

AN ABSTRACT OF THE THESIS OF

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Title-----~~A STUDY OF TEXT AND REFERENCE MATERIAL~~-----  
~~USED FOR INDUSTRIAL ARTS METALWORKING, IN THE~~-----  
~~SECONDARY SCHOOLS OF CALIFORNIA.~~-----

Abstract Approved:--  
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This study is based upon the problem of the selection and use of the books in California senior high school metalworking classes. One hundred schools furnish the data used, which were obtained by the questionnaire method. The school sizes varied from an average daily attendance of 135 to 4638 as shown in the 1940-41 directory.

The results show that:

1. About half of the teachers (51%) stated that their supply of metalworking books was insufficient.
2. Only one-third of the schools limit the expenditures for books.
3. The most desirable feature of metalworking books was that they contain working drawings of projects. Other desirable features, in the order of popularity, are: technical information, pictures and illustrations, related information, quantity of illustrated projects, and occupational information.
4. Sixty per cent of the teachers prefer a durable cloth binding on their shop books rather than a paper cover.
5. Only about half (51%) of the teachers use a textbook in classwork. Nearly two-thirds of the teachers in large schools use a textbook, while only forty-one per cent use them in the small schools.
6. The most desirable location for books to be used by students is in the shop.
7. Teachers use books most often for: (a) working directions, (b) assignments, (c) selection of projects, and (d) questions to be looked up.
8. The average weight on the students mark, given for "book work" was thirteen per cent.
9. The average <sup>PER</sup> teacher was thirteen books on hand in both large and small schools.
10. Approximately fourteen different books were considered sufficient for class use. Also those teachers who were limited in funds for purchases had as many books as those who reported that they had a sufficient number of books.

11. Teachers with over five years of trade experience use slightly fewer books, but the group with from one to five years of trade experience makes more use of book work in marking students.

12. There is no apparent lack of good books in any field of metalwork.

13. Among the 100 teachers reporting there were 172 different titles of metalwork books being used.

14. R. E. Smith and F. H. Colvin are the most popular authors.

15. Machine and equipment companies are a well-used source of books.

16. Three publishers produce over half the books used by teachers reporting.

17. Publishers and authors are keeping the books up-to-date.

18. The space devoted to occupational information is too small.

Only two recommendations are given, namely:

1. That more occupational information should be made available to industrial arts students.

2. That all schools should provide space in the shop for reference to books as well as a suitable method of caring for the books.



A STUDY OF TEXT AND REFERENCE MATERIAL  
USED FOR INDUSTRIAL ARTS METALWORKING,  
IN THE SECONDARY SCHOOLS OF CALIFORNIA

by

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A THESIS


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# A STUDY OF TEXT AND REFERENCE MATERIAL USED FOR INDUSTRIAL ARTS METALWORKING, IN THE SECONDARY SCHOOLS OF CALIFORNIA

## CHAPTER I

### INTRODUCTION

The selection of text and reference material for industrial arts metalworking appears to be a major problem, for the reason that current educational practices (23:92) indicate that most metal working teachers use from fifteen to twenty-five per cent of the class time in imparting information, either as the occasion arises or as a planned classroom procedure. The well established aims of industrial arts indicate the importance of technical, related, and occupational information. There are, of course, a minority of teachers who still believe that industrial arts is solely a manipulative activity and that the use of textbooks in the shop is a controversial issue.

Publishers are placing upon the market more and more text and reference material. Established authors are revising old books and writing new ones; new authors are appearing, producing a multiplicity of titles. It is a surprise to most educators, even industrial arts teachers, when they find how many books there are for sale in any field of the industrial arts. Included in this

study is a list of over 400 books pertaining to the single area of metalworking.

### Purpose of study

Because of the importance of the metalworking industry in American life and the large number of books available, there is reason to believe that a study of these books would be of value to students, teachers, administrators, and supervisors.

With this in mind, the purposes of this study are:

1. To determine the books on metalworking available to the students of California schools
2. To determine the content of the text and reference material which teachers of metalwork may find most valuable
3. To determine how many teachers use textbooks
4. To determine the methods of using books for instruction in metalworking classes
5. To determine the influence of the use of written instructions in book form on the student's mark
6. To determine the most desirable location in which to have books available for student use

### Terminology

In order to lessen confusion caused by differences of interpretation of terms used in this study, the



following definitions are presented. The term:

1. Art Metal is defined as a course in which skill and taste are applied to the production of lightweight metal projects according to aesthetic principles. The metals commonly used include copper, brass, aluminum, Pewter, silver, and similar alloys. The type of project varies from the simple trays and book ends to those made by spinning, as sugar bowls and cream pitchers. In the advanced courses, jewelry construction may be offered, but this branch of metalworking is usually considered to belong in the art department rather than in the shop. Some schools list metal handcraft and metalcraft, which would be included in the art metal courses.

2. Bench Metal refers to courses in which the major part of the work is done on a bench, using hand tools. (In the larger shops the power drill press and grinder are included in the equipment.) It is an introductory course to the metal trades, offering trade practices in hammering, cutting, measuring, drilling, filing, threading, tapping, and polishing.

3. Farm shop concerns that type of shop work usually found in the agricultural communities which takes the form of a general shop, specializing in the construction and repair necessary for farm upkeep. It is an attempt to fit shop work into the needs of the community.

4. Forge includes courses in that part of metal

working which requires the use of forge and anvil for heating and shaping metal. The hardening and tempering of steel are included in this course.

5. Foundry means the study of the forming of metal objects by casting in sand or loam molds. Some of the usual shop projects are book ends, candle sticks, etc.

6. General Metal refers to a metal course in which various types of metalwork are carried on in one room. It may be conducted on the unit basis, where the entire class works on the same unit, as sheet metal and then changes to another unit; or it may be conducted on the general shop plan, where different groups in the class work on different units. This type of class may have four or five students working on sheet metal, several students working on foundry; and others working on bench metal, lathe, forging, or art metal.

7. General shop concerns that type of shop in which various areas of instruction in industrial arts are taught in one room. This is especially valuable in the smaller schools where unit shops are not possible because of the small enrollment and the greater cost of the unit shop.

8. Industrial Arts as defined by the Western Arts Association, (39:21) is one of the practical arts, a form of general or non-vocational education, which provides

learners with experience, understandings and appreciations of materials, tools, processes, products, and of the vocational condition and requirements incident generally to the manufacturing and mechanical industries.

9. Machine Shop includes instruction in the shaping of metal through the use of machines such as the lathe, shaper, milling machine, and planer. The type of work is limited only by the equipment.

10. Metalworking is used to indicate the whole field covered in industrial arts in which metal is the chief material used for construction of projects. A school system may offer any one or more of the following courses, under the heading of art metal, bench metal, forge, foundry, general metal, machine shop, metal spinning, ornamental iron, sheet metal, welding, etc. Also, metalworking may be included with other materials, such as wood in general shop or farm shop.

