THESIS
on

THE GENERAL SHOP AS AN EDUCATIONAL ACTIVITY IN THE SMALL HIGH SCHOOL

Submitted to the
OREGON STATE AGRICULTURAL COLLEGE

In partial fulfillment of the requirements for the
Degree of

Master of Science

by

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It is now recognized as essential that boys in the seventh, eighth, and ninth school years should have, among other things instruction that will assist them in an understanding and an appreciation of all of the developments of human work and knowledge as well as in the determination of professional or vocational interests and capacities.

"They should have instruction in English for use as a 'tool' subject in an English speaking country; in mathematics for its functional value in the life of all; in history and the social sciences for a knowledge of past developments in order to more adequately guide future progress; in science for the purpose of creating an appreciative understanding of the developments of science; and in industrial arts for the purpose of a broader understanding of the great field of industry, founded upon the use of labor and machines in the producing and shaping of materials to meet the needs of mankind.

"It has long been recognized that mathematics is not taught in these grades for the purpose of making mathematicians; nor science for training scientists. More recently it has been recognized that industrial arts (manual training to use the older term) is not taught with a view of developing vocational competence, but in order to provide try-out and exploratory opportunities, and to give a broad, appreciative understanding of tools, materials, processes and designs as they are involved in the field of industry. Vocational preparation is reserved for later years and for vocational and trade classes. The shop instruction for industrial arts should be linked with information about the lives of the workers concerned, and with a wealth of other related information that is truly educational, though not at all vocational."1

Emphasis in this thesis has been placed on the "general shop" type of organization since industrial arts instruction of the diversified type of exploration and guidance cannot be given economically in the smaller communities, in high schools of two hundred pupils or less, in any other manner. The larger schools can more readily afford separate shops for woodwork, machine work, printing, electricity, drawing, etc., for specialized instruction in many activities. The smaller schools, having the same desire to cater to the best educational practice in guidance, have seized upon the "general shop" plan as the most economical solution to multiple contacts in the trade and industrial field.
CHAPTER I

GENERAL STATEMENT
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A. The Shop Work Principle.

Shop work in the public schools is the outgrowth of the general recognition of a need for providing in the school curriculum exploratory and developmental types of experiences for children of school age.

"Scarcely a school district of any considerable size can be found that does not offer shop work in some form or other to boys of junior high school age."1

B. Motives for Favoring Shop Work in the Public Schools.

"The general shop is decidedly of the junior high school level. It has been advocated and tried out in cities of all sizes. Because of its diversity of activities it possesses advantages over other types for small communities which can provide but one or possibly two shop teachers. It is particularly adapted to the furtherance of aims based on adolescence. It provides experiences with a variety of common tools; gives boys an opportunity to make things they like to make; is admirably adapted to the project method; and provides exploratory manipulative experience with several materials in a number of trades, where under the regime of the former manual training shop there was but one. As previously noted, it is characterized as extensive rather than intensive."2

According to Newkirk and Stoddard,3 "The following characteristics are to a large degree responsible

2. Ibid., p.
for the popularity of the general shop in presenting the industrial arts program.

(1) "It is well adapted to the organization of industrial arts content in the light of the general education, exploration, and guidance aims of the junior high school.

(2) "It permits students to be treated as individuals, with due respect for their differences in interest and capacity.

(3) "It enables a student to discover his abilities and aptitudes thru manipulation of a wide range of materials, tools and processes.

(4) "It offers an economical way to gain experience in many activities.

(5) "It makes possible an adequate industrial arts program for the small school.

(6) "It stimulates the setting up of a well-planned shop and a carefully organized teaching content.

(7) "It increases teacher efficiency."

"One of the chief ideas lying back of this school (junior high school) is the need of provision for individual differences and for guidance, educational, moral, avocational and vocational, of boys who are passing thru the critical years of the early teens....To provide for these needs, therefore, many types of activities must be offered, and if they have any guidance values they must be rich in interesting, thought-challenging material." ⁴

C. The Wood Shop, the Best Known Type.

Of the various school shops to be found at the present time, those offering woodwork are the best known. In the light of present-day thought and experience, however, it is believed that a wider differentiation of shop

⁴ Vaughn, S. J., & Mays, A. E., Content and Methods of the Industrial Arts, p. 197.
experience is not only of great initial interest and appeal to boys but that it has broader implications in general education. The following quotations may serve to support the statement of the frequency of woodwork at present, as compared with the shop activities.

"The general woodworking shop in which bench woodwork, furniture construction, wood-turning, millwork, and wood-finishing may be engaged in, has been a rather common type."5.

"The first illustration is drawn from the field of woodworking, and is more complete than the illustrations from other fields, not because of the importance of woodworking from a teaching standpoint, but because more people are familiar with woodworking processes and woodworking tools than with tools and processes in any other industry, and it is believed that an illustration drawn from this field will be understood and appreciated by more people than one drawn from any other field."6.

D. Possibilities for Several Kinds of Work in One Shop.

"A study of the trend has shown a shift in emphasis from 'manual training' through 'manual arts' to 'industrial arts', which includes the jury indorsement of exploration, guidance, consumers' knowledge, household mechanics, avocational purposes, social habits, correlation, and a degree of skill. When critically viewed these objectives serve as a control of the unit shop courses."7.

"A single large shop is one, in which the equipment is organized so that the entire class goes through

5. Erickson, Emanuel E., Teaching Problems in Industrial Arts, p. 307.


a number of different related divisions in a given order. For example, first six weeks, drawing; second, sheet-metal; and so on. This shop may have the equipment arranged in two ways; each division may be located in a separate space and the pupils rotated from section to section of the shop every six or nine weeks, (with the class divided so that all types of work are in operation at the same time), or a similar room may be used so that when a given activity (say sheet-metalwork) is to be taught, that equipment is put in the foreground, and the entire class instructed in sheet-metal at the same time. This type of organization requires rearrangement of equipment each time a different division is taught (and necessitates a large expense through duplication of equipment that is idle much of the time). It is obvious that this system reflects the related shop rotation plan, but holds to the older form of group instruction.

"The comprehensive general shop which houses a number of small related divisions under the direction of one teacher, is widely used and will give a small community with limited funds an opportunity to offer a rich course in industrial arts. For example, a comprehensive general shop may have instructional divisions in metal-work, woodwork, auto mechanics, concrete work, plumbing, finishing, and drawing. It may sometimes have a printing division in addition to those listed above.

"In this type of organization it often happens that one or two divisions will be given special emphasis. One may think of the comprehensive general shop organization as made up of a number of related shops shrunk by the removal of individual pupil equipment until they will all go into one shop. That is perhaps the logical way to house a broad non-vocational exploratory course with the limited equipment and space afforded by the resources of the small average school.

"With this method of organization, pupils may be assigned projects in any of the divisions or even projects which involve the doing of work in several related divisions. However, the real framework of the general-shop method is the same in all types of organization.

"Several kinds of industrial arts shop work can be
taught in one shop by one instructor just as efficiently as one kind, (provided the equipment, the organization of subject-matter, and the method of presentation is properly controlled). The main requirement is that the teacher, if he be a wood-shop or other shop specialist, shall be capable of adjusting himself to the new conditions imposed by a general shop."

E. Shop Work Classification.

The Federal Board states that, "it is important to make clear distinctions between: (1) industrial education of the vocational type which is contemplated under the terms of the national vocational education act, and (2) other forms of industrial education commonly known as manual training, industrial arts, exploratory or finding courses, or manual arts. All of the latter types of industrial education are considered (by the Federal Board) as phases of general education, and it is believed that the development of efficient trade and industrial education of the vocational type would be promoted in the United States if school administrators generally would make similar or equivalent distinctions."

At the present time there is a reasonably clear differentiation between the pupil who takes instruction in industrial arts for the purpose of furthering his general education and the student specializing in a vocational pursuit. Shop and related work of an industrial nature is classified as vocational if it is given in accordance with the State and Federal Vocational Education Laws which embody the provisions of the Federal Smith-Hughes Act.

All other shop and related work (including manual train-


ing, manual arts, mechanic arts and prevocational manual
training, mechanic arts and prevocational shop work) is
regarded as industrial arts for the purposes of classifi-
cation.

F. Factors in Selecting Shop Installations.

"It is of little avail to set up equipment lists
only to have them turned down by the school board
because they require too much money. It is essen-
tial that the person drawing up such lists have in
mind a close estimate of the amount of money that
the community is willing to spend for the first
year's installation, and for additional equipment
in the years to follow. In the end the best equip-
pped shop is the one which has used its available
resources to buy equipment that will be of most
value in presenting industrial arts content suitable
to the community needs. In a relatively small com-
unity it is good economy to select equipment in
the light of all the possible classes that may be
instructed; namely, the junior high school, ex-
ploratory, senior high school, technical and trade
courses, and part-time and evening vocational
courses. Needless to say, the industrial arts
teacher must at all times keep up the faith in
his work."10.

The demand for shops in any situation can be met
intelligently only after an examination of those fac-
tors that should always determine appropriate instruc-
tion.

1. A careful study of the pupils to be served is
essential in determining what kinds of shop in-
struction are likely to prove most timely and
effective.

2. The making of an industrial survey will furnish

10. Newkirk, L. V., & Stoddard, G. D., The General Shop,
p. 95.
much enlightenment concerning the nature of local industrial developments. This is important since any public school course involving a study of materials, processes, products and things significant to society should first be based upon the life of the particular community as regards these things.

3. Should not equipment be based upon these activities considered basic in the field of industry—regardless of local industries represented?

