lighting, covered by another portion of the same editorial (9) referred to previously, as follows:

An experiment made over a three-year period in Tuscumbia, Alabama, provides an example. Two exactly similar classrooms and two classes as nearly similar as possible were taken as the basis of this experiment. In Classroom "A" there were two 150 watt ceiling type direct sources controlled by a wall switch. In Classroom "B" were installed four 300 watt totally indirect fixtures controlled by a photo-electric switch. In Room "A" the amount of light was, at night, 2 foot-candles on the row of desks nearest the walls and 6 foot-candles on those in the center of the room. In Room "B" the amount, at the same period, was from 12 to 14 foot-candles on the tops of all desks. During the three-year period, there were 28 failures out of 115 pupils in Room "A" and only 9 out of 112 in Room "B". Teachers testified that holding the attention of the children
was much easier in Room "B". The additional cost of electricity per year from Room "B" was $24.33, or $73 for the three-year period. The cost of education of each pupil was $28 per year. During the period, the better illumination reduced the number of failures from 28 to 9. This leaves a difference of 19. To put these 19 pupils through a year's course for the second time, therefore, cost a total of $532 against the expenditure of $73 for extra electricity. No cost is given for the original change in lighting equipment, but this saving would amortize any such cost in short order. What saving might have been had the new illuminating system been of really adequate intensity and distribution it is impossible to say.

While some of the processes carried out in the school shop may not be quite so tiring as the continuous reading of fine print, it is nevertheless true that many of the processes require critical vision and should be performed only under favorable light conditions.

Ideally, the adequate natural light provided by the windows should be supplemented by adequate artificial light designed to take care of the situation on dark days, or in the early morning hours and late afternoon of the winter season. In the northern latitude in which Oregon is located, and particularly because of the many cloudy days of the winter season, lights are a necessity even in mid-day. Preferably, the artificial lighting should be of the indirect type, with localized direct light wherever it is needed to supplement the general indirect light. The general level of illumination should never be less than 25 foot-candles at the working surface. For many types of
work it should be as high as 50 foot-candles. One hundred foot-candles would not be excessive under any conditions, provided the quality of the light and the nature of the surrounding surfaces eliminate glare. In that respect indirect lighting is almost impossible unless the shop has a light ceiling surface to diffuse and distribute the light through the room. While gloss-paint and varnish stay clean longer than flat finishes, glossy surfaces are more apt to cause eye-strain because of reflected light. A surface covered with "flat" paint will reflect as much or more light than a glossy surface, but the light is diffused in such a manner that glare is eliminated.

Luckiesh (18) after considerable experimentation with industrial workers, suggests lighting standards as follows:

Ultra-conservative specifications, easily obtainable by a system of general plus local lighting call for:

100 foot-candles or more — For very severe, prolonged tasks, such as fine needlework, engraving, assembly, sewing on dark goods and inspection.

50 to 100 foot-candles — For severe, prolonged tasks, such as proofreading, drafting, fine machine work, average sewing.

25 to 50 foot-candles — For moderately critical, prolonged tasks, such as clerical work, common bench work, average sewing.

10 to 20 foot-candles — For moderate, prolonged tasks in office and factory.
In view of the circumstances cited by the Architectural Record (Tuscumbia, Alabama, experiment) and of the increased efficiency of industrial workers as shown by numerous experiments with lighting, it seems appropriate to quote Luckiesh and Moss (19) as follows:

Furthermore, the new goal of seeing easily, instead of barely seeing, has revealed the necessity for an entirely new order of magnitude of foot-candle recommendations. Lighting of the past has been in competition with darkness. The new concepts place it in competition with daylight intensities. Recommendations of 5 to 10 foot-candles are ridiculously inadequate when researches in seeing indicate that 100 foot-candles for reading and 1000 foot-candles for sewing on dark goods are conservative from the viewpoint of easy seeing for human seeing-machines.

Shape of Shop Rooms

Efficiency of natural lighting would indicate a preference for long, narrow rooms, so as to reduce the depth which light must penetrate from the window to the rear of the room. There is, however, a practical limit to the ratio between the length and the width of a room if one takes into consideration the efficiency of equipment organization and the ease of teaching. Long, narrow rooms are difficult to organize properly, and student work is difficult to supervise when distances are too great.

Ideally, the length of a shop should never be more than twice its width. Practical circumstances sometimes
dictate ratios as great as one to three, but certainly
that should be the limit. Even then the instructor will
be working under a handicap considerably greater than if
the ratio would allow more compact arrangement.

Extremely wide shops, unless they are lighted from
both sides, will require a higher percentage of artificial
illumination during the working day. One of the limiting
factors in the size of the shop, assuming there might be
circumstances in which an extremely large shop would be
required, is the matter of adequate natural lighting.
This becomes a critical factor if the light must come from
one side only. Where windows can be placed on two or more
sides, this problem is proportionately decreased. One
should not, however, assume that the ideal shop is one
with practically the whole surface of the four walls taken
up by windows. Such extreme illumination is usually un-
necessary and wall space is so valuable for certain types
of equipment — cabinets, bulletin boards, blackboards,
tool panels, storage racks — that a shop which is "all
windows" offers problems as difficult as the one with
insufficient illumination. The latter situation could at
least be remedied by providing artificial illumination of
the proper amount and quality. The former could not be
corrected in any satisfactory manner.
It should be clear that the shape of the shop (ratio of width to length) is important both with reference to the organization of the equipment and to the ease of teaching, as well as to the efficient use of natural lighting. Ratios between 1 to 1 1/2 and 1 to 2 1/2 are preferred. One to 1 1/2 or 1 to 2 seem to be as nearly ideal as one could wish, under normal circumstances.

Floor Surfaces

Two types of floors are used more commonly than all others combined. The wood floor, preferred for most types of shop work, is deserving of that preference because it is less fatiguing to the teacher and the students than a concrete floor and less destructive to the tools which may be dropped on it. Concrete should be used as a floor surface only where fire hazard or some special requirements of the work demand concrete.

Preferred types of floor surfaces were indicated in Table 5. Concrete floors are specified for the ceramic laboratory, because of the greater ease of cleaning; for the forging and the welding area and for the foundry because of fire hazard. It will be noted that alternatives are suggested in some cases.

For foundry work, if the program contemplates the pouring of metals whose melting points are above 600
degrees, concrete will not be a highly suitable floor surface for the pouring area. There is too much danger that spilled metals will cause surface explosions in the concrete, endangering student workers and spoiling the floor surface. The floor for foundry pouring areas, for metals with higher melting points, should be of firmly packed molding sand.