11. Occupational information is defined as information relating to choosing, preparing for, securing, holding, and advancing in an occupation. Discussions on opportunities for advancement and success in the machinist's trade would be an example of this type of information.

12. Ornamental iron is defined as a course in which the heavier metals are used for producing artistic



projects. It is usually very closely allied with forge work. The projects may include lamps, grills, andirons, metal gates, etc.

13. Reference book concerns those books used for obtaining data of the related-information type to aid in solving problems or in determining methods of procedure.

14. Related information includes information that is helpful but not necessary to the execution of the work. The history of drilling, the manufacture of iron, and the making of grinding wheels are examples of related information for the machine shop.

15. Sheet metal is concerned with courses developing and forming projects of thin gauge sheet metals, usually tin plate or galvanized iron. Cups, funnels, boxes, dust pans, scoops and waste baskets are among the popular projects.

16. Technical information is defined by Verne C. Fryklund as (10:401):

.....an inclusive term that will fit any kind of information that will help the worker to form judgments whether the information is direct or marginal in nature.

Reading of blueprints, cutting speeds and feeds for machine shop and solders, fluxes, sheet metals and their uses, etc., for sheet metal are examples of this type of information.

17. Text book indicates that the book is commonly used by the student to obtain basic information. A text-book may be studied individually or in groups, as the aims of the course and the facilities require. Also included is the "how to" type of book, sometimes known as the shop manual. Struck (34:345) speaks of the latter type of book as a work book ".....designed for individual work on the part of the pupil."

18. Text and reference material refers to printed books which may be used to present information, either directly or indirectly, to the student.

19. Vocational Education, as defined by the Western Arts Association, (39:24) is a form of practical education, the purpose of which is to prepare persons for gainful or wage-earning employment; specifically economic rather than generally social.

Or, as Lee (17:36) defines vocational education: "One objective only, the giving of an education which will assist an individual to earn his living."

20. Welding indicates a course in the process of joining or severing pieces of metal with the aid of an electric arc or oxyacetylene torch. Proficient welders are greatly in demand at present in the ship-building, airplane, and allied occupations.

### Location

The data for this study ~~were~~ obtained from California primarily because the author's home is in the central part of that state and also because this state is considered a representative state in the field of education. With the great number of teachers supplying the data from as many different localities, there should be small doubt that the material is authentic.

### Procedure

In order to obtain sufficient data, the questionnaire procedure was considered to be the only feasible one to follow in the present study. The only other method possible was the interview procedure, which would have entailed a great amount of time and expense. Since one hundred cases were studied, the data should be considered a valid sampling of the schools of the state.

Early in 1942, letters were sent to eight publishers asking for a list of the books that had been the most popular, as shown by their retail sales record. These eight companies publish a great percentage of the shop books that are in common use. From the seven lists returned by these publishers, together with the List of High School Textbooks, a California State Dept. of Education Bulletin (5), a list of forty-four books was



selected for the check list on page two of the questionnaire which was to be sent to teachers, to determine the books then in use by these teachers.

The list of questions on page one of this questionnaire was devised to obtain the information desired as to how the books were selected and used, where they were placed, etc.

The questionnaire, together with the letter of transmittal, was mailed to 150 teachers on March 14th, 1942, in the hope that 100 answers would be received. The personal notes and added lists of books and suggestions returned with these questionnaires, as well as the number of returns, would seem to indicate that many teachers were interested in the topic. Of the 106 answers (70.67% of the total sent out), 71.4% asked for the results when completed. Eighty-two questionnaires were returned in the first twenty days. After a reminder card was sent to the remaining sixty-five people, there were twenty-four more returns, which provided the one hundred completed questionnaires desired.

### Limitations

The study is limited:

1. To text and reference material in book form only, as no attempt was made to include magazines or

teacher-made materials

2. To the information received from questionnaires from 100 California senior-high-school metal-work teachers

3. To the knowledge of books and the integrity of the teachers who returned the questionnaire

4. To the ability of the author to interpret the raw data received

## CHAPTER II

### BOOKS AS A SHOP TOOL

Education is concerned with providing opportunities for the pupil to make maximum individual growth and to prepare him for rendering maximum service to society. The aims of industrial arts are built upon this assumption. These aims are well established and have been changed very little since 1934, when the Industrial Arts Committee of the American Vocational Association formulated twelve specific objectives of industrial arts, as follows (1-12):

1. To develop in each pupil an active interest in industrial life and in the methods of production and distribution.
2. To develop in each pupil the ability to select wisely, care for, and use properly the things he buys or uses.
3. To develop in each pupil an appreciation of good workmanship and good design.
4. To develop in each pupil an attitude of pride or interest in his ability to do useful things.
5. To develop in each pupil a feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation.
6. To develop in each pupil the habit of an orderly method of procedure in the performance of any task.
7. To develop in each pupil the habit of self-discipline which requires one to do a thing when it should be done, whether it is a pleasant task or not.
8. To develop in each pupil the habit of careful, thoughtful work without loitering or wasting time (industry).



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

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

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

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

In keeping with the newer general educational objective of social living in a democratic society, C. K. Lush presents the more recent opinion in industrial arts, as prepared for the Minneapolis public schools, in his Functions of Industrial Arts, as follows:

#### Summary of Functions

1. Development of personality, character, and desirable attitudes.
2. The fostering of democratic principles and social ideals.
3. The interpretation of industrial processes for a general understanding of the material surroundings; and for guidance purposes, both vocational and avocational.
4. The development of hand and machine skills.
5. The fulfilment of the natural desire for self expression through creative effort.
6. The contribution of information and experiences of value to future consumers and to

those who enjoy maintaining and improving the home.

7. The accumulation of respect for the aesthetic; for craftsmanship; and for the problems of all related occupations.
8. The attainment of a consciousness of conservation and safety.

Although it would be difficult to visualize an industrial arts shop without tools and equipment, it can readily be seen that, in order to accomplish these aims, there must be something more than the manipulative materials. On this subject, William F. Rasche makes a strong plea for the use of printed material in his foreword to a book list issued by the American Library Association, as follows (29:303):

Technical books, trade journals, hand books, and other suitable reading materials are as essential to effective instruction in school shops, drafting rooms and laboratories as are tools, machines and other practical equipment.

Also, the United States Office of Education Bulletin No. 34, 1937, adds (28:55):

The time has now arrived when a library of good books is an essential part of the equipment of every progressive industrial-arts shop, an evidence of their frequent use is an indication of one factor in good teaching. To the extent that books are used to stimulate self-activity on the part of pupils, they become teaching aids.