"While the larger number of schools or school systems have some person acting as purchasing-agent, it often happens that the instructor is authorized to make certain purchases directly from commercial firms. In either case the instructor should be aware of the necessity of specifying completely and technically every article to be purchased. Much time is wasted by the instructor, and much patience is lost on the part of purchasing agents and merchants, through slovenly-made and incomplete orders, to say nothing of the unfavorable impression of the instructor that is established. Failure to insert a necessary figure or specification in the original order has more than once delayed equipment for a month or more—while students are kept waiting in idleness, and serious disciplinary and other problems develop." 11.

CHAPTER II

TERMINOLOGY
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TERMINOLOGY

For purposes of fixing the terminology of this thesis, we shall use the definition given by Roberts in his treatise on Manual Arts in the Junior High School, and others as cited.

1. VOCATIONAL EDUCATION. "It has been broadly misinterpreted to include all of those activities, for whatever purpose, which may be related to handwork or commercial work in the schools. No situation can be more absurd than the classification of hand activities of the elementary and junior high schools under vocational education. In this writing vocational education is understood to include only such forms of public education as deal directly with preparation for a specific life vocation.

2. INDUSTRIAL EDUCATION. "Is here interpreted to mean vocational education within the field of industry--specific training in industry.

3. PREVOCATIONAL EDUCATION. "Is interpreted to mean study and investigation in a variety of activities which may suggest later vocational education and training in some specific field.

4. INDUSTRIAL ARTS. "The terms manual arts, practical arts, mechanic arts, industrial arts, and manual training, have been variously used to mean the same thing or different things. Some one of them has been used at different times to express different meanings or degrees of meaning. For the purpose of this discussion they have been accepted as synonymous and as defining hand activities given in school for general education purposes, providing life experiences within the field of industrial activities which may serve

as means of concrete expression in other school work, as opportunity for discovery of individual abilities and aptitudes, and as sources of information which may serve for educational guidance toward the later choice of a life career."

5. **THE GENERAL SHOP.** "The general shop is a broad group of educative industrial arts activities embracing technics of shop organization and teaching method which enables a community, whether large or small, to present a unified core of content based on life needs as summarized in these aims: developmental experience interpretative of the major phases of the world's industrial work, 'handy-man activities', consumer's knowledge and appreciation, guidance, hobbies, social habits, and (for a very small per cent) vocational preparation."

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CHAPTER III

AIMS OF INDUSTRIAL ARTS INSTRUCTION
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A. Aims Stated.

"Our purpose in general education is to provide experiences which will develop the individual into a useful, happy and successful citizen. It is the function of the industrial arts work to supplement and aid general education in realizing its aims, by providing experiences which will fit the individual through his knowledge, skills, attitudes, and accomplishments, to be more useful as a producer, more appreciative and happier as a consumer, and more valuable as a citizen. The things for which we should assume a large measure of responsibility may be stated as follows:1.

1. "To develop in each pupil an active interest in industrial life and in methods of production.
   (a) How things are made.
   (b) The sources of raw materials, and the methods and problems of transporting and using them.
   (c) Working qualities, durability, and adaptability of materials for particular uses.
   (d) Commercial sizes, grades, classification, and sales units of articles in common use.
   (e) Working conditions, requirements, and opportunities in a number of the principal industries of the community.

2. "How to select, care for, and use properly the things we buy.

3. "The appreciation of good workmanship and good design.

4. "Attitude of pride or interest in one's ability to do useful things.

5. "To develop a feeling of self-reliance and confidence in one's ability to care for one's self in an unusual situation.


7. "A knowledge and understanding of mechanical drawing, and the interpretation of the conventions of drawings and working-diagrams, and the ability to express one's ideas by means of a drawing.

8. "The development of elementary skills in the use of the more common tools and machines, and in modifying and handling materials in order to make them conform to our needs."2

B. Popular Appeal in Lieu of Definite Aims.

"Aims for shop courses have been stated in a great variety of ways. It has seemed at times that whereas nearly every one has been willing to accept the principle of shop work in schools because of its popular appeal, there has been little unanimity concerning aims resident in such courses.

1. "Worthy aims of instruction in industrial arts subjects may well be:

   a. To increase the general intelligence of the pupil (about things industrial).*

   b. To stimulate the pupil's powers of wise utilization (of the products of industry).

   c. To help the pupil lay the foundations of vocational choice.

   d. To assist the pupil to a proper interpretation of contemporary life.

2. Ibid., page 10.

*Portions in parenthesis were added by the author.
2. "As they stand, these aims embrace all of general education. It is only when qualifying means of attainment are stated that the aims become peculiar to the field of industrial, agricultural, commercial and home-making activities.

C. Skill not a First Requisite.

"Skill, as such, is not mentioned in the statement of aims, since the acquiring of it is not a first requisite in the study of industrial arts. It will invariably follow, however, that varying degrees of proficiency with tools will accompany any considerable instruction in and repetition of their use.

D. Realization of Aims in Smaller Schools.

"The smaller schools need not be handicapped in the realization of the aims for industrial arts. The general shop may be employed to furnish the occupational variety that a larger school unit secures by means of its opportunity of having several different kinds of shops.

E. Three Commonly Accepted Manipulative Aims.

1. "To provide opportunities for boys to make and do things they like to make and do.

2. "To provide training in common skills everyone should possess.

3. "To provide trade-exploratory or try-out experiences in typical trades to assist boys in finding and testing their interests and aptitudes.

F. Five Justifiable and Achievable Non-Manipulative Aims.

1. "To provide training in industrial arts and industrial arts appreciation (partially manipulative).

2. "To provide a natural medium for guidance, educational and vocational.

3. "To provide interesting technical information about the occupation or occupations represented in the school shop, and others closely allied."
4. "To provide organized training in reasoning and problem-solving.

5. "To provide studies in vocational economics closely related to everyday life."3

The aims and basic teaching content of the general shop are in harmony with the best practices in the industrial arts field. Varied types of spaces and equipment organization have been tried and developed by shop teachers and supervisors in an effort to solve the problem of housing an adequate general shop."4

But none have been more in harmony with the present trend in education at the junior high school level, and with the financial limitations of the small school, than the comprehensive, or trades exploratory general shop, where several activities are housed in one room and taught under one well-trained teacher.

"It must be remembered that the objectives of such a shop are not vocational, but that the work is a part of the general educational program of the secondary school field. It is specifically for the purpose of giving a background of information about, and a manipulative contact in, the realm of industry, upon which the boy may base future choices of both his life work and the products of industry that he must use, as well as his social reaction to both capital and labor."5


CHAPTER IV

SCOPE OF INDUSTRIAL ARTS INSTRUCTION
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A. In the Elementary Grades,

each classroom teacher should have been trained to instruct in industrial arts work. Such instruction should permeate the content of all subjects, adding a desirable equality to instruction by infusion of industrial arts values. Instruction in the shop may begin with the sixth grade but is often deferred until the seventh.

"In the organization of industrial arts activities in the grades below the seventh, formal work with tools and materials is less and less favored. The woodworking program that once was common has given way to a large extent to other types of activity, with less demand for skill in the doing, and more direct relationship to the study program of the classroom and to the life of the child. This means also that the special teacher of shopwork is less used in these grades, and that the activity carried on comes under the direct management and supervision of the regular classroom teacher. Special teachers are prone to feel that this is a lowering of standards of work, and probably a means for developing poor habits in tool manipulation. Of course, in many schools special rooms are used for the industrial arts activities; but in modern settings these activities are not confined to woodwork. The equipment of such rooms will include a variety of possibilities."\(^1\)

B. In the Junior High School Years,

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grades seven, eight, and nine, special shops should be provided for industrial arts instruction.

"The organization of the junior high school has brought with it a rapid increase in the variety of subjects and subject-matter for manipulative work. Where a grammar school existed previously, with woodwork as the only shopwork activity, the establishment of a junior high school meant at once five or six different shop subjects or even more. This increase in variety has brought with it shorter time periods for any one subject, and, probably because of this fact, more concentration upon essentials."2

C. In the Senior High School Years,

the tenth, eleventh and twelfth grades, instruction in industrial arts should be optional. It may be either vocational or none-vocational in nature but ordinarily few would take the work on a vocational basis.

"Shopwork in the senior high school based upon the vocational objective should be and usually is organized upon the basis of trade analysis. The selection takes place with the objective in view, and for this reason the items of subject-matter would be different in vocational automobile work from a ten-week course in the junior high school, or a semester course in industrial arts in the senior high school.

"Where the technical objective is the outstanding one, obviously the job is to find out if possible what body of facts and detailed skills the field of work represents, and then to proceed to select from the total those items that lend themselves to the possibilities of the school shop."3

2. Ibid., page 14.

D. Scope Detailed for Junior High School Years.

In the seventh, eighth, and ninth school years, industrial arts instruction includes shop work, mechanical drawing and work correlated with the other school subjects.

1. The wood shop of a type usually called manual training may be utilized for instruction in industrial arts. It seems probable, however, that the scope of such shops will gradually be enlarged to include some instruction in concrete, electricity, metal work and other significant industries.

If an industrial arts shop is considered as a laboratory in which the boy may grapple with problems requiring the forge, the engine lathe, the soldering iron, as well as woodworking and electric wiring, it will immediately appear that the traditional "manual training" shop equipment is inadequate to meet the needs of a course built around the processes mentioned. It is, therefore, recommended that existing manual training wood shops be broadened in scope to include other activities such as are hereafter noted under units of equipment.

2. The specializing type of wood shop may be installed as one of several unit shops devoted
respectively to wood, metal, electricity, printing or others of similar bearing on local needs. This wood shop partakes of the nature of cabinet making and usually turns out more productive work than would be undertaken in the traditional manual training type of wood shop.