While the entire machine shop floor is frequently of concrete, better practice is to use concrete foundations for the machines, with a wood floor or wood-blocks-on-end for the remainder of the shop. This applies particularly to the specialized or "unit" machine shops, where the floor must be quite substantial. The greatest objection to independent concrete foundations for machines is the fact that future modifications or the replacement of worn and obsolete machines in later years might be hampered somewhat if the old foundations were not in agreement with the new requirements. Perhaps the most satisfactory floor for a machine shop is a first quality job of wood-blocks-on-end, laid in mastic on a concrete sub-floor at least four inches thick.

Floors for the "general" shops of Table 5 are indicated as wood and concrete combinations. Concrete will be used wherever fire hazard or the nature of the service in a particular area indicates the need for that type of
floor surface. In all other areas preference will be for a sturdy wood floor, or for wood-blocks-on-end laid in mastic over a concrete base.

Since the blocks-on-end are not so common in Oregon as in the eastern states, and since heavy flooring or car decking is readily available at comparatively low cost, most Oregon architects and contractors will prefer to lay a heavy floor of vertical grain car decking or mill flooring on fir joists of suitable size and spacing to give the strength and rigidity required for good service. Shop floors should be perfectly rigid and should be designed by the architect to carry the combined load of equipment and students without noticeable vibration, and certainly without sagging.

Guiding Principles for Organization of Shop Equipment

Following is a list of guiding principles helpful to the teacher in organizing the equipment in a school shop. While some of these principles are pointed specifically toward certain types of shops, most of them will apply to many situations.

1. All parts of the shop should be visible to the teacher.

2. Whenever possible avoid building a store room, a finishing room, or some other auxiliary service area into the corner or side of a shop so that it will break up the main area into an "L" shape.
3. So far as possible service areas, such as store rooms, lockers, and similar auxiliary services, should be along one side or one end of the room, arranged in a manner to leave the fewest recesses, corners, and odd spaces.

4. Auxiliary rooms or areas should be conveniently located in terms of their relationship to the main room, and particularly to machines or other items of equipment most closely related to a given auxiliary space.

5. The finishing room should be as far as possible from the circular saw, planer, jointer, and other dust-making machines.

6. The lumber storage room or rack should be convenient to an outside entrance for receiving lumber and heavy supplies, and also convenient to the machines or the cutting area in which the lumber will be first used.

7. The whole shop should be organized with reference to the line of flow of the raw materials, from the stock room to the various work stations and finally to the finished article.

8. When possible, lockers should be recessed or built in along a wall. If not recessed, they should extend to the ceiling, the higher portion being enclosed by cupboard doors that the space might be used for general storage purposes. Otherwise the tops of lockers become general "catch-alls."

9. Batteries of lockers can sometimes be arranged under balconies, with the space above used for project storage — for items too large to be accommodated by the lockers themselves.

10. Lockers, store rooms, and other services requiring less light should be placed in the darker portions of the room.

11. It is convenient to have the lockers near the entrance to the room, if this can be done without violating good practice in other respects. Students may then come and go with the minimum amount of travel.
12. The "line-of-flow" of students is even more important than the line-of-flow of raw materials. Equipment should be arranged to permit free passageway from one point of the shop to another, with due consideration for width of aisles along the main lines of passage.

13. Each shop should be provided with adequate bulletin boards for the display of notices, plans, project drawings, and other materials pertinent to shop teaching.

14. Each shop should have a demonstration area, ample in size for the whole class, and provided with seats (fixed or portable), in which demonstrations and class discussions can be conducted as required.

15. A blackboard of ample size and good surface quality should be adjacent to the demonstration area. Smaller blackboards may be required in other areas of the shop.

16. In a "general shop" organization, an auxiliary planning or consultation room sufficient in size to accommodate the whole class, or at least the largest sub-division of the class represented by any one activity included in the shop, should be provided that the teacher may carry on discussions with any activity group while other groups are at work.

17. This "recitation area" may be combined with the planning area, if space must be conserved and if the use of the planning area is not so intensive as to exclude its use for recitation purposes.

18. In the smaller shops, the teacher's office is frequently combined with the library-planning area.

19. Transparent partitions should be used between the auxiliary rooms and the main shop whenever those auxiliary rooms will be used for any major degree of student work.

20. The main shop should be accessible to a driveway, with at least a five-foot door opening to the drive. Nine-foot doors are required for auto-mechanics and farm shops.
21. So far as possible, provision should be made for the centralized control of supplies.

22. Tools and equipment used only in one place should be located as near that place as possible. Example: circular saw blades and attachments for the saw should be arranged on a tool panel or in a cabinet convenient to the saw bench. Other things being equal, there is no reason to keep this equipment in a remote tool room.

23. Open tool panels, or tool cabinets so arranged that they may be thrown completely open when classes are in session, with special racks and/or painted silhouettes for all items, require less student and teacher time to administer than do less accessible tool rooms and cabinets.

24. Tool storage facilities should be adequate, located at convenient points, and as nearly self-administering as possible. Every item of equipment should have a "home station." Both the tool and the home station should be identifiable in a way that there can be no mistake in returning it to the proper place.

25. If the shop has several tool panels or tool cabinets, the tools and their corresponding silhouettes in one may be painted black; in another, red. Use contrasting but pleasing colors.

26. When painting tools to match silhouettes in different cabinets, select some readily visible portion of the tool. It should also be a portion which can be painted readily without affecting the general appearance or the usefulness of the tool. Likewise, it should be a surface protected sufficiently that the paint will not wear off readily. All painting should be neatly done.

27. All machines should be arranged on solid footings, separate bases being required only if the floor is not sufficiently strong.

28. Machines commonly used in sequential order should be placed with due regard to the natural flow of stock through those machines.
29. Machines and power driven equipment should be self-contained wherever possible. Individually motorized equipment lends itself to much more flexible arrangement in the shop, is safer to use because of the elimination of exposed belts and line shafts, and is more sightly.

30. Locate machines such that the working space around them will be ample, taking into consideration the dimensions of the lumber or other stock which will be used with those machines.

31. Avoid having lumber from the "on-feed" or the "off-feed" side of a machine project across the main-travelled aisles.

32. Paint safety zones around dangerous machines and require students other than the operators to stay out of those zones when the machines are in use.

33. All machines should be equipped with the best of modern safety devices, kept in good order and used consistently.

34. Shop equipment should include at least one fire extinguisher, strategically located and easily reached. Keep it filled and ready.

35. Provide sealed containers for inflammable materials — containers with reasonably close-fitting covers, easily removed and replaced.

36. Cover the tops of all finishing cabinets with galvanized sheet metal. Require all rags or absorbent paper used for wiping up or cleaning off surplus finishing materials to be placed in a suitable metal container. Keep that container in the finishing room rather than invite trouble by making it inconvenient to carry out this rule.