The above references would seem to indicate that books should be considered as part of the tools used by the industrial arts teacher. J. J. Metz, editor of the

Industrial Arts and Vocational Education Magazine, suggests the inclusion of books in the school budget, along with the other tools, when he said (21:19):

Shop libraries, however, are all too frequently still looked upon as something distinct and separate, yes, as something extraneous to shop matters. Unfortunately, too many shop teachers look upon books from this same viewpoint, forgetting that books have become a real necessity in the modern school shop. Many of them have learned that books make the teaching job much easier and permit instructions to be given much more efficiently, but they have not succeeded in overcoming the habit of considering the shop library an adjunct rather than a necessity. Their budgets and requisitions, therefore, still put the books into painfully apparent isolation.

The past has shown how difficult it was to establish the necessity of making additions and renewals to the tools and equipment of the school shop. No doubt, it will be equally troublesome to show the necessity of adding to or renewing the books which compose the shop library. To accomplish this result will require, first of all, a change of attitude on the part of the teachers themselves. They know, of course, that books are as necessary in the modern school shop as are the tools and the other equipment, but they must first habituate themselves to treat books that way on their requisitions and in their budgets.

It will naturally take time to put this idea across with administrators and others whose duty it is to make school-shop purchases, but until it is done, shop teachers who cannot get the books which they need will be seriously handicapped.

In some schools, the shop books are placed in the main school library, while others have a special library for the shop department. Still others provide a place for the books in the shop, where they are



readily accessible to the pupils.

R. Russell Munn (24:186) writes:

Furthermore, the reading does not necessarily have to be done in libraries. The best practice indicates that books are most effective if they are available in the place or places where they are most needed, whether this be in the shop, the classroom, the library, or in the student's home. Best results are gained when they are available in all these places.

In January 1939, (31:2-3) the Industrial Education Magazine published an article by Homer J. Smith, in which he said:

... Industrial arts, at its best, is informative, inspiring, exploratory, and foundational. It is basic to continued understanding of the mechanical and artistic in our surroundings. It is interpretive of home, school, community, and more distant places and groups. It is about the world and its people more than of industry in the large, in all its physical and human ramifications. It advances a boy or girl, a man or a woman at leisure, toward discerning and competent citizenship.

These objectives and dozens like them are unattainable except where a considerable part of the instruction time be given to topics of information. The percentage of time is a matter for the teacher's suggestion and for the administrator's decision. These are both modified by school precedents, student feelings, and parent concepts, right or wrong.

In the same article, he continues, as follows:

Two concepts regarding informative items may well be kept in mind by all teachers. First, that definite times should be set aside when functioning materials will be certain to be covered under schedule.

Secondly, that often the best effect is to be had by the offering of some materials incidentally as the opportunities arise. The teacher who plans in an ordered way and strives to make his course function as to timing and completeness deserves commendation. The teacher who takes advantage of student interest and forsakes his plan for brief periods, for a heightened return under chance conditions, is superior, and considerably so.

Mortimer (23:92) reports in his study of informational material that teachers of metalworking believe that from 19 to 25 per cent of the time should be used in the presentation of informational material, but that the actual time given was 15 to 19%, for an average of 17.9%.

Since the beginning of the depression, the necessity for economy has been emphasized in most school systems. One result of this retrenchment was the introduction of larger-sized classes. Twenty years ago, it was thought that shop classes should contain not more than fifteen students, to obtain the best results. This number was based upon the theory that classes were too large if the enrollment was more than the teacher was accustomed to. Shop teachers in 1933 contended that the nature of their work, the individual approach to their problem, and the increased hazards in shop classes as compared with that of academic courses necessitated classes not exceeding twenty-five pupils (36:245). Some studies, such as that of Bloomfield and Brooks (4:6-20),

show that there is no appreciable difference in the achievement of pupils in a small class over that of students in large classes, but that the large classes force the student to rely upon himself rather than upon the teacher. A well chosen textbook might be used to compensate in part for this lack of the teacher's personal attention. If that were the case ten years ago, it would seem to be even more necessary today, with class enrollment in shopwork ranging above thirty pupils, as is indicated by comments of teachers now attending summer schools.

#### Probable Advantages of Shop Books

Wooley (42:317-18) presents the advantages of books in the school shop as follows:

- A. From the standpoint of the instructor
  1. The teacher's appreciation and judgment are aided by having at one's finger tips the creation of those who are older in experience and training - the books of the past.
  2. Books establish breadth of contact, suggesting models and interesting supplementary problems for slow, average, and rapid students.
  3. Books reduce the amount of necessary individual oral instruction and routine duties in the classroom by answering many of the students questions of how and why, when the teacher knows how and when to direct student's reading. Books thereby help take care of the individual differences in students.



4. The teacher is inspired and spurred on to greater achievements in teaching through increased self-confidence.
  5. Teachers experience greater enjoyment of their work by having their "load" lightened by books.
  6. Books vitalize the course of instruction and the teaching power of the instructor.
  7. Books help teachers to prepare demonstrations, recitations, etc.
  8. Books help suit the project to the boy and to the various seasons of the year.
- B. From the standpoint of the student. 'Children learn to read by being surrounded with books.'
1. Students interests in shopwork are often aroused and maintained on a higher level through association of the hand with love of books.
  2. The student is able to do better hand work because of increased knowledge of tools, processes and materials, as gained thru reading. Practically everything that has been learned about the use of tools, lumber, iron, and other materials used in the shop is found in books, if the teacher knows how to find it.
  3. Boys may learn to use books so that they may be more self-directive, thereby helping them earn money and properly engage in recreation and enjoyment of leisure time, making for more worthy home membership.
  4. Books give general educational value to handwork and correlation of shopwork with other subjects more effective, and vice versa.
  5. Books help to correlate the mind with the hand.
- C. From the standpoint of both teacher and student.
1. Proper use of books results in better understanding between students and instructor.
  2. Books help teacher and students to work out better designs of projects. (Does it not seem reasonable that to construct anything whether new or old in any field of human endeavor, that

it is best to thoroly investigate the fund of knowledge and ideas already available?)

3. Good books establish high standards of attainment and form a basis for comparisons and discussions.

Ericson (8:148-9) summarizes his reasons for using textbooks as:

1. Text-books encourage the covering of a definite scope of work.
2. They check the instructor.
3. They fix the responsibility on students.
4. Practice in reading is necessary.
5. Books specify standards.
6. Books assist in teaching.
7. They are an economical investment.

#### Possible Disadvantages of Shop Books

While the above quotations present the arguments for the use of textbooks in shop classes, there are some teachers who, for various reasons, prefer not to use them. Ericson (8:146-7) is again quoted:

1. Text-books limit the program. Teachers argue that they do not wish to tie up to a "stereotyped" program such as is indicated by a book, or to follow instructions for students laid out by some one in some other locality. "It will not fit," is the usual comment in this connection.
2. Teachers prefer to use their own methods. Some teachers have so much respect for their own methods and practices which they have obtained by practical experience or otherwise that they cannot tolerate the thought of different suggestions coming from some other source. There is fear that damage may be done to the students from learning about methods that the teacher considers inferior to his methods and practices.