3. Other unit shops, similar to the specialized wood shop just noted, may be installed with profit in schools requiring several shops. Among these the more usual are devoted to machine shop work, sheet metal, electric wiring, auto repair, printing, and painting and decorating.

4. In small schools, requiring but one shop, the type of equipment that gives the largest return in terms of aims for industrial arts instruction is the general shop. An indication that school authorities have begun to accept this as being true, is demonstrated by the amount of prominence given to the general shop in educational magazines, state departments of education, colleges for the training of teachers and in school districts which are changing their shops to conform with this idea.

The following items are of high social utility, and when translated into specific jobs, would form a good
portion of a rather diversified course in the general shop.

"Ability to use all common kinds of measuring devices: measures of length, area, volume, capacity, weight, time, value, temperature, specific gravity, etc.; ability to sharpen, adjust, clean, lubricate, replace worn or broken parts, and otherwise keep household and garden tools and appliances in good order and good working condition; ability to make repairs, adjustments, and additions to the house and its equipment; ability to make repairs, adjustments, and sometimes to construct household furniture or other equipment; ability to participate intelligently in the original planning of one's home; ability to operate household equipment; ability to keep the house, premises, and equipment clean and sanitary; ability to keep the house in good order; ability to care for and operate the electrical system and appliances in one's home; and to make simple repairs, adjustments, or replacements; ability to perform the operations involved in the care of the premises and garden."4.

The place of the general shop in the junior high school is succinctly described by M. M. Proffitt, as follows:5.

"The general shop, which is a recent type of organization for teaching elementary work in a number of shop activities under the direction and supervision of one individual, has been growing in favor, especially for some of the manual arts work on the junior high school level. The number of schools adopting this general-shop plan has increased rapidly during the past few years. Of 1,500 representative school systems furnishing information to the Bureau of Education on this point, more than 40 per cent report that they have organized a general shop course. More than one-fourth of these were inaugurated during the past two years, (1924-1926), and ten per cent of all the schools

having general shops started them within this period.

"The majority of these general shop courses are organized on the plan of a single, comprehensive shop to include work in all the activities offered in the course, rather than on the basis of a cycle of shops, through which the students are routed as a group for a limited period of work in each activity. The comprehensive shop plan makes it possible for a pupil to work continuously on a project involving more than one activity, until it is completed.

"Instruction is based upon the development of projects rather than upon a plan to teach the beginnings of any trade. The philosophy underlying the general shop course is the same as that for a general course in science or a general course in mathematics. The aim is to give elementary instruction in a number of more or less related lines of work, and on a basis corresponding to the interest and ability levels of the student, rather than to carry instruction in one branch into advanced stages. For the general shop the relating factor is based upon characteristics common to all shop activities included, such as hand manipulation of tools and machines applied to common construction material for creative purposes, technical types of knowledge, and the working qualities of materials."6

"The 'general shop' is making its appearance. In a word, it brings the activities of the separate shops into one room and often under the charge of one teacher. The work is organized, not on the basis of wood, metal, or electricity, but as a series of projects of increasing complexity. A project may combine sawing or planing with electrical wiring and elementary metalwork. The educational theory behind the general shop is excellent. It seems to be the most feasible solution of the manual arts problem in the small school; it may supplant the special shops in the large school."7

6. Ibid., page 18.

E. Schedule of Shops for Schools of Different Sizes.

A schedule of shops which will be helpful for the small high school is here suggested.

1. For schools containing 100 to 200 pupils.

Option No. 1

1 General Shop

1 Drafting room (Classroom will do).

Option No. 2

1 Large room containing both shop and drawing.

"Any program of industrial education in order to be effective must be flexible enough to be adapted to a wide variety of local situations. The objectives set up in the foregoing pages may apply almost universally, but the means of realizing them will vary rather widely with the local factors. In view of these varying conditions several suggested programs are offered, each being based upon an assumed typical situation.

"The first type of industrial program to be given consideration is one suitable for a consolidated school of 12 grades, located in a rural community. Such a school ordinarily will have from 100 to 200 pupils in the six higher grades, usually thought of as junior and senior high school grades. Since a school of this type is usually too small to have more than one shop and one shop teacher, any industrial program should be built around a single general shop to accommodate both the junior and senior high school pupils. The fact that such a school is in a rural community does not indicate that all or even a large percentage of the boys will become farmers. However, the logical core for school shop activities in such a community should consist of work related to the jobs about the farm and home. Wherever other shop activities in which the boys are interested can be introduced this should be done, but most of the work should be centered in the activities connected with farm and
F. Minimum Time for Instruction.

The minimum time that is profitable for industrial arts instruction should be two hours a week. All boys in the seventh, eighth, and ninth school years should have at least that amount of instruction divided between shop work and mechanical drawing.

By referring to the program of studies for junior high schools, it will be noted that electives are provided which make available additional shop work for boys who choose extra units in industrial arts.

Not all the suggestions would likely be carried out in any one school. In every case the course in industrial arts should be developed to meet any outstanding local need or situation. The suggestions are particularly applicable for a school having as a maximum the number of boys indicated and distributed as shown below:

<table>
<thead>
<tr>
<th>Grades</th>
<th>Classes</th>
<th>Number of boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seventh</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Eighth</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Ninth</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Elective group from 10th, 11th, and 12th</td>
<td>1</td>
<td>15 to 20</td>
</tr>
</tbody>
</table>

Each group should meet as follows:

<table>
<thead>
<tr>
<th>Grades</th>
<th>Number of periods per week</th>
<th>Length of period in minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seventh</td>
<td>2</td>
<td>90</td>
</tr>
<tr>
<td>Eighth</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>Ninth</td>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>Elective</td>
<td>5</td>
<td>90</td>
</tr>
</tbody>
</table>

"By this arrangement the teacher has three 90-minute periods, or the equivalent of six regular class periods, of teaching per day. A larger number of boys could be cared for on this plan by increasing the shop facilities and adding an assistant instructor for either full or part time. This would also make it possible to increase the number of shop activities that could be offered at one time."9.

CHAPTER V

MEANS AND METHODS USED IN PRESENTING
INDUSTRIAL ARTS INSTRUCTION
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INDUSTRIAL ARTS INSTRUCTION

A. The Use of Textbooks.

Industrial arts instruction does not lend itself readily to a formal textbook treatment. It is generally agreed among those in charge of this work that flexibility must be here maintained to a greater extent than in the more formal school subjects.

"Within recent years there have appeared, however, well-written books upon practically all mechanical subjects that are offered in schools, as well as upon methods of using the books and teaching the work. And these books have developed because of an existing need for some help in strengthening the aim of the instructor and making his time and efforts of greater benefit to his students. For the purpose of discussion at least, the various kinds of books which have been published in the field may be classified into five different types: (1) textbooks; (2) project and problem books; (3) shop manuals; (4) reference books; (5) teachers' or professional books.

"While some arguments against textbooks carry some weight, each can be met effectively while another indicating the value of such books. In general, it may be said that the path of least resistance in shop teaching does not lead to their use. Up-to-date teachers avail themselves of the aid that can be had in books, both for their own use and in teaching.

"All the arguments against textbooks for shop subjects could equally well be presented against books for mathematics, English, history, and other subjects. I once knew a teacher who used no textbook in algebra, and who gave several of the reasons enumerated here to justify himself. No student in his class
shared his opinion, however, that the teaching was more effective without a textbook. 1.

B. Limitation of Standardization.

In districts where a number of shop centers are maintained, there are administrative difficulties that can be obviated only by the employment of a degree of standardization in problems, supplies, and equipment. Such standardization, however, can be justified only up to a certain point since it is frequently found that two groups of pupils in the same school district differ, due to their peculiar backgrounds. A school in one part of the county may, for example, draw pupils from a native neighborhood while another school may get its pupils from a cosmopolitan neighborhood, the group interests of which are consequently different from those of the first group. It would seem unwise to standardize the same problems for both throughout a course of industrial arts instruction for the grades under consideration.

"Interest as a factor in the educative process has been emphasized to the point that it has been given first consideration in organizing subject-matter into a course of study. Or, it might be nearer the truth to say that it has been emphasized to the exclusion of a tangible course of study. Under the cover of real or pretended zeal in approaching the subject of woodwork through the avenue of student interest, much wrong has been committed against youth and the profession. An approach through this avenue would at its maximum of enthusiasm declare that students should make what they wish, and hence, what would be the use of a course

1. Ericson, Emanuel E., Teaching Problems in Industrial Arts, pp. 143; 147.
of study?

"There is, however, a saner viewpoint possible in considering student interest. Manual arts work when introduced into the various schools was heralded as a means of self-expression, and for breaking down formalism. But in many settings this new type of work became fully as formal as any academic subject, and failed to 'vitalize' the student and stimulate his interest.

"While the shifting interests of students may be dangerous as the controlling factor in selecting and organizing subject-matter, it nevertheless is true that subject-matter should be tested by the measuring-rod of student interest, and if there is no chance that it is, or can become interesting, this fact alone should suggest its reorganization or elimination."2.

C. The Exercise Method.

Conspicuous examples of more or less formalized courses of shop training have revealed themselves in the use of the exercise as a unit of instruction, particularly in wood shops. The abstract exercise was prominent in shop courses a decade ago but in the more modern pedagogical thought it stands, for the most part discredited. Corresponding emphasis is placed upon the making of usable articles significant to society.

The exercise method of teaching industrial arts shop work pre-supposes that skill in handling tools is to be considered as an end in itself rather than as a means to an end, and exercises have usually been planned to economize time in teaching a variety of tool processes. There is a tendency at the present time to dis-

Ibid., pp. 336-37.
courage the exercise idea in favor of a more vital treatment.