37. Provide vents for fumes, injurious gases, and if necessary equip these vents with exhaust fans. An exhaust fan is especially necessary in a spray booth for finishing materials. Common household fans should never be used for corrosive or explosive fumes. Motors should never be in the air stream or line of fumes.
38. In case of doubt on any architectural problem — consult an architect.

39. On electrical problems, consult a competent electrical contractor. Do not attempt major wiring jobs unless you have an electrician's license.
CHAPTER VII

EXAMPLES OF SHOPS PLANNED FOR SPECIFIC COMMUNITIES

The preceding sections of this study have presented the basic concepts and the guiding principles of school shop planning. It is the purpose of this chapter to illustrate those basic concepts and guiding principles with several examples of school shops planned to meet specific circumstances in different communities presenting a wide variety of local conditions. Some of these examples apply to large communities, some to small; some apply to elementary school work under conditions essentially equivalent to a "unit" shop, and some to widely diversified "general" shops.

In selecting these various examples attention has first been given to the illustration of types. Each example is truly a typical case study.

These selected examples cover the following types and cases:

1. An elementary school (seventh and eighth grade) shop, featuring woodworking experiences as the principal instruction area.

2. A pair of floor plans, showing the "before and after" views of a development in a small school. This case illustrates the type of planning required when a preliminary survey indicates adequate space might be made available by a possible reassignment of space in an existing building.
3. A pair of plans showing a "before and after" study of the possibility of expanding and improving a program by more efficient utilization of space already available.

4. A "laboratory of industries" development, with unusual diversification in a "general metal shop."

5. A "multiple shop" development for a community able to support two or more instructors and to organize the shop program on a "related activities" basis, employing three basic shops.

6. A recommended basic plan for a "composite general shop." Suited to the needs of a typical Oregon school employing one full-time industrial arts teacher.

1. **Standard Plan for Portland Elementary School Shop — Seventh and Eighth Grades**

With the major activity centered about woodworking, quite natural indeed for the schools of the major lumber-producing state of the United States, this grade school shop of the Portland system is more or less typical of the limited range of experience areas included in the majority of Oregon school shops. Provision is made for a small amount of simple metal work, limited almost wholly to simple flat metal work bordering on the "artistic", and to very effective and altogether satisfactory work with tin salvaged from cans.

While the plans do not mention the fact, provision is also made for leather craft and for simple electrical work. One familiar with shop work, and particularly with
the planning of school shops, recognizes that these experiences can be conducted on the usual woodworking benches, supplemented of course with the necessary specialties in the form of small hand tools and minor equipment of other sorts.

While the Portland grade school shops are quite typical of the "range of experiences" in the majority of Oregon schools, the well-planned and carefully executed physical plants of these shops are not at all typical of the smaller school shops of the state. Too many of this latter group are still in the "basement" stage, some actually in abandoned woodsheds, and others in separate buildings of the so-called "portable" type. Too often the equipment is inadequate, the arrangement poor, and ideals are lacking.

The plan of the Portland elementary school shop is submitted here as an illustration of a well-ordered, neat, efficiently arranged, and thoroughly satisfactory unit of its type. While it contains no power machinery, and the storeroom facilities are somewhat smaller than might be required of an isolated school without the benefit of a central stores department like that available in the Portland system, 50% of the small schools of the state would do well to pattern their shop organizations along the same general lines. Since most of these smaller schools would not need to plan for an enrollment of 24 students
per class, this same basic shop would provide sufficient space for the inclusion of some power machines, and perhaps for the enlargement of storeroom facilities to accommodate a supply sufficient for even the isolated school.
STANDARD PLAN
FOR
INDUSTRIAL ARTS SHOPS
PORTLAND GRADE SCHOOLS
PORTLAND, OREGON

SCALE 1/4" = 1'-0"
The pair of drawings accompanying this section illustrate the development of facilities for industrial arts in the Monmouth High School. Plate No. 1 shows the ground floor plan of the high school building as it was in 1930. The two playrooms and the janitor's workroom were relatively little used. Used more intensively when the one building housed both the elementary and the high school activities, these rooms had been assigned to playroom and storage service with the development of a new elementary school.

A survey of the actual use of these rooms indicated such low intensity of use that the administration agreed to a "trial balloon" with a small shop program assigned to the space previously occupied by the janitor as a workroom. After two years of experience with a minor industrial arts program in that single room the community expressed an interest in expanding the program. The plans shown on Plate No. 2 were based upon a survey conducted jointly by the instructor in charge and the industrial arts department at Oregon State College. The proposals were accepted by the school board and put into effect in the year 1933-34. The accompanying legend sheet lists the details of equipment.
### LEGEND FOR MONMOUTH PLAN - PLATE 2