3. The expense is considered. Leaving out books will reduce the per capita cost where books are furnished; and will reduce the cost to the student where he must purchase them. It is assumed that larger enrollments will result if the expense to the student is kept down; that is, that boys come to classes because they are cheap. Such teachers adopt the same attitude regarding their own professional books; they do not wish to spend the money.

4. The habit must be formed. Some instructors have never formed the habit of using books and other written material in their work. They began to teach long ago when such material was scarce, and do not realize that "times have changed." The experiences of others have never been capitalized by these few and probably never will.

5. Some are afraid. They fear that what they are doing will not measure up to accepted standards, and that they will be forced to exert themselves more vigorously if text-books are brought in. "Ignorance is bliss" among the students, and it is better to leave good enough alone.

While some arguments against text-books carry some weight, each can be met effectively with 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 text-books 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 text-book 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 text-book.



### The Requirements of a Text Book

If the teacher is to select the proper books for his shop use, he should know some of the fundamentals of a good book. Vaughn and Mays (37:138-40) give the following as important:

1. The material should be prepared in problematic form.
2. The fundamental principles and the fund of information furnished by the text should be given in direct connection with those problems or projects which illustrate concretely such principles and information.
3. Constructions and fundamental operations should be well illustrated.
4. The material of a properly prepared text should be so presented as to encourage constructive and independent thinking, arouse curiosity, challenge investigation, and inspire sustained effort.

There are, of course, certain criteria that should be considered in the selection of books. Coltharp (6:44-48) discusses requirements and arrives at a score card which is given as an example of an attempt to evaluate industrial arts textbooks:

#### SCORE CARD OF EVALUATION INDUSTRIAL-ARTS TEXTBOOKS

Textbook . . . . . Author . . . . .  
 Publisher . . . . . Date of Publication . . .  
 Grade Level . . . Size of Book . . Price . . . . .  
 Type of community in which book is to be used . .  
 . . . . .

# Directions:

The items in this score card have been selected as being essential in a textbook. The numbers in the parentheses represent maximum and minimum values. In the blank to the right of an item you are asked to place the value which you ascribe to that particular item.

- I. Physical make-up of textbook
  - a) Binding: cloth (4) paper (2) \_\_\_\_\_
  - b) Cover: interesting (3) \_\_\_\_\_  
uninteresting (1) . . . . . \_\_\_\_\_
  - c) Title:
    1. short (2) long (1) . . . . . \_\_\_\_\_
    2. interesting (2) \_\_\_\_\_  
uninteresting (1) . . . . . \_\_\_\_\_
  - d) Size: convenient (3) \_\_\_\_\_  
inconvenient (1) . . . . . \_\_\_\_\_
  - e) Paper:
    1. Color: white (2) \_\_\_\_\_  
tinted (0) . . . . . \_\_\_\_\_
    2. Gloss: none (2) some (1) \_\_\_\_\_
  - f) Margins: wide (3) \_\_\_\_\_  
narrow (1) . . . . . \_\_\_\_\_
  - g) Type: 10-point (3) other \_\_\_\_\_  
size (2) . . . . . \_\_\_\_\_
- II. Publisher
  - a) Experienced in field (3) \_\_\_\_\_  
inexperienced (1) . . . . . \_\_\_\_\_
  - b) Copyright date (4 if revised \_\_\_\_\_  
or copyrighted during last 2  
years, 1 less for each year  
previous. Minimum of 0) . . . . . \_\_\_\_\_
- III. Author: authority (4) \_\_\_\_\_  
novice (1) . . . . . \_\_\_\_\_
- IV. Preface: author's purpose  
stated, yes (3) no (0) . . . . . \_\_\_\_\_
- V. Table of contents: detailed (4) \_\_\_\_\_  
general (1) . . . . . \_\_\_\_\_
- VI. Content:
  - a) Suited to grade level (5) \_\_\_\_\_  
unsuited (0) . . . . . \_\_\_\_\_
  - b) Psychological (9) logical (2) \_\_\_\_\_
  - c) Suited to local needs (6) \_\_\_\_\_  
unsuited (0) . . . . . \_\_\_\_\_
  - d) Sentences: short (3) long (1) \_\_\_\_\_

e)	Illustrations:	
	1. Numerous (5) few (2) . . .	_____
	2. Interesting (5)	
	uninteresting (1) . . . . .	_____
f)	Headings: few (3) many (1) :	_____
g)	Related information: much (3)	
	little (1) . . . . .	_____
h)	Optional jobs and processes:	
	yes (4) no (1) . . . . .	_____
i)	Questions: listed in unit (3)	
	not listed (0) . . . . .	_____
VII.	Index: complete (5)	
	incomplete (2) . . . . .	_____
VIII.	Price: economical (4)	
	expensive (1) . . . . .	_____
	Total . . . . .	_____

Struck (34:409) presents a short evaluating chart in:

#### Score card

Subject matter content . . . . .	70 points
Drills and reviews . . . . .	6
Kinds and type of illustrations	12
Mechanical phases . . . . .	7
Author - expense and training	5
Total	<u>100</u>

#### How to Use a Text Book

In speaking of text-book use in the general high school subjects, Harold Spears (32:31) says:

The most inexpensive program to be run by a school is the basic-text program, which means the same book in every pupil's hands, to be assigned and "recited on" page by page with little time left for consideration of other material or experiences. It is not only the most inexpensive, but also the most unproductive program.



Wilcox (41:454-5) says that the assignments for study in a textbook should be very definite and recommends assignment sheets, in which the book to be used, the exact pages or paragraphs to be studied, the reasons for the assignment, and the questions are given to each student.

These study questions must be so carefully devised that, to answer them, the student must have studied the most important information and procedures included in the assignment. Questions could even be made to emphasize the lessons in the text-book illustrations, with such study aids as these, the boy who registers late and the pupil who was absent when the assignments were made make fewer demands on the teacher's limited time. A textbook assignment may be used, according to Ericson (8:150-152):

1. To prepare the pupils for a demonstration, thus introducing them to a considerable part of the material as a preliminary step.
2. To emphasize and follow up oral instruction.
3. To furnish a guide for manipulative processes, and
4. For related information.

To these arguments may be added the fact that the textbook tends to keep the whole class functioning as a group, by furnishing information necessary for the pupil with greater mechanical ability to work ahead of the other class members. The class demonstrations and

informational material become a review for this type of student. For the slower-working pupil the textbook is a source of information for him when he lags behind the other pupils. This is of great assistance to the instructor with a large class and a short class period.