"Undoubtedly the greater number of shops operating in this way (the exercise method) do so, not because the instructor has figured out that this is the best pedagogical procedure, but because it follows the line of least resistance, and is a result of lack of preparation on his part.

"While it is unquestionably true that too much stress has been laid upon sequence of tool processes to the extent of discouraging students and destroying interest, it also is true that interest may vanish because of lack of definiteness in the program, and proper requirements. After all, the majority of students come to the shop as well as to other classrooms with the desire to learn something new and definite, and if they are put to work without a semblance of organization they will soon feel that their time is wasted. The free choice of things to make may sound feasible, but in practice it has not been successful. The idea came largely as a rebellion against the lock-step type of organization involving nothing but a so-called sequence of tool processes applied to a set of exercises, but in application it has been modified by practically all its former advocates; except, of course, those who wish to sit at their desks and let the shop run itself."3

D. Individual Problem Method.

Industrial arts shop work is best taught by the use of the individual problem as a medium of instruction. The true project is admirable in this connection. Frequently pupils have projects upon which they are working outside of school. The teacher should endeavor to give recognition in school for any such worthy accomplish-

ments. In some cases certain boys will be found who are able, because of their special knowledge of wireless sets, for example, to assist the teacher in giving instruction to others in that particular work.

"The dominant type of class procedure in a general shop is a form of individual instruction. This type of organization demands that a large per cent of the instructor's teaching time be devoted to the needs of individual members of the class. This gives the teacher a splendid opportunity to do a fine piece of work with his class. Thus far the chief difficulty has been that the instructor has relied too much on written instructions and has had to devote considerable time to routine tasks about the shop--tasks which he would be free from under an improved organization."4.

"Teaching is an individual process, just as learning is an individual accomplishment. We must never forget that we are teaching individuals, although they may be assembled in groups. All learning conditions, such as intelligence, interest, attention, and readiness, are individual conditions, and vary with the individuals. We never have the same degree of interest, or readiness, among all the members of a group, nor the same ability, nor the same background of experience; nor do we have the same aspirations for the future, nor an equal willingness to strive for a common purpose. These things are individual and personal, not group qualities and characteristics. They affect learning and our methods of teaching only as they affect the individuals of the group. It is necessary that the arrangement of our instruction materials be flexible enough to meet these individual situations."5.

E. Approximate Number of Pupils to a Teacher.

Where classes are large and the periods short, the individual problem method makes unusual demands upon the

instructor. In general, this fact alone suggests an approximate maximum enrollment per week for one teacher. Twenty boys are as many as one teacher can successfully instruct at one time, although schedule difficulties may make necessary the including of a larger group. Half a day each week is a reasonable average time that each class should devote to this work. Thus it will be seen that two hundred pupils a week would be a sufficient number of pupils for one instructor working under maximum class load for a maximum number of classes. In no case should the number in any one class exceed the number for which equipment is available.

"Another variable which must be considered is the number of students in the course, and the probable number that will work in any given unit at one time. In a class of 20 students working in a comprehensive general shop equipped for woodwork, sheet-metalwork, electrical work, and auto mechanics, with about equal emphasis on each division, an equipment selected on the basis of five boys per instructional division should prove adequate. If one division is made paramount, the provision of others can be curtailed somewhat. Often woodwork is made the major division with additional work in electricity, plumbing, concrete, sheetmetal, and forging. In this case the small division may be equipped for two or three boys, and the major division for from five to ten. A real danger is that the chief division will receive all the emphasis to the neglect of the so-called minor ones, thus lessening the opportunity for fulfilling the aims of the course."5

F. Productive Work.

School shops are turning more toward the production of articles of commercial value for use in the schools. These are often made in quantity. This practice is frequently referred to as "doing productive work".

"In contrast to the individual-problem method has come the practice of organizing classes for productive work in the school shop. Quantity production is known as that form of activity which results in the manufacture of a number of similar articles, as a dozen chairs, or desks, or trash-cans, or what not. The product from such effort may be sold, used by the school board, or divided among the class members. Under the plan last mentioned, the boys agree upon an article that each will want when finished. The class is then organized for the production of the required number, and the boys each receive one when the job is done.

"Some teachers are inclined to look upon production work as merely a chance for the school board to exploit students; others are enthusiastic about its values. While one instructor fears the loss of interest if such activity is engaged in, others testify to the fact that enthusiasm has been stronger while production work was under way than at any other time."7.

The educational contribution of each is different. In making an individual article for personal use the motive is not the same as that attached to the factory production work. The latter develops team work and furnishes training in cooperation; whereas the former,

7. Ericson, Emanuel E., Teaching Problems in Industrial Arts, p. 158.
while richer in its range of technique, has a more self-centered objective. Both should be represented in school shop work, but where factory production methods are used, caution is necessary to prevent too much repetition after the main instructional content has been exhausted.

G. Materials, and Methods of Handling.

Materials are now so expensive that the cost contingent upon operating school shops has become a problem in the prosecution of the work. Various plans are in operation to control costs. Among these the two most commonly used are: (1) pupils pay for materials used in the construction of articles which become their personal property, and (2) pupils manufacture articles, needed by the schools, on a productive work basis.

"The general shop requires a good method of distributing supplies to the individual pupils, preferably a scheme that is almost automatic. The instructor cannot afford to spend much of his teaching time in giving out supplies. He should have materials readily accessible during the class period. A very efficient method is to have a supply-cabinet which may be locked when not in use. The small, consumable supplies such as wire, surplus finishing materials, sandpaper, solder, tape, glue, and the like, may be kept in this cabinet. It should provide a definite location for each type of material, and each type should be labeled so that the pupil can see at a glance where the materials are. There should be placed on the door of the cabinet a sheet, upon which the pupil is to record his name, and the amount and type of material taken from the cabinet. The cabinet should be under the supervision of the shop foreman and the instructor."
"The more bulky supply items may be conveniently placed in the specific shop division. For example, the cement and sand may be kept in bins near the equipment for concrete work, the sheet-metal may be kept near the sheet-metal equipment, and the lumber near the woodworking division. Such items may be checked easily when the individual projects are assigned."8

"Is it better to charge students for materials, or to have the school furnish them? No considerable group of teachers would probably agree on the answer to this question. There are advantages and disadvantages on both sides. In favor of charging for materials it might be stated: (1) the student feels more responsibility for his work if he must pay for the material; (2) less material is wasted, and better habits of thrift and conservation are developed; (3) the per capita cost to the school will be lessened, resulting in fewer objections by taxpayers in general to the high cost of schooling; (4) whatever is made on the individual basis becomes the property of the student, and is always worth more than the materials; (5) students will be less likely to be over-ambitious in selecting large projects for construction; and (6) they will not insist on working with unnecessarily expensive materials.

"In arguing for free materials it may be said (1) some of the best students who could find larger and more attractive articles must work on unimportant jobs because they cannot afford to pay the price for materials; (2) public schools should offer opportunities to rich and poor alike in the workshop as well as in academic instruction; (3) many of the poorer students come to the school shop, and charging for materials is a cause of discouragement, and of keeping down the enrollment.

"A reasonable practice is to provide a certain amount of free material for the preliminary and most necessary individual work; then in advanced work, on the individual basis, to expect students to pay for their own materials. It should not be compulsory

to spend money for materials; and need not be, since there are always opportunities for turning out a product for the school or for some individual who will gladly pay for the cost of the materials.

"It appears unjust and unreasonable to expect, as some principals and school boards do, that full reimbursement shall be made by students for the value of all materials. When such demands are made it places the instructor in the position of a factory manager, and forces him to forget the instruction for the necessity of construction. Waste in the school shop, or elsewhere, is inexcusable; but to expect to spend nothing on materials, particularly in classes of beginners and young students is a short-sighted attitude."9.

H. Related Information and Correlation of Subject-Matter.

Shop work should be accompanied by a certain amount of information concerning processes and materials, their distribution and economic aspects. This work can be handled to a considerable extent by the regular classroom instructors in the school. It is recommended that all classroom teachers be encouraged to come into the shops and get first-hand material for correlation with classroom subjects. In addition the shop instructor must do a considerable amount of related teaching in the shop.

This work should be carefully planned in order that too much time may not be taken from actual manipulative work, especially in cases where but a short time each week is available for shop work.

"The teaching of related information involves a knowledge of some of the elementary principles of science, such as the effect of heat on metals,

effect of moisture on wood, rust, methods of preserving materials, how the electric current works, how to trace the lines of power through a mechanism, the principles of machines, lubrication.

"These things do not involve skills but certain fundamental knowledge and understanding of natural laws. Enormous losses occur every year because people do not know the importance of protecting materials from the action of moisture. They have only a vague understanding of why doors, and drawers in furniture crack and fall to pieces during the heating season. Machines are worn out with a mere fraction of the service they should render, because they are not properly lubricated or cared for.

"One of the most important things we can teach the young people in industrial arts courses is that they should know how to care for equipment and furnishings in the school and home; and how carefully and thoughtfully to correct, without damage to the article, any difficulty that may appear."

"The art of knowing just how much material of the related type to use in order to 'color' a demonstration, and yet not divert the interest, is something which can be had only through experience and close observation. Some instructors with much experience spend an unreasonable amount of time on what they think is necessary information in connection with their demonstrations; others, a very few probably, fail to take advantage of a legitimate portion of such material.

"A woodworker could probably be an expert in his trade and never learn from whence his woods came, or how they are handled before they arrive in his shop. But he will not be an educated person. And it is just here where the justification for broader information (items of knowledge) comes in. In the junior high school particularly, and to a large extent in the senior high school, we are not making mechanics in the school shop; we are offering a means for receiving an education. And if this education is to be at all comprehensive we must think of it in broader terms than simply producing articles in wood and metal.