**LEGEND SHEET 2**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Double Benches - storage below</td>
</tr>
<tr>
<td>2</td>
<td>Wall Benches - storage below</td>
</tr>
<tr>
<td>3</td>
<td>Entrance</td>
</tr>
<tr>
<td>4</td>
<td>Bulletin Board - on brick flue</td>
</tr>
<tr>
<td>5</td>
<td>Waste Box</td>
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<tr>
<td>6</td>
<td>Tool Cabinet - lockers below</td>
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<tr>
<td>7</td>
<td>Supplies Cabinet</td>
</tr>
<tr>
<td>8</td>
<td>Gluepot - electric</td>
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<tr>
<td>9</td>
<td>Jointer - medium Wallace</td>
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<tr>
<td>10</td>
<td>Wood Lathe - 14 inch swing</td>
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<tr>
<td>11</td>
<td>Band Saw - 20&quot;</td>
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<tr>
<td>12</td>
<td>Saw Filing Clamp</td>
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<tr>
<td>13</td>
<td>Table Saw - direct drive</td>
</tr>
<tr>
<td>14</td>
<td>Machinists Vise</td>
</tr>
<tr>
<td>15</td>
<td>Wood Lathe - rigged for sanding, etc.</td>
</tr>
<tr>
<td>16</td>
<td>Miter Saw</td>
</tr>
<tr>
<td>17</td>
<td>Blackboard - magazine rack below</td>
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<tr>
<td>18</td>
<td>Broom Rack</td>
</tr>
<tr>
<td>19</td>
<td>Book Shelves - lockers below</td>
</tr>
<tr>
<td>20</td>
<td>Records Desk - lumber - supplies - attendance, etc.</td>
</tr>
<tr>
<td>21</td>
<td>Clamp Rack</td>
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<tr>
<td>22</td>
<td>Benches - metal covered - shelves below</td>
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<tr>
<td>23</td>
<td>Shelves - materials</td>
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<tr>
<td>24</td>
<td>Turn Table</td>
</tr>
<tr>
<td>25</td>
<td>Sink - large size</td>
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<tr>
<td>26</td>
<td>Towel container - waste container</td>
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<tr>
<td>27</td>
<td>Blackboard</td>
</tr>
<tr>
<td>28</td>
<td>Desk - teacher's</td>
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<tr>
<td>29</td>
<td>Chairs - desk arm type</td>
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<tr>
<td>30</td>
<td>Drawing Tables</td>
</tr>
<tr>
<td>31</td>
<td>Book Cabinet - glass doors</td>
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<tr>
<td>32</td>
<td>Work Table - layout</td>
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<tr>
<td>33</td>
<td>Paper Roll</td>
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<tr>
<td>34</td>
<td>Lockers</td>
</tr>
<tr>
<td>35</td>
<td>Clothing Hangers</td>
</tr>
<tr>
<td>36</td>
<td>Door - seldom used - bulletin board on inside</td>
</tr>
<tr>
<td>37</td>
<td>Girls' League Room</td>
</tr>
<tr>
<td>38</td>
<td>Girls' Rest Room</td>
</tr>
<tr>
<td>39</td>
<td>Girls' Toilet and Wash Room</td>
</tr>
<tr>
<td>40</td>
<td>Ping-pong Table</td>
</tr>
<tr>
<td>41</td>
<td>Boys' Wash Room</td>
</tr>
<tr>
<td>42</td>
<td>Boys' Toilet</td>
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<tr>
<td>43</td>
<td>Fuel Storage</td>
</tr>
<tr>
<td>44</td>
<td>Furnaces</td>
</tr>
<tr>
<td>45</td>
<td>Hot Room - heating system</td>
</tr>
<tr>
<td>46</td>
<td>Fan - heating system</td>
</tr>
<tr>
<td>47</td>
<td>Fan Motor</td>
</tr>
<tr>
<td>48</td>
<td>Main Brick Flue</td>
</tr>
</tbody>
</table>

Shop has wood floor - the lumber - finishing and drawing rooms concrete. All interiors light cream walls and ceilings - balance all in light gray. Shop equipped with six 150 watt lights - individual controls.
The acceptance of the proposal depended largely upon a satisfactory disposition of the restroom facilities for girls without an undue cost of moving the toilet facilities. Please note these arrangements on the second plan, especially the means of access proposed for the girls' league room so as to remove that entrance as far as possible from the space immediately adjacent to the boys' restrooms. Also note the proximity of the plumbing connections for the new restroom location to connections already established in the boys' restroom. A preliminary survey of the service connections for the building showed the waste line for the plumbing to be located immediately below the proposed re-location site for the girls' toilet.

With this major item of expense disposed of satisfactorily, the reorganization of that portion assigned to the Industrial Arts Department was of much less consequence. The result was an improved efficiency in the use of the entire physical plant, and the development of a department of which the school and the whole community is justly proud. It has been rated by the State Department of Education as Oregon's outstanding industrial arts department in schools of its size. The Monmouth high school employs six teachers, has an average daily attendance of 101 students. The industrial arts teacher devotes about
three-fourths time to instruction in the department, the remainder to mathematics and world history.

3. Illustrating the Reorganization of an Existing Department, Providing for an Improved Organization of the Physical Plant and an Expansion of the Number of Experiences.

There are at least ten times as many opportunities for the improvement of an existing plant as for the construction of a new one. While it is not recommended merely for the sake of "making a show", the wide-­awake, conscientious and professional teacher will often find an opportunity to materially improve the physical plant of a school in which he may have only recently accepted employment. The old adage that a new broom sweeps clean applies to a school shop as well as to other situations. The incoming teacher may see ways and means of improving a situation that the former teacher failed to see.

The next pair of drawings illustrates a reorganization program recommended for the old Corvallis Senior High School (now the Junior High School) some years before the construction of the present Senior High School building. The recommendations were made in 1929, accepted in part by the school board, and carried out in time for use in the school year of 1929-30.

Mention was made in connection with the Monmouth plan, of the expense of moving toilet facilities. It will be
noted by comparison of the "present" (1930) and the "proposed" plan for the Corvallis improvement program that the moving of the boys' toilet was a part of the proposal. That, incidentally, was the stumbling block to the full acceptance of the whole plan.

In the Corvallis proposal, as in the Monmouth plan, connections were already available at the proposed relocation site of the toilets. The move could have been made at a reasonable cost. The objection registered was not so much because of the cost involved as because one member of the board — a member who had served many years — recalled that the toilet, only a few years before, had been moved from the proposed relocation site to its "present" location. The move was made then because the space at the earlier location was insufficient.

While the proposal took into consideration the insufficiency of the original space and suggested a means of remedying the situation by decreasing the adjoining room where the space was not required, the relocation of the toilet was not approved. The general metal shop was lost.

These details are cited only to illustrate the small points upon which proposals sometimes turn. Had these plans been submitted one year later, after the expiration of the term of office of the one board member, the chances are they would have been accepted in their entirety. As
it is, the change was never made, except in so far as it affected the general woodworking shop, where a sweeping reorganization in accordance with these proposals gave a material improvement, eliminated many dead corners apparent in the old plan, increased the efficiency of use, and also increased the amount of space available for the department.

These drawings are submitted in illustration of the value which often comes from replanning and reorganizing a shop. Such a program should be based on a survey of the use of existing space in the building, particularly space adjacent to the shop quarters. Proposals should be checked in detail, presented to the principal and the superintendent (or other officer immediately responsible for the supervision and approval of such proposals), with an estimate of the approximate cost in so far as the teacher is able to prepare those data. Careful presentation of the proposals, with a thorough-going consideration of all details beforehand, will assist in winning for the teacher the support of the superintendent and principal. Following that, detailed estimates on larger jobs may be arranged with a contractor or an architect and the proposal submitted to the superintendent, for presentation to the board.
4. A "Laboratory of Industries" Development

Reference was made in the definitions of terminology, and elsewhere in this study, to the "laboratory of industries" plan of shop development. This term, originated by Warner of Ohio State University, is applied to a highly diversified type of general shop in which the emphasis is on the laboratory technique and student personnel management to a slightly higher degree than in most other types of general shop programs. While there is nothing in the terminology itself which would imply this sort of treatment, and while there is also the same relative need for an efficient personnel organization in other types of "general shop" programs, the "laboratory of industries" terminology has come to be associated with these two points — a higher degree of diversification, and student personnel management.