### Some Problems of the Shop Library

Norman C. Thomas (35:63) thinks that books should have a place in our educational philosophy when he states that "boys and girls must be taught how to find information in magazines and books". Wooley also (42:319) writes that "It should be remembered that modern education does not demand so much that we become mere storehouses of information as it does that we learn to locate information quickly when wanted for a given situation".

If the shop courses are to include this type of instruction, suitable physical facilities should be provided. Many writers indicate that proper space (closed book shelves with glass doors) should be provided in or near the shop. La Voy (16:451) recommends a reading table, with space for from four to six boys which must be properly lighted. Bollinger (2:373-5) lists as one of the problems that confront the teacher the necessity of teaching the boys how to

use the library. They should be taught to protect the books by always washing their hands before handling them. Also, they should learn not to cut or deface the books in obtaining the information or drawings wanted and to use them at a designated place rather than at the bench or machine. Then there must be a system of returning the books to their proper place, with some method of checking the books in before the class leaves, which can be done by assigning one or two boys to the task. Books that are to leave the shop will necessarily have to be checked by the teacher or a boy assigned to the task at some designated time.

It will be necessary to guard against the boy who wants to "look at pictures" rather than to work. Some method of checking on the material read must be devised. A list of questions to be answered, an oral or written report to the class or teacher, or possibly a progress chart indicating material covered could be used to reduce the number of abuses from the lazy boy. Also the teacher must guard against the giving of library work as punishment. This would tend to reduce the values of having a shop library.



## CHAPTER III

### THE STUDY

Returns to the questionnaire used in this study yielded a great deal of information pertaining to metalworking books and their use. This information is analyzed in the following pages, in order to facilitate its use. It is hoped that it will be of value to the students and teachers who may have occasion to use it. The record of daily questionnaire returns is included in the appendix and indicates that 100, or  $66 \frac{2}{3}$  per cent of the original 150 questionnaires mailed were returned in the first thirty days. The final number of returns was 106, or 70.67 per cent of the total. These answers were received from all parts of the state, as shown by the dots on the map, Figure I, on the following page. Large schools as well as small were included. The school size indicated is based upon the Average Daily Attendance for 1940-41, taken from the California School Directory of November, 1941 (3:111-244). The schools were divided into three even groups at time of mailing the questionnaires. Thus, the small schools are considered to be from 135 to 505 average daily attendance, the medium schools, those with 520-1031 average daily attendance, and the

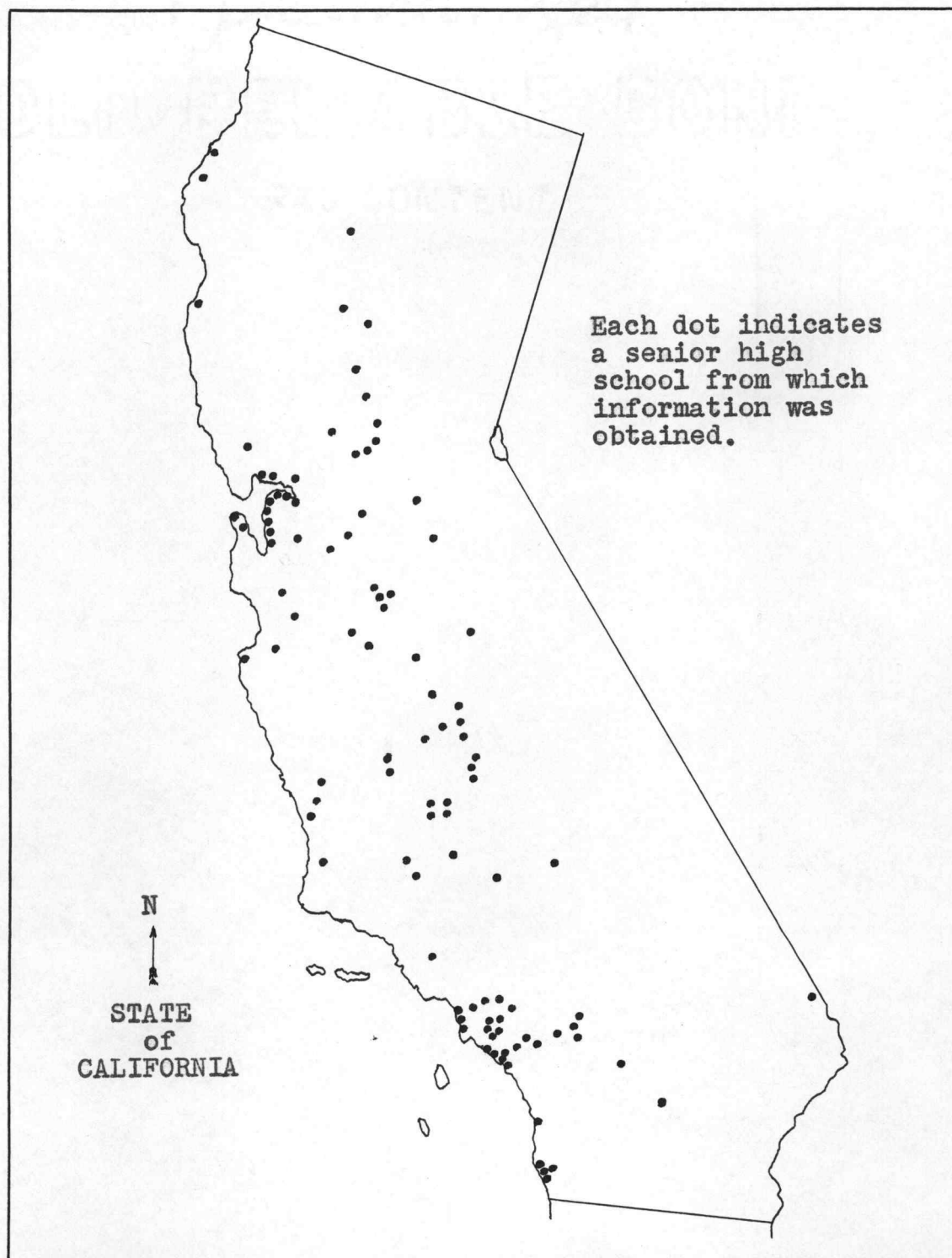


Figure 1

Location of the Schools Used in This Study

large schools those with 1072-4638 average daily attendance. The mean size was 336 for the small school, 774 for the medium-sized school, and 1949 for the large school. These figures are shown in Table I.

TABLE I  
Size of Schools to Which the  
Questionnaire was Sent

Number of Schools	1940-41 A.D.A.	Mean A.D.A.
50 small	135-505	335.76
50 medium	520-1031	774.14
50 large	1072-4638	1948.78
150 Total	135-4638	1019.56

Read: The A.D.A. (average daily attendance) of the 50 small schools to which questionnaires were sent was 135 to 505 with a mean of 335.76

From the small school group, thirty-nine answers were received; but only thirty-four of them were used. The other responses were from schools where very little metalwork was taught, or where the course had recently been started. These teachers felt that they were not qualified to give the information desired. Table II shows the distribution as to size of the 100 schools from whom the answers were used.