"Information, then, even if having only a remote relationship to the types of work being done in the shop, is justifiable, and to the larger number of students fully as valuable as the actual tool and machine operations."11.

"Convenience in administration has led to the practice of requiring that a certain percentage of the time be devoted to so-called 'Related Subjects' in trade teaching. This has been done in order to prevent over-emphasis of shopwork by some teachers, and under-emphasis of shopwork by others. While the purpose of this rule is good it has not been satisfactory in practice. It is perfectly obvious that the amount of time required to learn the scientific principles and the practices involved in the successful practice of certain trades is quite different from that involved in the practice of other trades. The amount of time required for the related matter for printer or electrician is much greater than that required for the automechanic or the bricklayer."12.

I. Instructional Devices.

Devices which may be used effectively by the teacher of industrial arts may be noted as follows:

The situation---A class of 20 boys in a general shop. Five boys each are assigned to woodwork, sheet metal, machine shop work, and electric wiring. The class is just beginning to take this work. The teacher finds it necessary to start the entire 20 boys at the same time.

a. He has provided himself in advance with five different 'Individual Assignment Sheets' for each activity.


b. Each boy is given a sheet showing the article or problem assigned to him.

c. Each boy, as he proceeds, keeps his assignment sheet and has it available to refer to his teachers in English, geography, mathematics, and any other subjects presenting opportunities for correlation.

l. Excellent material for short class recitations in the shop may be provided by means of 'Supplementary Lesson Sheets'.

a. The teacher provides himself with mimeographed lesson sheets containing related information which ordinarily might have been imparted by the lecture method.

b. A lesson sheet on shellac, varnish or any timely subject can be given to the pupil for outside study between class meetings. When he comes to class again, the teacher can, in a very short time, clinch the subject and thereby conserve class time for the manipulative side of the instruction.

c. If desired, each sheet can be clipped into individual notebooks or may be expanded upon (never just copy work) by the boys as a required outside assignment.
d. Written work based on industrial arts may be done in connection with shop notebook work. Preferably, it should be handled by the teacher of English as an important means of correlation, and as a means of lending additional interest in the English.

2. Descriptive material may be posted upon the walls adjacent to each unit of equipment. This information should be organized in a very clear manner and should contain drawings, photographs, exhibits, blueprints, and descriptive booklets. In addition to this it is desirable to have a set of handbooks or encyclopedias and other references in the shop for ready reference. These may all be used to aid investigation on the part of pupils as part of the work in industrial arts.

"It is sometimes advisable to take the class on short excursions to points of interest, such as a machine shop, foundry, or planing mill; or a building in various stages of construction. The instructor should remember, however, that the full instructional value of such trips will not be realized unless they are carefully planned. Previous discussion of the points of interest and the conduct of the pupils on the trip is necessary. Excursions are of doubtful educational value if they are not carefully planned and supervised.

"Individual instruction sheets containing organized instructional material for the use of individual pupils have taken a prominent place in shop instruction. They are absolutely essential to the teaching of a well-organized general shop course. It is well, however, to bear in mind that individual instruction sheets are designed to supplement the instruction and not to take the place of the
teacher.

"The job sheets, which tell how to do a complete job, are a type of instruction sheet well adapted to meet the needs of the general shop. The individual instruction sheet can be a highly refined teaching device. It is especially valuable because it allows the pupils to advance at rates in keeping with their individual differences." 13.

Selvidge 14 sums up the chief characteristics of individual instruction sheets of the better types as follows:

**Operation Sheets:**

(1) "The purpose of operation sheets should be clearly stated in the title; as "How to Thread a Pipe".

(2) "Operation Sheets should be based upon units of instruction of the trade involved in work jobs, and not upon jobs.

(3) "The instructions for performing the operations should be given step by step in a very complete form.

(4) "Illustrations should be given to clarify written instructions.

(5) "Questions should be designed to make the student seek the reasons for doing things in a certain way.

(6) "Only the information necessary for performing the operation should be presented.

(7) "A list of the tools and materials required should not be given because that belongs to the job and is a part of the job plan.

(8) "Operation sheets are applicable to any job

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in which those units of instruction covered by the sheets are involved.

(9) "The student should be left the problem of analyzing his job and planning the order of procedure in doing it.

(10) "As a part of the job plan the student should determine the materials and tools required.

(11) "Operation sheets should give references to available sources of information when such information is needed.

**Information Sheets:**

(1) "A specific statement should be made of the subject treated in each; as 'The Characteristics and Action of Lubricants'.

(2) "The information should be given in brief statements and without discussion.

(3) "Problems may be presented with the necessary information for their solution.

(4) "References to available sources of information shall be given.

(5) "Questions should be given to act as a guide in reading and observation, and to form the basis of class discussion.

**Assignment Sheets:**

(1) "A definite statement of problems should be given.

(2) "Sources of information should be stated with exactness.

(3) "Questions should be designed to direct the reading, observation, and thought.

(4) "Provisions should be made for written answers to these questions.

**Job Sheets:**

(1) "Job Sheets should be prepared for specific work jobs and the instructions are given for
these jobs and for no others.

(2) "They should give a list of all tools and materials required for the job.

(3) "They should give the plan for doing the job, listing the steps in their order

(4) "They should give instruction for performing certain operations involved in the job.

(5) "They should give illustrations to clarify written instructions.

(6) "They should present the information as part of the job.

(7) "They should give questions concerning the job.

(8) "References to available sources of information should be given." 14

J. Records.

Some form of records and progress charts should be used in connection with classes in shop work. These are frequently worked out by the individual teacher. Records should be kept of a pupil's progress through the various phases of the course. In a general shop where individual members of the class are assigned to use the several units of equipment, there is no definite way to insure a proper balance of instruction in these different types of work except by progress charts or cards for the different pupils.

"Another approach to the solution of this problem

is to assign students to the duty of supply-clerk much in the same way as tool-clerks are assigned. The value of such an assignment has been pointed out, especially for high school classes where one of the objectives is that of training managers and foremen. In this connection a rather complete system of bookkeeping can be evolved; including also the perpetual inventory, in which a complete check is kept at all times upon the materials which remain in stock.

"Where classes are large this type of work can easily furnish excellent experiences in maintaining stockrooms; and also in bookkeeping, if charge accounts are kept for individual students.

"Another source of assistance in keeping accounts of supplies is the commercial department. Very often this department will welcome the opportunity for work under practical conditions, and the school shop may be made to furnish a setting very similar to the commercial plant.

"In purchasing and using supplies the instructor should be careful to provide himself with all records necessary for future reference. In the first place, he will profit greatly when ordering supplies for the coming year or for coming classes, if he has provided for himself a means of knowing how much has been used in the past, and how the materials were distributed in various classes. He can also tell where economy may be practiced through certain changes in courses of study, use of equipment, or through changes in class management and teaching procedure."15.

"A record system meets a definite need in the general shop. Information about individual pupils which should be accessible, and a matter of permanent record as well, may be summed up as follows:

(1) Name of the pupil
(2) Shop number
(3) Attendance
(4) Materials used
(5) Progress sheet
(6) School marks

15. Ericson, Emanuel E., Teaching Problems in Industrial Arts, pp. 132-133.
"Numerous types of record sheets have been devised and used. The series presented here has shown its worth for varied types of general shop organization, and has been found adequate for the purpose. These sheets may be mimeographed and kept in manila folders for filing.

(1) Class-Record Sheet
(2) Attendance Sheet
(3) Individual-Progress Sheet
(4) Individual Cost-Record Sheet."16.

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CHAPTER VI

SUGGESTED UNITS OF EQUIPMENT FOR A
GENERAL SHOP
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SUGGESTED UNITS OF EQUIPMENT FOR A GENERAL SHOP

A. Variety of Work Provided.

The equipment of a general shop should represent in its appointments a wide range of activities. So far as is feasible these activities should reflect the industrial life of the community. In an average situation a group of four to six activities, selected from among electric wiring, woodwork on bench and lathe, sheet metal work, cement work, automobile repair, elementary machine shop work on bench and lathe, and printing might easily meet this condition. Where significant activities desirable for study may not be included in the equipment, an effort should be made to consider them in visits to industrial plants, and through auxiliary instruction and related information.

"The number and character of activities that may be carried on by a single teacher in one shop is an open question. Much depends on the size of the shop, the character of the equipment, the plan of instruction, and probably more important than all others, the teacher himself. Usually from four to eight activities is the maximum range for the three years (of the junior high school period). If more than eight are offered the time devoted to each is too short for the work to be of much value.

Commonly included groups of activities are:

Group 1.--Metalwork: Sheet metal, forging, machine work, auto mechanics, and foundry.
Group 2.--Woodwork: Carpentry, cabinetmaking, and pattern making, (finishing).

Group 3.--Electricity: House wiring, motor and dynamo operation, and automobile electricity.

Group 4.--Drafting Trades: This would be correlated with all the others.

Group 5.--Printing Trades: Hand composition and press work.

"Not all of these five groups with their subdivisions could profitably be offered in any one school. A suggestive typical shop program follows:

<table>
<thead>
<tr>
<th>Seventh Year</th>
<th>Eighth Year</th>
<th>Ninth Year</th>
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<tbody>
<tr>
<td>Carpentry and Drafting, one semester.</td>
<td>Drafting, one-half semester.</td>
<td>Machine shop, auto mechanics, one semester.</td>
</tr>
<tr>
<td>Sheet metal, one-half semester.</td>
<td>Pattern making, one-half semester.</td>
<td>auto electricity, drafting.</td>
</tr>
<tr>
<td>Electric wiring, one-half semester.</td>
<td>Forging, one-half semester.</td>
<td>No specified time for any activity.</td>
</tr>
<tr>
<td>Auto mechanics, one semester.</td>
<td>Machine shop, auto mechanics, one semester.</td>
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"This program includes activities which are fundamental to the wood and metal trades. It also gives a boy enough try-out experiences to discover whether or not he has any aptitude for trade work. It gives him an opportunity to become interested in trade and industrial work and is a means for gaining some appreciation of trade and industrial processes.