The plan of the Tucson (Arizona) Senior High School "general metals laboratory" is included in this study to illustrate the extreme diversification carried out in the laboratory of industries program. While this plan embraces only the metals experiences, including pattern-making as a closely related auxiliary service, there are at least ten major experience areas and some minor services. The shop is planned for 60 students and three instructors.
VENT 1

MELTING FURNACE

FOUGDRY

FORGING

INSTRUCTORS

DESKS

WASH BASIN

BLACKBOARD

SCREEN

iventilation: COMPLETE AIR CONDITIONING.

PARTITIONS--MADE OF STEEL UP 42" AND DOUBLE STRENGTH GLASS TO CEILING.

LIGHTS--LOUVERED LIGHTS OVER ALL MACHINERY.

MACHINERY--FLUORESCENT LIGHTS OVER TABLES AND BENCHES.

SERVICE--GAS, BUR, AND POWER OUTLETS AVAILABLE THROUGHOUT THE LABORATORY.

SUPPLIES--DISTRIBUTED FROM ONE STORAGE ROOM.

PUPIL CAPACITY--SIXTY PUPILS.

INSTRUCTION--THREE INSTRUCTORS.

NOTES

PERSONNEL--C. A. CARSON

SUPT. OF SCHOOLS--C. E. ROSE

CONSULTANTS--E. W. WARNER AND W. BOLLINGER

PLANNED BY--ELLIOTT C. HUTTON

GENERAL METALS LABORATORY

TUCSON SENIOR HIGH SCHOOL

1940

1 2 3 4
There are numerous vary excellent features to be found in this plan. Space is not at a premium, and the organization of the equipment is excellent. The equipment itself is of a quality and quantity that would appeal to any shop teacher. It is a plant of which the community can well be proud. On the other hand, according to usual standards it will offer numerous teaching difficulties.

Question should be raised whether it is ever advisable to throw so many students into one large room, recognizing the necessity for three teachers to handle the large group but failing utterly to recognize that each of those teachers will be forced to work against the noise and confusion of the classes of the other two. The combined office, planning room and recitation room will help considerably, but the transmission of noise through the full-glass partition, and the interference from other sources would seemingly reduce the efficiency of the instruction over what might be expected had the plan provided for three shops, each presided over by one instructor. It is not inconceivable that the same experience areas included in this one large shop might have been organized even more efficiently in three separate shops, with no major increase in space requirements and with a considerable increase in the efficiency of instruction because of the
elimination of interference unavoidable in one large general metals laboratory.

5. A Proposed "Multiple Shop" Development.

Submitted next is a proposal for a multiple shop development at the Corvallis Senior High School. With industrial arts facilities already outgrown, and with prospects of continued enrollment increases as well as of increased emphasis in the industrial arts area, the teaching staff, the number of experience areas and the physical plant all need to be considerably increased. While the proposals are not so elaborate as those included in the Tucson development, the plans presented herewith are submitted in the belief that they are more in keeping with the general conditions and possibilities in Corvallis, and that they will result in a physical plant permitting somewhat more efficient instruction than if the same experience areas were included in one large shop.

The three basic instructional areas include the graphic arts, the general metal area, and the general woodworking area. Each of these is sub-divided, with each of the three basic instructional shops organized on the "related activities" plan. Electricity and automotive service are included as parts of the total experience in general metal work. Leathercraft is combined with the woodworking group.
The first of the set of four drawings covering these proposals indicates the relation of the three basic shops and their several auxiliary service rooms. The whole development is shown in relation to the vocational agriculture shop and classroom erected within the past year, the plans for which anticipated an expansion in the industrial arts program along the lines now proposed.

In this first drawing — the general plan — one will notice the provisions for natural lighting in all shops. These provisions include three industrial type saw-tooth skylights over the area for drawing and bookbinding. The glass area of these is toward the north and they can be opened for ventilation.

The double office adjacent to the printing and drawing rooms will serve both the graphic arts and the woodworking instructors. Note the provisions for visibility between this office and the several work areas affected. While it is not possible to do good teaching by directing the program from an office, there are times when an instructor needs to conduct conferences or do minor office work while classes are in session.

Turning to the plans for the individual shops, one notes the provisions for the office furniture just mentioned, for the printing equipment, for the drafting,
A PROPOSED
INDUSTRIAL ARTS BUILDING
FOR THE
CORVALLIS
SENIOR HIGH SCHOOL
CORVALLIS, OREGON

SCALE 1/8 = 1'-0"

GENERAL PLAN

PRESENT VOCATIONAL AGRICULTURE SHOP

DRAWING & BOOK BINDING

GRAPHIC ARTS LABORATORY
1080 SQUARE FT.

PRINTING
590 SQUARE FT.

GENERAL METAL SHOP
1506 SQUARE FEET

GENERAL WOOD SHOP
1856 SQUARE FEET

LUMBER STORAGE

GENERAL STORAGE
13'-0"

METAL DRYING

FINISHING ROOM

LOCKERS

OFFICE

SUPPLIES

TOILET

JAN.

O O O O

OFFICE

30'-6"

22'-6"

36'-0"

29'-6"

6'-0"
PROPOSED DEVELOPMENT
OF
INDUSTRIAL ARTS SHOPS
THREE-YEAR SENIOR HIGH SCHOOL
CORVALLIS, OREGON

PLANNED BY - R. BUXTON, R. FUGATE, H. MEIER
CONSULTANT - GEO. B. COX
SUPT. OF SCHOOLS - J. F. SCHENK
PRINCIPAL - H. S. PARKER

GRAPHIC ARTS LABORATORY

GRAPHIC ARTS

1. SAWH
2. TABLE
3. BLUE PRINTING TABLE
4. DESKS
5. BULLETIN BOARDS
6. BLACKBOARD
7. INSTRUCTORS DESK
8. PRINTING PRESS
9. EXHIBITION AREAS
10. LOCKERS

PRINT SHOP

1. SINK
2. TABLE
3. BLUE PRINTING TABLE
4. DESKS
5. BULLETIN BOARDS
6. BLACKBOARD
7. INSTRUCTORS DESK
8. PRESS
9. BULLETIN BOARD
10. LOCKERS

OFFICE

1. DESKS
2. FILING CABINETS
3. REFERENCES

SCALE 1/4 - 1'-0"
blueprinting, bookbinding and other facilities of the graphic arts area; also the provisions for built-in display cabinets adjacent to the front hall, and for student lockers in the drawing and bookbinding area. One of the three skylights projects across the central zone of the hallways to provide ample light of excellent quality.

The general metal shop provides for experience areas in foundry, forging and welding, machine shop practice, flat metal work, metal spinning, and electrical work. Space is also provided for elementary automobile mechanics, including the theory of operation and the rules for safe driving as well as simple servicing.