TABLE II  
Number of Returns and the Size of  
the Schools

Size	Sent	Answers	% Returned	Used
small	50	39	78	34
medium	50	31	62	31
large	50	36	72	35
Totals	150	106	71-	100

Read: In the small school group 39 or 78% of the 50 questionnaires were returned, and that 34 of these were used for this study.

Some of the educational consultants, notably Hart and Peterson from the University of California (13), have been advocating the use of the 6-4-4 plan for grade grouping in schools of California. According to this plan, the junior high school would include grades 7 to 10, with grades 11 to 14, combining the last years of high school with those of the junior college, for the senior high school. This study indicated that few schools have changed to that system so far. The four-year high school, including grades 9 to 12, is still the practice in 69 per cent of the schools. Ten of the schools studied include the junior and senior high school in a single system, having

grades 7 to 12 inclusive. The complete distribution is shown in Table III.

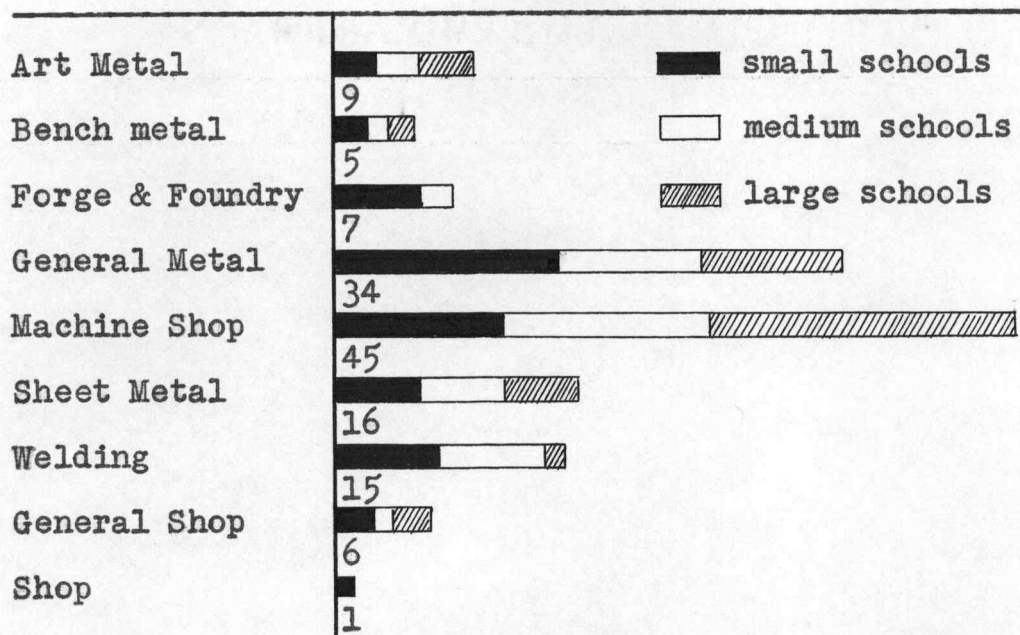
TABLE III  
Grades Included

Size	9-12	10-12	7-12	11-12
small	27	3	4	0
medium	22	2	5	2
large	20	14	1	0
Totals	69	19	10	2

Read: In the small school group 27 schools had grades 9-12; 3 had 10-12; 4 had 7-12; and none in the 11-12 type of school.

Figure 2 shows the subjects taught by the teachers answering the questionnaires. This shows that machine shop teachers returned the most questionnaires, with general metal teachers second, and sheet metal and welding teachers third and fourth. There is strong reason to believe that this shows the popularity of the various courses. When sending the questionnaire, an effort was made to distribute them to a variety of class instructors; but in a large number of schools, machine shop is the only course in metal working listed.

Figure 2  
Subjects Taught



Read: The comparative length of the lines indicates the number of teachers in each subject who answered Question 1.

There is very little evidence, as indicated in Table IV, that war training programs have interfered with the regular day school classes in industrial arts.



TABLE IV  
Distribution of Industrial Arts  
and Vocational Classes

Size	Small	Medium	Large	Total
Ind. Arts	28 (82%)	22 (71%)	21 (60%)	71%
Vocational	6 (18%)	4 (13%)	5 (14%)	15%
Both	0	5 (16%)	9 (26%)	14%

Read: In the small schools, 28, or 82% of the classes taught, were industrial arts and 6, or 18%, vocational. No teacher in this classification taught both types.

The writer wondered in which of the four senior-high-school grades the various metalworking courses might be the most popular. The tabulations in Table V show that books on bench metal, forge, foundry, and general metal should be written on a reading level suited to the freshman and sophomore years, while the other courses are more often given in the junior and senior high school classes.

TABLE V  
Distribution of Subjects with Reference  
to Grade Levels Taught

Grade	9	10	11	12	Total
Art metal	5	10	*10	10	35
Bench metal	6	*5	3	3	17
Forge	10	*15	11	9	45
Foundry	2	*2	1	1	6
Gen. Metal	24	*23	17	16	80
Machine Shop	20	46	*58	56	180
Sheet Metal	11	17	*16	19	63
Electric Welding	5	9	*15	15	44
Gas Welding	9	14	*24	22	69
General Shop	7	8	*7	5	27
Ag. Mech.	1	1	1	1	4

Read: Of the 35 art metal courses indicated, only five schools teach it in the first year or 9th grade of high school, while it appears ten times in each of the other three years. The asterisk\* indicates the probable average placement.

Table VI shows the experience in the metal trades of the teachers assisting in this study. It was surprising to find the great amount of trade experience which was reported. Forty-eight per cent of the

teachers indicated five years or more of such experience. One reported 37 years, another, 35 years, and two, 30 years, while only 27 per cent answered that they had had no experience. This table, No. VI, shows that the teacher inexperienced in the trades is more likely to be found in the small school, and the experienced teacher in the large school.

TABLE VI

Previous Experience in the Metal-  
working Trade of One Hundred  
Teachers of Metalwork

	Not any	Year or less	1-5 yrs.	Over 5 years	Total
Small	14	1	8	11	34
Medium	9	2	5	15	31
Large	4	3	6	22	35
Totals	27	6	19	48	100

Read: In the small schools, 14 teachers report no vocational experience in the metal trade, one, a year or less, eight, from 1 to 5 years, and eleven, over 5 years.

### Selection of Books

Items number 4, 5, and 6 of the questionnaire concern the teacher's opinion on the selection of books

for the metal working shop. The results are shown in Table VII. Question 4, as taken from the questionnaire, is:

Check the following items that limit your purchase of books.