"It does not, however, touch the field of printing and leaves room to take up home mechanics only in an incidental way. However, carpentry, sheet metal, electricity, forging, and machine shop all offer some opportunity to include home repair jobs."1.

"The planning of the equipment for a general shop need not involve the elimination of useful materials from the list, but rather a restriction in the num-

bers and amounts of things. In a comprehensive general shop each division is equipped for a small group of students only, in contrast to the large group-requirements of a shop in which many students must work with the same type of material at one time.

"The determining factors in the selection of equipment suitable for a general shop are:

(1) The aims and content of the course of study.
(2) The resources of the community.
(3) The trade units represented in the shop.
(4) The number of students taking the work at one time."2.

B. Differences Due Mainly to Amount of Machinery Used.

It will be readily appreciated that the units of equipment here listed must, by the very nature of the case, be merely suggestive in view of the fact that one district will not be able to equip a shop as completely as others. Since the principal cost lies in the purchase of machines, it is probable that the main differences in such shops will occur in the amount and kind of machinery included in an equipment. In some instances it has been possible to secure pieces of old machinery or other material to help in equipping a school shop. Frequently business men and industrial plants are willing thus to assist the schools.

In selecting equipment it should be noted that the

use of power-driven machinery is somewhat dependent upon
the availability of electric current, although other
power is not entirely impracticable. Whatever is used,
either new or second-hand, electrically powered or other-
wise, it should be in good condition, and at least rep-
resentative of the machines used in industry. Above all,
the power machines must be safe-guarded.

"The cost of education has mounted to the point where
it is an important social problem. It is well-
known that the per capita cost is higher in shop-
work and other special types than in classroom sub-
jects; it is also conceded that in spite of this
the special subjects must remain in the curriculum.

"There is evidence, on the other hand, that the cost
of equipping shops in some places has been unneces-
sarily high. Equipment has been bought because
money was available, or because it was offered at
a reduction; or because other schools used similar
equipment. Fascination for fine, imposing appear-
ance of the shop has sometimes been a contributing
factor, to say nothing of the insidious work of the
capable salesman.

"Machines or tools should not be purchased because
they are cheap or expensive, small or big. All
these types have some use or they would not remain
on the market. But, the question of cost can well
be taken into consideration, oftentimes costs can
be reduced through intelligent analysis of the situa-
tion from various angles before the purchase is made.
It is not necessary that an equipment be costly in
order to be efficient.

"Boards of education which attempt to buy equipment
from so-called standard lists instead of hiring
the teacher a month earlier and allowing him to
select it, should realize that money is not saved
in that way. If a person has the needed qualifica-
tion for teaching a certain course it should be as-
sumed that he also knows something about the
C. Services of the Department of Public Instruction in Planning Equipments.

It is recommended that districts make use of the services of the Department of Public Instruction, Bureau of Vocational Education, and the Industrial Arts Department of the State College or University in planning equipments, rather than to rely upon any standardized list. The above mentioned agencies will very likely take up each situation separately in view of the fact that local needs are not exactly alike in all districts.

D. Placing Equipment.

When a decision has been made as to the extent of equipment to be placed in a room, it is well to have a scale drawing made of the floor plan. Then, in order that the equipment may be placed to the best advantage, the following procedure may be observed:

Determine the size of the benches, machines, and floor equipment. Draw these to scale in the form of small rectangles upon this cardboard. Cut them out and place them around the floor plan, fastening them to the drawing board by means of ordinary pins. A number of combinations can be tried to eventually arrive at the best and final arrangement.

The equipment can then be drawn on the floor plan.

In providing for a forge it is important to see that it is placed with reference to the chimney location.

"A few considerations to be kept in mind when locating pieces of stationary equipment in a shop may be of help. It often happens that the service of equipment is materially reduced by poor placing. If a definite plan for placing the equipment is made out, as previously suggested, the following points would probably receive attention:

1. Consider the operating space.
2. Consider light conditions.
3. Consider the routing of work.
4. Consider safety.
5. Consider room for later additions."  

E. Selection for the Smaller Schools.

The smaller schools in most cases have rather definite limitations as to room and equipment. Therefore, while a large variety of shop units may seem desirable from an educational standpoint it is probable that selection of about four will eventually be made. The activities chosen will naturally be those which best fit the situation when all factors are considered.

F. Three-Year Schedule for Equipment.

To expedite the early installation of an industrial

arts shop in a small school having limited resources, it is often advisable to start with a partial equipment and then make additions annually over a period of three or more years. Such initial equipment would naturally be reduced to the bare minimum essentials. A schedule showing minimum lists for the various activities, including annual additions, is here given. No attempt is made, however, to indicate any particular group of activities which might be considered as forming a standardised shop for general application.
EQUIPMENT FOR A GENERAL SHOP
(Five Boys)

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of pieces to be ordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single benches with vise</td>
<td>5</td>
</tr>
<tr>
<td>Jack plane, iron bottom</td>
<td>5</td>
</tr>
<tr>
<td>Smooth plane</td>
<td>1</td>
</tr>
<tr>
<td>Block plane</td>
<td>1</td>
</tr>
<tr>
<td>Spoke shave</td>
<td>2</td>
</tr>
<tr>
<td>Claw Hammer, 12 oz.</td>
<td>3</td>
</tr>
<tr>
<td>&quot;T&quot; bevel</td>
<td>1</td>
</tr>
<tr>
<td>Try square</td>
<td>5</td>
</tr>
<tr>
<td>Marking gauge</td>
<td>3</td>
</tr>
<tr>
<td>Ratchet brace, 10&quot; swing</td>
<td>1</td>
</tr>
<tr>
<td>Automatic push drill</td>
<td>1</td>
</tr>
<tr>
<td>Steel square</td>
<td>1</td>
</tr>
<tr>
<td>Rip saw, 6 pt. 26&quot;</td>
<td>1</td>
</tr>
<tr>
<td>Cross cut saw, 10 pt. 26&quot;</td>
<td>1</td>
</tr>
<tr>
<td>Cross cut saw, 10 pt. 24&quot;</td>
<td>1</td>
</tr>
<tr>
<td>Cupped nail sets assorted (1 set)</td>
<td>4</td>
</tr>
<tr>
<td>Socket chisel 1/2&quot; 6&quot; blade length</td>
<td>2</td>
</tr>
<tr>
<td>Socket chisels 1/2&quot;-6&quot;</td>
<td>2</td>
</tr>
<tr>
<td>Socket chisels 1&quot;-6&quot;</td>
<td>2</td>
</tr>
</tbody>
</table>
Auger bits, sizes #4 to #16...... 1
Twist drills, Nos. 2,3,5,7,8.... 2 ea.
Countersink................... 1
Oil stone, combination faced.... 1
Bench grinder................... 1
Glue pot.......................... 1
Coppered oiler, straight spout.. 1
Malleable iron clamps 36"........ 6
Steel bar clamps, 6"............. 4  2
Universal bench saw or band saw 1
Bench jointer 6"............... 1
Rules, Boxwood, brass tipped.... 5
Number of pieces to be ordered.

<table>
<thead>
<tr>
<th>Item</th>
<th>1st yr</th>
<th>2nd yr</th>
<th>3rd yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring booths, size 36&quot;x48&quot;</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat nose pliers 6&quot;</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screwdrivers 4&quot;</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door bells</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buzzers</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annunciator</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell wire (feet of)</td>
<td>500</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Pkg. insulated staples</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry cells</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto bulbs, 6 volt &amp; 3 volt</td>
<td>2 ea.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptacles (to fit auto bulbs)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christmas tree lighting outfit</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell ringing transformer</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toy Motor (D.C.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automobile horn (electric)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model of an electric meter</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(This can be made in the shop)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wireless outfit</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptacles, knobs, cleats, tape, etc.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Small motor generator set</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage battery</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
### Sheet Metal Work

*(Five Boys)*

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>1st yr.</th>
<th>2nd yr.</th>
<th>3rd yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand punch</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bar folder</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turning machine</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Folding machine</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Hollow mandrel stake</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circumference rule</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square stake</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blowhorn stake</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elbow edging or burring rolls</td>
<td>1 pr.</td>
<td></td>
<td>1 pr.</td>
</tr>
<tr>
<td>Straight snips</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circular snips</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting hammer</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand groover</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting nippers</td>
<td>1 pr.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ring scratch awl</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid punches</td>
<td>1 set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivet set</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallet</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr. dividers 8&quot;</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Soldering coppers, 2 lb. (pr.) 2
Handles for soldering coppers 2
Plumber's scraper.......... 1
Double burner gas furnace.. 1
Stone soldering slab $\frac{3}{4}'' \times 14'' \times 14''$ 1
Acid cup.................... 1
Acid swab.................... 1
Jar for dipping solution.... 1
Beading machine............ 1
Additional tools and equipment suited to any special product made in the shop........... x
<table>
<thead>
<tr>
<th>Item</th>
<th>1st yr.</th>
<th>2nd yr.</th>
<th>3rd yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drafting boards 18&quot;x24&quot;</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;T&quot; squares, 24&quot; blade</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celluloid triangles, 60-30, 8&quot;</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celluloid triangles, 45, 6&quot;</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruling pens</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compasses with pen attachment</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual drafting tables</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box thumb tacks</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pkg. buff detail paper 11&quot;x15&quot;</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue print frame</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Blue print paper, 5 yd. roll</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bow pens</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Drawing board 20&quot;x30&quot;</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Tracing paper (yds.)</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>&quot;T&quot; square 30&quot; blade</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Bottles black waterproof ink</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Demonstration set of drawing instruments for instructor's use</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
# ELEMENTARY MACHINE WORK