Auxiliary areas include an office for the instructor, reasonably adequate provisions for storage of supplies, tools and special equipment, and a finishing room used jointly with the wood shop.

The general wood shop provides for all basic woodworking activities likely to be included in any school shop program. Auxiliary services include adequate storage facilities for both the general supplies and the general tools, project storage, and a finishing room equipped for spray application of modern finishes. Areas are provided for large assembly work and provision is made for a demonstration area, adjacent to which is the demonstration bench, a large blackboard, and sufficient space for the seating of
PROPOSED DEVELOPMENT
OF
INDUSTRIAL ARTS SHOPS
THREE-YEAR SENIOR HIGH SCHOOL
CORVALLIS, OREGON

PLANNED BY: R. BUXTON, R. FUGATE, H. MEER
CONSULTANT: GEO. B. COX
SUPT. OF SCHOOLS: J. F. SCHENK
PRINCIPAL: H. S. PARKER

GENERAL METAL SHOP

1. BULLETIN BOARD 20. FORGE
2. PROJECT STORAGE 21. ELECTRIC WELDER
3. CHAIR STORAGE (HEAVY WORK) 22. WELDING BENCH
4. BLACKBOARD (parts under) 23. SPRAY BOOTH
5. DEMONSTRATION BENCH 24. FINISHING ROOM
6. SINK 25. OXY-ACTYLENE WELDING
7. JANITOR'S CLOSET 26. DRY-ACTYLENE WELDING
8. TOILET 27. BLACKBOARD
9. OFFICE 28. DRILL PRESS
10. SLIP ROLL FORMER 29. PORTABLE ELECTRIC TESTER
11. FORGE ETCHING CABINET 30. GRINDER
12. WELDING BENCH 31. METAL STORAGE
13. WORKBENCH 32. TOOL PANELS
14. BAR FOLDER 33. BENCH FLAT METAL
15. ANVIL 34. SQUARING SHEAR
16. SCREW CUTTING LATHE 35. MACHINE BENCH
17. FOUNDRY 36. BAR FOLDER
18. ANVIL 37. ELECTRICITY BENCH
19. SCALE 38. LOCKERS

SCALE 1" = 1'-0"
PROPOSED DEVELOPMENT
OF
INDUSTRIAL ARTS SHOPS
THREE-YEAR SENIOR HIGH SCHOOL
CORVALLIS, OREGON

PLANNED BY: R. BUXTON, R. FUGATE, H. MEIER
CONSULTANT: GEO. B. COX
SUPT. OF SCHOOLS: J. F. SCHENK
PRINCIPAL: H. S. PARKER

GENERAL WOOD SHOP

1. MORTISING MACHINE 16. PAINT STORAGE
2. MORTISING ATTACHMENTS 17. PAINTING TABLE
3. CLASS ENTRANCE 18. SPRAY BOOTH
4. STUDENT LOCKERS 19. MORTISING ATTACHMENTS
5. TEACHER FILES 20. LARGE PROJECT EXIT
6. LUMBER STORAGE 21. GLUE TABLE
7. SINK 22. GRINDER
8. BULLETIN BOARD 23. BENCHES
9. FOUNTAIN 24. LARGE PROJECT EXIT
10. LUMBER STORAGE 25. SPRAY BOOTH
11. LEATHER STORAGE 26. BENCHES
12. LOCKERS 27. LARGE PROJECT EXIT
13. BLACKBOARD 28. LARGE PROJECT EXIT
14. SEMI-FINISHED PROJECTS 29. SHORT STOCK CRIB
15. SUPPLIES-CHAIR STORAGE 30. LARGE PROJECT EXIT
16. DRYING ROOM 31. PLANER
17. TOOL PANEL 32. LATHE TOOLS BELOW
18. PAINT STORAGE 33. SHAPER
34. DEMONSTRATION BENCH

SCALE ¼" = 1'-0"
students for major demonstrations or discussions. To con­
serves space it has been necessary to use folding chairs 
for the demonstration areas in both the wood shop and the 
metal shop. When not in use, these chairs are stored in 
the lower part of conveniently located supplies cabinets.

6. A Proposed Basic Plan for a Composite General Shop, 
Adapted to the Needs of Oregon Schools Employing One 
Industrial Arts Instructor.

The last of the plans submitted herewith provides for 
a maximum of 24 students per class, and is equipped to 
offer instruction in five primary experience areas. In 
these five areas, woodworking equipment will accommodate 
eight persons, with four each assigned to the drawing and 
planning area, and three separate metal working areas — 
foundry, forging and welding, flat metal work (metal craft). 
Supplemental experiences are provided by means of limited 
equipment for metal spinning as a part of the metal craft 
work, wood and metal finishing, wood turning, lathe work 
in metals (screw cutting lathe), elementary electricity, 
avtomotive theory and servicing, and leathercraft.

It will be recognized that the primary instructional 
areas are the five first mentioned. The others are auxil­
iary services with insufficient equipment to permit the 
regular assignment of students to regular work stations.
The nature of the work in these areas will permit rotational application as the projects dictate and as opportunities permit. The capacity of the shop is, therefore, determined by the capacity of the equipment in the primary instructional areas.

This plan, providing for a floor space 35 feet wide by 60 feet long, was developed so that it can be located appropriately across the end of the main school building. The 60 foot length of the shop coincides closely with the width of the average school building when planned for a double row of classrooms separated by a hallway. The blank wall along the side of the shop containing the main entrance door is presumably a partition wall separating the shop from the remainder of the building. The entrance would then open off the end of the hallway.

On the other hand, if a shop is to be erected separately rather than as an integral part of a new school building, this same plan will lend itself to that purpose almost equally well as to the purpose for which it was originally designed. In that case the blank wall should not be broken up with windows, but should be located in such position with reference to other buildings that its blankness, broken up by window panel effects instead of by actual windows, would offer no objection to its surroundings. If it should become necessary to treat the blank
wall as the rear of the building, a centrally located front entrance could take the place of the double window in the opposite side of the shop. The two wood lathes could then be relocated, possibly end to end in the space that is now the passageway from the main entrance, between the two sets of lockers. The present entrance door would become a double window to admit light and ventilation. Localized artificial light would be needed over the lathes. The saw and jointer would need to be shifted slightly so that the lathes would not interfere with the passage of stock over those machines.

It is interesting to note the provisions for the flow of stock from the centrally controlled storeroom, to the machines and thence to the woodworking benches. Stock for the metals area has a direct flow equally convenient.

There is no waste space in this plan. It was necessary to utilize the area above the lockers as a balcony for the storage of larger projects and for those occasional articles which remain over from term to term or year to year in only a semi-active stage.