TABLE VII  
Factors Limiting the Purchase  
of Books

Times checked	Limiting factors
(49)	School has sufficient text and reference material on hand
(33)	Expenditures limited
(8)	Lack of up-to-date book information
(6)	Books offered for sale are too advanced
(5)	Books offered for sale are too elementary
( )	Lack of books in _____ field

On the last item, the space was filled in as follows: six wrote general metal, two wrote machine shop, one wrote ornamental furniture, and one wrote welding.

This would indicate that 49 per cent of the teachers consider that they have sufficient books on



hand. Seven teachers wrote that they were not limited as to the number of books they were permitted to purchase. The difference in the size of schools did not show any significant difference in regard to this item. The number of teachers who either mentioned that they were not limited or did not check that they were limited was 67, divided as to school size as follows: small 21, medium 22, and large 25. Only 33 per cent checked that they were limited. Item three of question four, as to whether or not the teacher lacked up-to-date information was checked only eight times, and shows that the publishers are keeping the teacher informed on the new books. A very small percentage of teachers think that the books are either too advanced or too elementary for their needs. As far as a lack of books is concerned, only 10 per cent think that there is a need for new books in any field.

Question 5, from the questionnaire, is:

If books were selected by an organized appraisal, what items would be the most valuable, number in order of importance.

TABLE VIII  
Features of the Content of Books and Their  
Rank in Popularity

Ranking	1	2	3	4	5	6	7
Working drawings of project	29	26	18	11	3	1	
Pictures and illustrations	8	15	22	19	8	6	
Quantity of illus- trated projects	11	10	11	17	14	12	2
Occupational information	4	7	9	6	24	22	1
Technical information	25	21	16	11	9	6	
Related information	4	14	22	16	10	17	1

Note: This tabulation of results is used in Table IX.

There were additional comments written in by those making returns on this question including:

In Column 1, as the most important, math was checked three times; blueprint reading, one; and suitability to aims of course, one. In Column 2, loose leaf book with projects, checked once; Column 3, questions at end of each chapter, year published, and practical value, were each checked once. Completeness, in Column 4, and durability in Column 7, were each checked once.

For ranking this question, an index was determined by multiplying the number of times each item was checked by the check number, in reversed order.

Example: The working drawing item was checked first, 29 times; therefore, the number 29 was multiplied by 7, and the number 26 in column 2 was multiplied by 6, etc. When these figures are added, the results are:

TABLE IX  
Showing the Ranking Order for  
Question 5

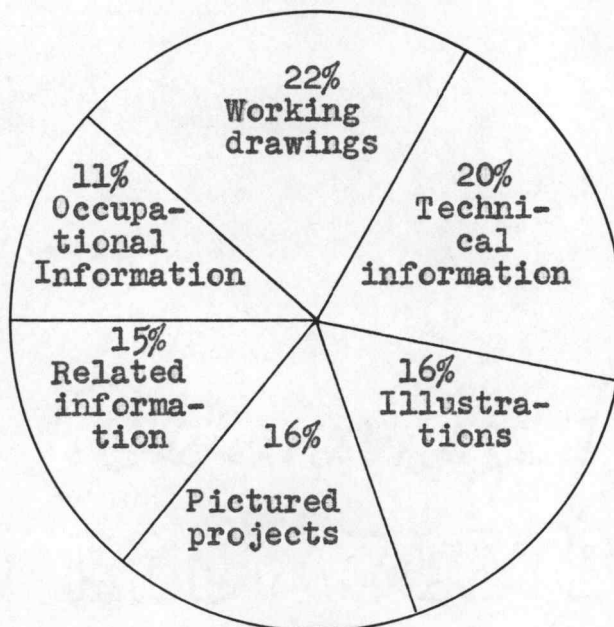
Features	Index	%	Order No.
Working drawings of projects	504	22.19	1
Pictures and illustrations	368	16.13	3
Quantity of illustrated projects	328	14.38	5
Occupational information	256	11.22	6
Technical information	464	20.34	2
Related information	361	15.83	4

Read: According to the opinion of one hundred teachers of metalwork, working drawings are the most desirable feature of a book. Technical information second, etc.

This would indicate that if all items were to be combined in one book, 22 per cent should be working drawings; 20 per cent, technical information; 16 per cent, pictures; 15 per cent, related information;

16 per cent, pictures of projects; and 11 per cent, occupational information.

Figure 3  
Composite of Desired Book



Question 6, as taken from the questionnaire, is:  
Would you prefer a book with paper cover for 80¢  
( ) or with cloth binding for \$1.25 ( ) ?

Figure 4  
Type of Binding Preferred

Paper cover 39%	Cloth binding 60%	*
-----------------	-------------------	---

\*One person failed to check this item.



Question 6 was included because several publishers have begun to produce paper-covered books at a reduced rate for sale to shop teachers. The answers indicate that 60% of the teachers would pay the difference to obtain a more durable binding.

### Use of Books

I It was thought that the metalworking teachers might be willing to indicate the use made of books by checking four questions No. 3, No. 7, No. 8, and No. 9.

Question 3, from the questionnaire, is:

Do you make regular use of a textbook in your shop classes?

TABLE X

The use of Textbooks in Metalwork  
Classes and the Size of the School

	Yes	%	No	%	No check
Small	14	41	19	56	1
Medium	15	48	16	52	0
Large	22	63	13	37	0
Total	51		48		1

Read: The bottom line shows that 51% of the teachers use a textbook, while 48% do not.

This difference is not significant. Therefore,

this question only indicates that there is still some difference of opinion as to the value of using a textbook.

The number of books used by the teachers who report, that they do not use a textbook, shows that they probably use books without a definite plan such as a weekly assignment. Most teachers who do not use published material make up their own work books or information units.

Question 7, as taken from the questionnaire, is:  
Where are your books kept?

TABLE XI  
Where Shop Books Are Kept

Place	Small	Schools Medium	Large	Total
Main School library	6	10	11	27
A shop library	12	9	13	34
The shop	20	24	25	69
not checked	2	1	1	4

Read: Books were kept in the main school library in 6 small schools, 10 medium-sized schools, and 11 large schools, making a total of 27.

It was also noted on the returns that fourteen schools had books in both the main library and shop; nine schools had books in both the shop library and

shop; six schools had books in both the main library and shop library; two schools had books in all three places; six schools issues textbooks to all students; one checked books from the toolroom like tools.

Question 8, as taken from the questionnaire, is:

How do you use books in your metalworking classes?

TABLE XII

Methods of Using Shop Books

Method	Times Checked	Rank
Assignments	58	2
Written reports or outline	16	6
Note book report	14	5
Questions to be looked up	28	4
Select projects	50	3
Working directions	60	1

Read: Assignments were checked 58 times to rank the assignment method second in reference to the six items on the list.