*(Five Boys)*

<table>
<thead>
<tr>
<th>Number of pieces to be ordered.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st yr.</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Long bench fitted with 3 stationary machinist's vises</td>
</tr>
<tr>
<td>Swivel machinist's vise</td>
</tr>
<tr>
<td>Hack saw frame with 6 blades</td>
</tr>
<tr>
<td>Assorted files</td>
</tr>
<tr>
<td>Ball peen hammers, 12 oz</td>
</tr>
<tr>
<td>Cold chisels, 1/2&quot;</td>
</tr>
<tr>
<td>Sensitive drill press</td>
</tr>
<tr>
<td>Machinist's scale, 6&quot;</td>
</tr>
<tr>
<td>Combination square, 12&quot;</td>
</tr>
<tr>
<td>Heat treatment furnace (or forge)</td>
</tr>
<tr>
<td>Anvil</td>
</tr>
<tr>
<td>Bench lathe with essential tools</td>
</tr>
<tr>
<td>Grinder</td>
</tr>
</tbody>
</table>
**CONCRETE WORK**
*(Five Boys)*

<table>
<thead>
<tr>
<th>Item</th>
<th>1st yr.</th>
<th>2nd yr.</th>
<th>3rd yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spading tools</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edger</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groover</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel finishing trowels</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement worker's trowel</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pointing trowel, 4&quot;</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wooden float (made in shop)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small bins for storing sand and cement</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water tub for curing small pieces</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring box, size ½ cu. ft.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring box, size ¾ cu. ft.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring box, size 1 cu. ft.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply of wire and rods</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw iron oxide (lbs.)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon (sack)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement (sack)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flower box forms (made in shop)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand (cu. ft.)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urn forms (made in shop)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forms for advanced projects</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### AUTOMOBILE REPAIR  
**(Five Boys)**

<table>
<thead>
<tr>
<th>Item</th>
<th>1st yr.</th>
<th>2nd yr.</th>
<th>3rd yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine (out of an old car)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set of socket wrenches</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set of solid fork wrenches</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stillison wrench, 10&quot;</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monkey wrench, 8&quot;</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set taps and dies (A.L.A.M.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tube vulcanizer and materials</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast drill</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing scraper</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portable lamp and cord</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve lifter</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chassis</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto parts such as extra transmission, rear axle assemblies, starting motors, etc...</td>
<td>1</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER VII

SCOPE OF SHOP PROBLEMS
CHAPTER VII

SCOPE OF SHOP PROBLEMS

A. Pupil Interests Determine Problems.

In general, the interests of the pupils should determine the problems to be presented. Projects which arise in the lives of the pupils may be woven into any course in the general shop. The teacher should have a number of problems ready to present, but these will ordinarily be prepared for use in the absence of individual or class projects which present themselves from time to time. For example, the construction of scenery frames for a class entertainment might well be substituted for some of the set problems in woodworking and meet even more fully the aims of industrial arts instruction.

"Shop activities and projects should be selected in accordance with the primary objectives for the industrial arts, and not in accordance with any indirect values they may have for other types of studies.

"Activities existing in the locality should have preference in the general shop work in so far as these activities involve fundamental trades and industries."1

"Some instructors, approaching this subject entirely from the standpoint of student interest, have gone so far as to advocate that students be given an almost unlimited choice of what they wish to

---

make. Such advocates might or might not have a course of study indicating operations to be covered and knowledge to be obtained. If they had one, they would insist that it makes little difference where the student begins.

"This may seem far-fetched to those who have school-ed themselves in orderly and well-planned procedure, but in reality it is not so. Many shops are attempting or have attempted to operate on the principle that, within a very liberal scope, the student may make what pleases him."2

B. Wood Shop Problems.

Wood shop problems may be considered from two angles; the industrial arts work given in a special wood shop, and the woodwork that is included in the activities of a general shop.

1. Problems for the shop devoted to wood alone should be planned in such manner as to attain the aims of industrial arts instruction—first, through making articles for the pupil's individual ownership; second, through producing things needed by the schools or civic bodies; third, through a carefully selected list of problems which the teacher arbitrarily plans out in advance.

2. In the general shop, the scope of woodwork is reduced in point of time, as compared to the single purpose wood shop. This must usually be

the case, since the general shop contains four or five types of work, each of which is given about equal time with the other activities within the shop.

"The specific aim of the general wood shop is to acquaint the pupils with the different branches of the woodworking industry. It covers a broader range of material than cabinet-making or pattern-making alone. The general wood shop does not cover the different divisions of the woodworking trade for the purpose of training skilled tradesmen. The work may or may not be vocational."3

C. General Shop Problems.

The problems undertaken in a general shop will often be made of several materials. The making of a toy motor is primarily electric work but it may have a wooden part, such as the base or mounting, and the construction of it would entail the use of machine shop and sheet metal equipment. In this respect many of the wood problems for such a shop may differ from the ones found in a shop devoted entirely to wood.

"The pupils who want to build radios or work on some other project involving several different types of material may carry on the various operations in the same shop. The cabinet may be built in the woodworking division, the metal parts in the metal division, and the wiring done in the electrical division. However, not all of the best projects are of the varied types."4


4. Ibid., p. 16.
"As time went on in the operation of the one-activity shop, there appeared a desire and a need for additional activities. This condition was prompted by three factors: (1) formal woodworking became commonplace; its newness wore off; (2) industrial conditions changed, leaving for wood and woodworking a less important place; and (3) boy interest, affected by these factors, demanded a broader scope of activity. To these might be added the fact that the need for exploratory opportunities touching a wider range of mechanical work became recognized. In response to these considerations, and probably others, the woodworking shop began to admit other types of work within its wall, and to lose some of its earlier formalism."5.

D. Sheet Metal Shop Problems.

The sheet metal work that may be done in a general shop consists of a range of problems that bring out the typical sheet metal operations. A variety of cookie cutters are often made at the outset of the course. Cups, funnels and parts of such projects as water motors and electric motors or other apparatus are found to be useful problems. In many schools useful things are readily made from tin cans.

E. Electric Shop Problems.

Electric wiring and construction, given in a general shop, may include a variety of bell wiring problems, followed by experimental work on small motors, transformers and auto ignition. It may also include simple repairs of household electrical appliances, and very

5. Ericson, Emanuel E., Teaching Problems in Industrial Arts, p. 304.
elementary radio construction, if time permits.

F. Elementary Machine Shop Problems.

Elementary machine work includes problems in chipping, filing, cold-bending, tapping and threading. Such problems as a bolt and nut, nail set, ice pick, center punch and parts of articles made in more than one material are suitable for bench work. Plain turning on the bench lathe may be varied and may contribute to problems entailing the use of more than one material.

G. Automobile Shop Problems.

In schools having an automobile unit in the general shop, a number of interesting problems can be developed in taking apart and reassembling, testing, tire repairing, relining brake bands, ignition work, and a variety of such typical operations in repairing an automobile. All of these should be related to the "science" or theory content of the job and as much as possible the work should cover simple service and repair jobs that can be done by the boy at home.

H. Problems in Concrete Work.

Cement work is highly adaptable to school shop instruction. Many small vases, urns, flower boxes, and the like can be made as a part of a general shop unit of instruction. The forms for moulding the articles mentioned make excellent problems in woodwork. Rods for reinforcing are good cold-bending problems in metal work.
I. Mechanical Drawing Problems.

A mechanical drawing should in most cases precede the construction of an article in the shop. In the making of such drawings, care should be exercised to conform to the accepted rules for use of the "T" square and triangles. While drawing may in this way be incidental to each shop problem, it may also be used to form a separate unit in a general shop. At least the aim should be to develop enough ability in the pupil that he may read a drawing understandingly, and be able to make simple pencil drawings, both by the freehand sketching method and with the basic instruments. It is not necessary that the pupil make drawing for each project or job, but it is invariably necessary that he use a drawing of some kind. He must, therefore, understand the "language" of a drawing.
CHAPTER VIII

MAKING THE COURSE OF STUDY
CHAPTER VIII

MAKING THE COURSE OF STUDY

A. Basis of Course Planning.

A course of shop problems in the general shop should be based upon--first the life interest of a pupil group; second, the essential characteristics and operations of the several occupations represented; third, the fullest use of the equipment available.

"The construction of the course of study may be considered the fourth step in the procedure of establishing a course or a school activity; the three preceding ones being: (1) determining aims and objectives; (2) surveying or analyzing the field or industry from which subject-matter may be chosen; and (3) choosing or selecting from the sum total of the possible items of subject-matter those which will function toward satisfying the accepted objectives.

"These three steps in the chain of progress having been completed, there will be at hand a definite list of items accepted as useful, and the next task is to arrange these items or bits of instructional material in the most effective order and combination."1

B. Course Should be Flexible.

Since life interests differ with pupils, it is necessary to make industrial arts instruction flexible and to have it in a state of continuous evolution. It is necessary and proper, however, to make an outline plan

for each term, and not leave everything to inspiration and the chance that a teacher will make a timely discovery of the exact needs of every pupil.