Further conservation of space has been possible by combining the library and the teacher's office. "Office facilities" are limited to a built-in "highboy" type of desk, ample for all usual requirements of the teacher. The upper portion will house personal books and reference
materials, behind glass doors. The central portion is closed by a sloping lid which hinges out to give a desk. Back of this compartment are the usual "pigeon holes." When closed it houses records and personal effects safe from prying hands and from the collection of dust. Below will be correspondence files and provision for shop records, course outlines, equipment inventory and similar necessities.

The finishing room provides for a small spray booth, for storage cabinets to care for the finishing materials, for a brush-application table near the windows, and drying space for small articles on shelves and large articles on the floor to the right of the finishing cabinet.

Tools will be stored as near to the respective work stations as possible. Woodworking bench tools will be kept in drawers at the respective benches. Additional drawers will provide for other needs. General tools for woodworking will be stored on an open tool panel at the end of the double bank of lockers. Tools for other areas will be stored on open tool panels adjacent to those areas. General tools of a more delicate nature, and those whose shape will not permit them to be placed readily on an open panel, will be stored in the tool cabinet adjacent to the demonstration area.

Folding steel chairs for use in the demonstration area,
BASIC PLAN
FOR
A DIVERSIFIED GENERAL SHOP
ADAPTED TO THE NEEDS OF
OREGON SECONDARY SCHOOLS

LEGEND

1. TABLES
2. BOOKS-CUPBOARD BELOW
3. INSTRUCTOR'S DESK & FILES
4. DRYING SHELVES
5. PAINTING TABLE
6. SPRAY BOOTH
7. PAINT STORAGE
8. STORAGE
9. TOOL CABINET-STORAGE
10. BULLETIN BOARD
11. SINK & FOUNTAIN
12. STUDENT LOCKERS
13. TOOL PANEL-WOODWORK
14. BULLETIN BOARD
15. STORAGE
16. WOOD WORKING AREA
17. BLACKBOARD
18. TOOL PANEL-FORGING
19. LUMBER RACKS
20. CHIMNEY-FOR FORGES
21. ELECTRIC WELDING BENCH
22. A.C. WELDER-TRANSFORMER
23. OXY-ACETYLENE WELDING
24. OVERHEAD DOOR
25. WORKBENCHES
26. SAND
27. MELTING FURNACE-GAS
28. SNAGGING GRINDER-1 1/2 HP
29. ANVILS
30. FORGES-HAND BLOWERS
31. DRILL PRESS
32. FLAT METAL BENCH
33. BUFFER-GRINDER
34. SCREW CUTTING LATHE
35. TOOL PANEL
36. SHEET METAL CENTER, SHORT STOCK BELOW
37. WOODTURNING LATHES
38. CLAMP RACK
39. TRIMMER-METRE SAW
40. COMB SAW & JOINTER
41. JIG SAW
42. GRINDER
43. BENCHES
44. DEMONSTRATION BENCH
45. VISUAL AID STORAGE

1. PRIMARY SERVICES
   DRAWING & PLANNING
   FOUR STUDENTS
   FORGING & WELDING
   FOUR STUDENTS
   WOODWORKING
   EIGHT STUDENTS
2. FOUNDRY
   FOUR STUDENTS
3. AUXILIARY SERVICES
   FINISHING
   WOOD & METAL
   LATHE WORK
   SCREW CUTTING
   METAL SPINNING
   WOOD TURNING
   AUTOMOTIVE THEORY
   OPERATION, SAFETY, SERVICE
   ELEMENTARY ELECTRICITY
   MISCELLANEOUS CRAFTS
   LEATHER, PLASTICS

SCALE 3/16 = 1'-0"
and for individual use throughout the shop, are stored in the lower portion of the general tool cabinet. The woodworking bench near the sink will be used for demonstration purposes when required. The blackboard, counterbalanced and suspended on sash cords above the finishing room door, can be pulled down for use during the demonstration or discussion periods. When discussions are to be had with only a section of the entire class, the pupils of only one experience area, the teacher can make use of the seats in the library and planning area and of a small blackboard on the broad pilaster between the windows of that room.

What of the Smaller Schools?

This suggested basic shop provides for 24 students. Smaller schools, whose enrollments would not justify the provision for quite so much space and equipment, may well consider the suggestions given in connection with the description of the Portland grade school plan, presented as the first of this series. See page 129. That shop, somewhat smaller in area than the suggested basic plan just presented, could be used as the basic plan for the smaller schools of the state. Modifications suggested previously (page 127) would allow the inclusion of woodworking machines and possibly another experience area. It is not readily possible, however, to include in that
shop all of the experience areas included in the suggested basic plan for a composite general shop, nor to provide for these same experiences in a shop much smaller than the original plan of page 154. The saving in space is not proportional to a reduction in enrollment when a shop is planned for a large number of experience areas.

With the increased tendency toward consolidations, and particularly in view of the continued decrease of the small school units reported by Nee (20) in his survey of industrial arts in Oregon public schools, it is anticipated that these suggestions -- the modification of the Portland grade school shop plan for the smaller schools of Oregon, and the adoption of the proposed "Basic Plan for a Composite General Shop" -- will meet the needs of the Oregon schools as well as those needs can be anticipated en masse. Each school offers a particular problem. Shop planning to meet modern objectives of education has become so specialized a problem as to require special consideration in almost every instance. A closing quotation from Hunter (15:101) seems appropriate here:

Probably another reason why industrial arts laboratories have been inadequately planned has been that the task is really becoming one too big for even the best of educators. For the electrical outlay, one really needs an electrical engineer; for lighting, an illumination engineer must be consulted. The science of acoustics has outgrown the average person; the architect's advice must be
secured. The mental health of the pupils must be considered from the psychological standpoint; and such things as floors, dust, and the like are of importance from a health angle.

Furthermore, shopwork has too often been forced to crowd into rooms of standard classroom size. All in all, the problem of laboratory planning is a large one, and this writer feels that the data collected so far are not sufficiently digested to permit the making of final recommendations.
CHAPTER VIII

SUMMARY AND RECOMMENDATIONS

Pointed specifically toward the improvement of facilities for industrial arts instruction in the public schools of Oregon, this study undertook to compile data from the Oregon School Directory (22), and from the original questionnaire responses of a contemporary study — Nee's "Survey of Industrial Arts in Oregon" (20) — to interpret these data in terms of the historical and contemporary developments of industrial arts in modern education, and to evaluate them in comparison with currently accepted objectives, recent nation-wide surveys, and the established national pattern of industrial arts.

Summary

The purpose of the study is to present an adequate picture of industrial arts in Oregon and to prepare a broad, factual base upon which to lay plans for the improvement of industrial arts in Oregon schools. While pointed especially toward the improvement of the physical plants of the public schools, the study will be useful to the College in the preparation of industrial arts teachers and to the State Department of Education in the supervision of industrial arts in the secondary schools.
Evaluation of the data showed that Oregon secondary schools are considerably behind the national pattern in:

1. The number of teachers employed for industrial arts instruction.

2. The number of experience areas included in the industrial arts programs, especially in the larger four-year high schools.

3. The adoption of the "general shop" program in recognition of modern objectives of industrial arts.

4. The certification of industrial arts teachers on the basis of professional preparation, including at least a major or a minor teaching norm.

5. The adoption of a basic pattern for school shop planning, to eliminate educational and economic waste resulting from the attempted performance of so specialized a job by persons totally unfamiliar with the objectives and methods of industrial arts, and unacquainted with the techniques of planning and organizing a school shop.

As compared with the findings of a recent survey by Ericson (14), 47 high schools of Oregon show a deficiency of industrial arts instructors amounting to a total of 65 full-time-equivalent teachers. These same 47 schools employ only 33 full-time-equivalent industrial arts teachers against a total need for 98 as shown by Ericson's ratio. In other words, based on the ratio of one full-time instructor to each 300 (approximately) average daily attendance, the normal ratio established by Ericson's survey, these 47 Oregon high schools need approximately three times as many industrial arts instructors as they
now employ. See Table 4.

Contrary to normal expectations, the larger schools are further from the national pattern than the smaller schools, in both the number of full-time-equivalent instructors employed and the number of experience areas included. Principal offenders are the Portland four-year high schools, with others throughout the state in somewhat the same situation. It may be the belief that the Benson Polytechnic School relieves the Portland high schools of the need for a normal program. Such reasoning fails to take into consideration the real objectives of industrial arts — exploratory, developmental, cultural, avocational, consumer appreciations — all as important and as valuable to the many who do not wish to "specialize" as to the few who are able to attend the semi-vocational program at Benson.

In the smaller schools, the vocational agriculture program helps to relieve the deficiency by supplying some practical arts experiences in the farm shop quite comparable to those of industrial arts. At least that is true in the distinctly rural schools, too small for both programs. It is not true in the larger communities, where only a small percentage of the boys enroll in farm shop work because that program presupposes farm life and farm application.
Since the teacher is the most important single element in any teaching program, responsible alike for the development of the physical plant and the instruction, and since the success or failure of the teacher in both of these responsibilities depends so greatly upon his preparation for the job, this study has undertaken an evaluation of teacher-preparation and the time devoted to industrial arts instruction. While it is admitted that the information available is neither complete nor perfectly valid, the close agreement of the data from the two different sources (Oregon School Directory and Nee's questionnaire to Oregon industrial arts teachers) indicates a very high reliability.

The increasing acceptance of industrial arts as an integral part of general education, contributing vitally to the functional curriculum as a developmental experience and an integrating medium, and the swing of secondary education toward a more realistic, child-centered program patterned somewhat after recent advances in the elementary schools, has focused the attention of Oregon school administrators upon the desirability of establishing industrial arts programs. It is inevitable that many academically-trained educators, unfamiliar with the historical background and educational ancestry of industrial arts should misconstrue this trend and confuse the objectives and
developmental outcomes of industrial arts with the objectives and functions of vocational-industrial education. Having confused these two they quite naturally misinterpret the professional qualifications required for a successful industrial arts teacher. Neither have they a full appreciation of the character and extent of the equipment required for the school shop.

Industrial arts is a functional practical-arts subject. Its chief objectives are non-vocational. It is developmental and broadly cultural rather than vocational and pointedly specific. Present practice in industrial arts instruction includes many experience areas rather than one specialized trade or industrial pursuit. The modern industrial arts program gives to each boy a diversified industrial experience valuable alike for the broad developmental, cultural, social, economic and avocational objectives of general education, and for the general industrial background prerequisite to the intelligent selection of and preparation for a vocational-industrial pursuit.

Because of the diversification of industrial experiences now considered necessary in a modern industrial arts program, and because trade experience alone, or trade experience plus a liberal arts education, seldom produces a teacher versed in the objectives and methods of industrial arts, nor in the diversified skills and subject-
matter of the several experience areas usually included, it is possible that there is some correlation between the large number of Oregon industrial arts teachers whose only preparation has been "trade experience" and the resemblance of many Oregon school shops to a low-grade carpenter shop rather than to a modern industrial arts laboratory.

Few Oregon school shops are equipped for diversified experiences in keeping with the age and interests of the boys, and with modern educational objectives. While trade experience of the right kind and quality is a valuable asset for the industrial arts teacher, there should also be some familiarity with the objectives, the methods and the professional ancestry of industrial arts. The present condition of many industrial arts shops and the nature of the programs conducted, are strong evidence of a need for improvement.

Philosophical criteria and practical guides for school shop planning, and typical case studies illustrative of several types of industrial arts shops, established the base for proposing a basic plan for a composite general shop adapted to the needs of Oregon schools. It is believed the plan suggested will meet the requirements of all schools employing a full-time industrial arts teacher.
Recommendations

1. That certification for Oregon secondary school teachers be based upon subject-matter majors and minors adequate to protect the schools from officials or teachers otherwise willing to commit professional mayhem.

2. That provision be made for some central authority to pass upon plans and specifications for all new school buildings, including equipment and the complete physical plant in the case of industrial arts and other fields requiring specialized knowledge beyond that normally possessed by an architect.

3. That provision be made for a state supervisor of industrial arts, appointed by and operating under the direction of the State Superintendent of Public Instruction.

4. That the duties of the state supervisor include up-grading and improving industrial arts instruction and instructional facilities in Oregon, to bring them more nearly in line with the national pattern.

5. That the College cooperate more closely with the State Superintendent and the Public Schools, assisting in the development of shop plans suited to the needs of specific communities, and in the further development of industrial arts on a professional plane.

6. That, to secure this closer cooperation between the College, the State Department, and the public schools, financial provision be made to enable:

(a) Staff members to render professional and consultation service to schools seeking assistance with shop planning problems. Teaching loads do not permit such service at the present time.

(b) Cooperative employment of a staff member who will serve the State Department as industrial arts supervisor from September 5 to December 31 and from April 1 to June
10 each year; and the College as a member of the graduate staff in industrial arts from January 1 to March 31 (winter term), and from June 10 to August 5 (summer session).
BIBLIOGRAPHY


13. Epsilon Pi Tau — The 1933 Review. Columbus, Ohio. Published by the National Secretary. 1933.