"The significance of the democratic movement lies in the notion that training for specific objectives can not be the whole aim of education for the reason that the purpose of this movement is precisely to make over the social order and our present modes of living so that we may progressively substitute new objectives for old ones. Any scheme of education that fails to make provision for this element of progress is, so far hostile to the democratic purpose of humanizing both education and life........

"The method of activity analysis must be directed by a theory of what education should seek to achieve, and not be regarded as a substitute for such theory. Activity analysis does not determine objectives, but the objectives determine what sort of facts are needed, and consequently how the method is to be used."2.

C. Core of Instruction.

Participation in and information about any trade or occupation may be used as the core for course construction. It may happen that only one phase of a trade will be found in the vicinity of a school. This phase should usually have more emphasis in a course which is planned for the pupils of such a school.

D. Problems Meet Equipment Limitations.

The amount and kind of equipment vary in different schools, and while this is usually a matter that can be

2. Bode, Boyd H., Modern Educational Theories, pp. 79; 112.
easily controlled, it is well to think of problems for a course in terms of the tools and machines to which pupils have access, both inside and outside of school.

E. Need of Planning.

Successful work in industrial arts depends largely upon the teacher. Because of the individual nature of general shop instruction there is need for planning, previous to class time, a number of suitable problems that can be given to pupils on Individual Assignment Sheets. The danger of formalizing the instruction is remote since the number of problems thus worked out would at no time include the entire class activities. It is certain that no teacher can do effective work without detailed planning before the class comes into the shop. It is suggested that the teacher work out his outline for the duration of the course, giving number of weeks; shop work; related instruction in the shop; classroom correlation; and class visits.

"The lesson plan is essentially a treatment in detail of a small unit of subject-matter for presentation to students. No lesson or demonstration can be presented with the greatest measure of success unless the instructor has first developed a plan.

"The course of study furnishes an outline of the major phases of the program to be followed. A comprehensive course may furnish a part of the teaching directions. Nevertheless, it falls upon the instructor to organize his material in complete form immediately before presenting that material, and the teacher who has made preparations
for his daily work is the one whose efforts will be marked with success."

F. A Further Aid to Instruction.

A further aid to instruction will be found in the use of Individual Instruction Sheets of various kinds. These may be mimeographed for convenience. Their purpose is two-fold; first, they give the individual pupil a drawing to guide his construction; second, they note the correlation of the shop work with regular classroom activities.

"Individual instruction sheets containing organized instructional material for the use of individual pupils have taken a prominent place in shop instruction. They are absolutely essential to the teaching of a well-organized general shop course. It is well, however, to bear in mind that individual instruction sheets are designed to supplement the instruction and not to take the place of the teacher.

"The job sheets, which tell how to do a complete job, are a type of instruction sheet well adapted to meet the needs of the general shop. The individual instruction sheet can be a highly refined teaching device. It is especially valuable because it allows the pupils to advance at rates in keeping with their individual differences."

G. Home Repairs, a Project in Course Planning.

An interesting project in course planning may be worked out on the basis of a survey of jobs which the average man is called upon to do around the home from

3. Ericson, Emanuel E., Teaching Problems in Industrial Arts, p. 81.
time to time. A list of minor repairs to the house, plumbing, wiring, heating plant, furniture, electrical appliances, garden equipment and the like may be compiled as a basis for problems that may be used for industrial arts shop instruction. This work is readily handled with a general shop equipment. It may be given profitably in the early periods of a junior high school course.

"Home mechanics seems to be coming forward; first as the small town's solution to the junior high school industrial arts philosophy; second, as a means of providing shopwork for students in junior high school in larger cities not particularly in the industrial group; third, as one form of shop in which a variety of occupational work may be presented in the schools of the larger cities where it does not seem feasible to have a number of single-activity shops; fourth, it is being used in some places as the shopwork to give to the part-time pupil in the vocational school who comes without any basis for intelligent choosing of occupational work."

CHAPTER IX

CONCLUSIONS
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Even though the general shop idea is scarcely twenty years old, it is becoming widespread and is the most recent development in the field of industrial arts. One may see an example of this type of organization in the different levels of schoolwork.

"The general shop idea has been enjoying a great popularity among school administrators. Manual training, as such, is no longer in good standing, and definite vocational training does not seem to belong in junior high schools. Therefore, the general shop is hailed as the means by which a changed situation may be met. Whether or not this proves to be the case, it may be well to consider just what a general shop really is. The following is offered as one point of view concerning the meaning of this shop and the place it holds in relation to the teaching of industrial-arts subjects in our schools.

"The Detroit plan of industrial arts instruction is based upon the use of a general shop. This general shop is merely a workroom equipped in a diversified manner. The term "general shop" is not conceived of as a definite subject of study. Included in each general shop is the equipment necessary for the teaching of a number of related units. The courses which may be taught in these shops are limited only by the equipment and the time which may be allotted to them."

B. Advantage of General Shop Idea to Younger Children.

This type of organization, general shop, makes it possible for young people of the first six grades to carry out special projects which may involve experimentations and the use of various tools and materials.

In rural and consolidated schools the general shop can be made accessible to pupils from the first grade to the twelfth.

Youngsters of today have infinitely more opportunity to learn at first hand scientific facts coupled with information about materials and tools; the general shop idea tries to meet this need. It would be difficult to say just what part this type of shop will play in the tremendous advances that will be made in the realms of science and invention.

C. Equipment as a Factor.

Because many valuable suggestions pertaining to specifications, standards, and the ways and means of establishing general shops may be found in the current literature on the subject, a discussion of those factors will be omitted.

"The courses of study that may be offered in a general shop are dependent upon the equipment in the shop; therefore, it should be determined what course the shop is being equipped to handle. The economical equipping of a shop is dependent upon the courses to be offered. Even though much of the equipment might be identical, it is quite apparent that a shop designed for a course
in general metal work would hardly be adequate to handle a course in household mechanics.

\[ \text{The titles of such courses as household mechanics, industrial mechanics, general metal work, farm mechanics, general printing, general woodworking, and general automobile mechanics are indicative of their scope, a scope which is limited only by such factors as stated in the foregoing. Such courses called for a variety of carefully selected, but not a heterogeneous conglommeration of equipment that has been installed with no definite use in mind.}^{2} \]

D. Adjusting to a Small Budget.

\[ \text{"Many schools in the smaller communities are still limiting their shop course to woodworking because they are frightened by the bugbear of high cost of new equipment, and they are paralyzed by the long lists that are published from time to time as being essential to the teaching of any kind of shop course. The fellow with an almost unlimited spending allowance for equipment likes to tell about what he has bought even though he has so much that he never uses it all. The fellow who has to limit his equipment doesn't tell about it because he does not relish admitting that he is too poor to have more. There is, however, one course that can be introduced into any school where woodworking is taught, which will not cost more than is within the reach of any community. That course may go under several names, but it is usually called the general shop course."}^{3} \]

E. Teaches a Worthwhile Lesson.

One must realize that every person is not able to apply the general information contained in purely academic courses. It is only by specific applications, a

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learning by doing, that will enable many of our people to apply the general to the particular. The general shop is particularly strong in teaching many of the worthwhile lessons that function in everyday life. This type of shop should be remembered especially in these times of retrenchment, when so many misguided efforts are made to rob the young of the valuable assistance given by the shop courses.

F. Desirable Traits of Behavior Gained by Shop Work.

"The general shop idea has come in response to a demand for socialized courses. It seems to be the consensus of opinion of those leaders who are best acquainted with the problems and objectives of the junior high school that shop courses should be of a general nature. It is quite generally recognized that the outcomes of our instructional efforts are measured to a great extent by the manner in which our pupils fit into their community life. There are many persons who believe that social efficiency may be a greater factor in an individual's success than his technical knowledge or his possession of manipulative skill. Being aware of the importance of the social efficiency factor should not lead us, however, to neglect the development of skill nor to place less emphasis on the acquiring of technical knowledge. It is not suggested that training in social efficiency should supplant what have been so long considered the essential elements of shopwork. It is being suggested, however, that desirable traits of behavior may be developed in the pupil through participation in a good shop organization. It would seem that the development of such traits as represented in the following situations should become an integral part of shop instruction: (1) taking orders from a superior, (2) giving orders to helpers, (3) assuming responsibility for getting things done, (4) participation in planning an organization, (5) accepting duties for the good
of the school."4.

G. In Conclusion.

It is, therefore, concluded that:

I. The general shop is an effective instrument of public secondary education, suited specifically for the junior high school, or early 4-year high school level, in which the major objectives should be,

1. To develop leadership and judgment.
2. To develop ability to analyze orderly procedure.
3. To develop the power to visualize.
4. To develop imagination and encourage originality.
5. To develop habits of neatness.
6. To develop a pride in ability to accomplish things.
7. To gain confidence in meeting new situations.
8. To develop understanding and appreciation of labor.
9. To make more efficient choice and use of products of industry.
10. To develop elementary skills in common use.
11. To train in the understanding of verbal and written directions.

II. It is well suited to meeting these objectives in the small school because of

1. The several related activities are under the direction of one teacher.
2. It provides an economic solution for giving multiple contacts in a number of trades and industries.
3. Socialization procedures could be provided more readily in the small school.
4. Exploration and guidance instruction could be taken care of in the small school.
5. The recognition of individual differences can be catered to more easily in the small school.

III. Because of the varied and unstandardized nature of the work, selection and organization of equipment becomes a very important factor in the success of the general shop, especially if costs are to be reasonable and efficient instruction is to be maintained.

IV. Organization of subject-matter and major items for the course of study are even more important than in other types of shop work, and the use of all forms of workable instructional aids becomes a necessity.
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