On question eight, six of the instructors said that they used books for reference only. One teacher used books for supplemental material, and another used them to broaden the scope of his class.

Question 9, as taken from the questionnaire, is:

Approximately what percentage of the students' grade indicates the achievement of information through the use of books?

TABLE XIII

The Weight on the Marks of Pupils for  
Instruction from Books

	0%	5%	10%	20%	25%	30%	No check
Times checked	4	19	31	22	10	2	6
(mean 13%)							

Read: Four teachers checked that no part of the students final mark depended on the use of books, 19 checked 5%, etc.

Of the 100 returns, only six failed to mark this question. The results, therefore, have a high degree of accuracy.

Questions 10 and 11 were used to secure information about the specific titles of books used by students of metalwork in the California senior high schools. The results were very gratifying. The information was obtained by a check-list of forty-four titles on page two of the questionnaire with a space provided at the bottom for other books not included but in use in the various schools. The number of books reported is shown in Table XIV.



TABLE XIV  
The Number of Books Reported

Size of school	Check list	Mean	No.added	Mean	Total	Mean
Small	293	8.9	99	2.9	392	11.5
Medium	342	11.0	113	3.6	455	14.7
Large	378	10.8	99	2.8	477	13.5
Total	1013	10.1	311	3.1	1324	13.2

Read: In the answers from teachers in small schools, 293 checks were recorded on the check-list, for an average of 8.9 books each. These same teachers added 99 new titles, averaging 2.9 per teacher. The total for small schools was 392 books, or an average of 11.5 per teacher.

Table XIV gives a clear picture of the book situation in relation to the number of titles reported. There was reason to believe that, in the larger schools employing a number of shop teachers, the results represent only the books used in one subject or the subjects taught by the reporting teacher. In order to confirm this opinion, the ten largest schools were tabulated. Of the ten teachers, six taught machine shop, two taught general metal, and one taught bench metal. The machine shop teachers report 48 machine-shop books and only five others; welding teachers reported six welding texts and one other; general metal teachers reported

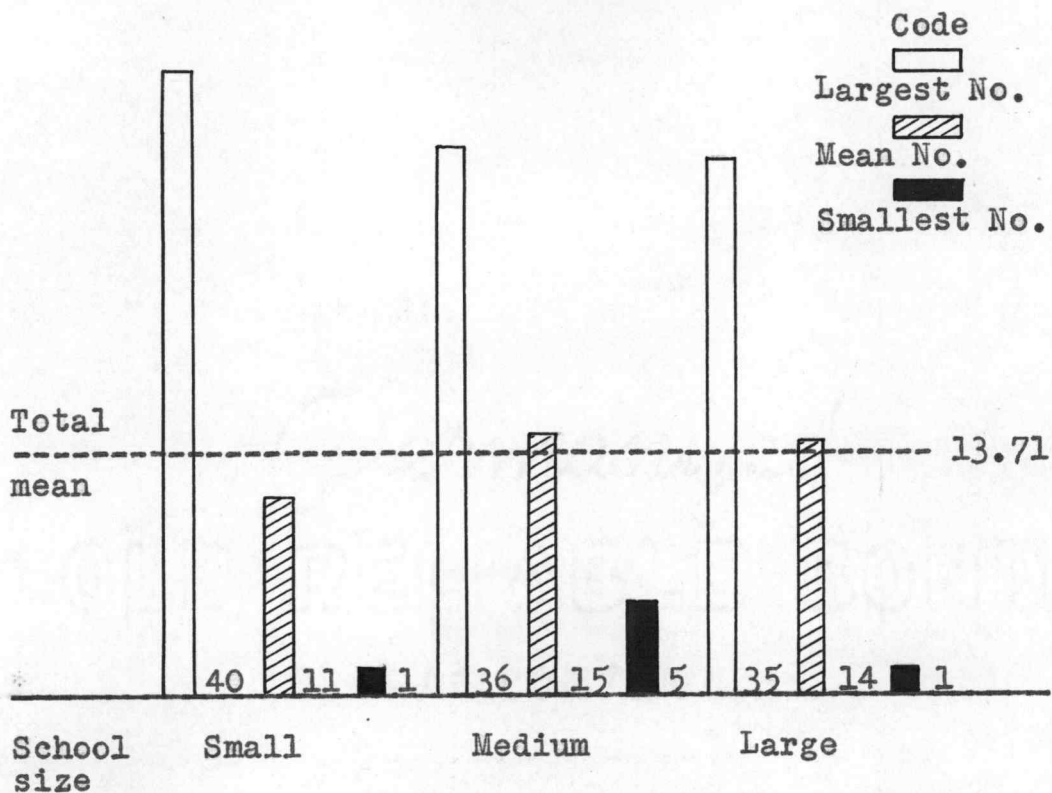
42 books in seven classifications; and the bench metal teacher reported only one book which was on his own subject.

As to the comparison between the size of schools and the number of books reported, the results in Table XIV show that the medium-sized group has a slightly larger mean total number of books than the others. The correlation between the size of the schools and number of books reported was shown to be  $+0.09$ , indicating that the size of the school and the number of books used for instruction are not at all related.

In an effort to show how many books were considered to be sufficient, as reported in Question 3, a graph is presented on the following page.

Figure 5

Number of Books Considered  
Sufficient by the Teacher  
in the Three Sizes of Schools



Read: The long lines indicate the largest number of books reported as being considered sufficient. The short lines show the smallest number of books, while the medium-length lines represent the mean. The dotted line gives the mean number shown for all teachers that checked this item.

The returns were also tabulated to see how much variation there was between the schools that were not limited in their purchase of books and those who were limited. Table XV shows that there is a mean difference of approximately three books. This is not

so great a difference as might be expected. The following table compares this variation for the three sizes of schools.

TABLE XV  
Comparison of the Number of Books  
on Hand and the Limitations on  
Purchases

Size of School	Limited		Not limited	
	No. of schools	Mean No. of books	No. of schools	Mean No. of books
small	12	10.33	21	12.29
medium	9	10.55	22	16.14
large	10	12.70	25	13.80
Total	31	11.16	68	14.09

Read: Of the 12 small schools that were limited the mean number of books reported was 10.33. In the 21 schools that were not limited the mean number reported was 12.29.

It was considered desirable to discover the effect of trade experience on the value which teachers placed on the use of books for shopwork. The results are shown in Table XVI.



TABLE XVI

Comparison between the Amount of A  
Teachers' Trade Experience and the  
Mean Number of Books Reported by Them

No. of books	Trade experience				Total yrs.
	Not any	Year or less	1-5 years	Over 5	
	11.6	26.6	16.6	10.7	13.05

This table shows that the average teacher with a large amount of trade experience uses fewer books than the other teachers.

The following table was devised to learn whether or not the teacher with trade experience required a higher percentage of book work in marking pupils than the teacher without such experience.

TABLE XVII

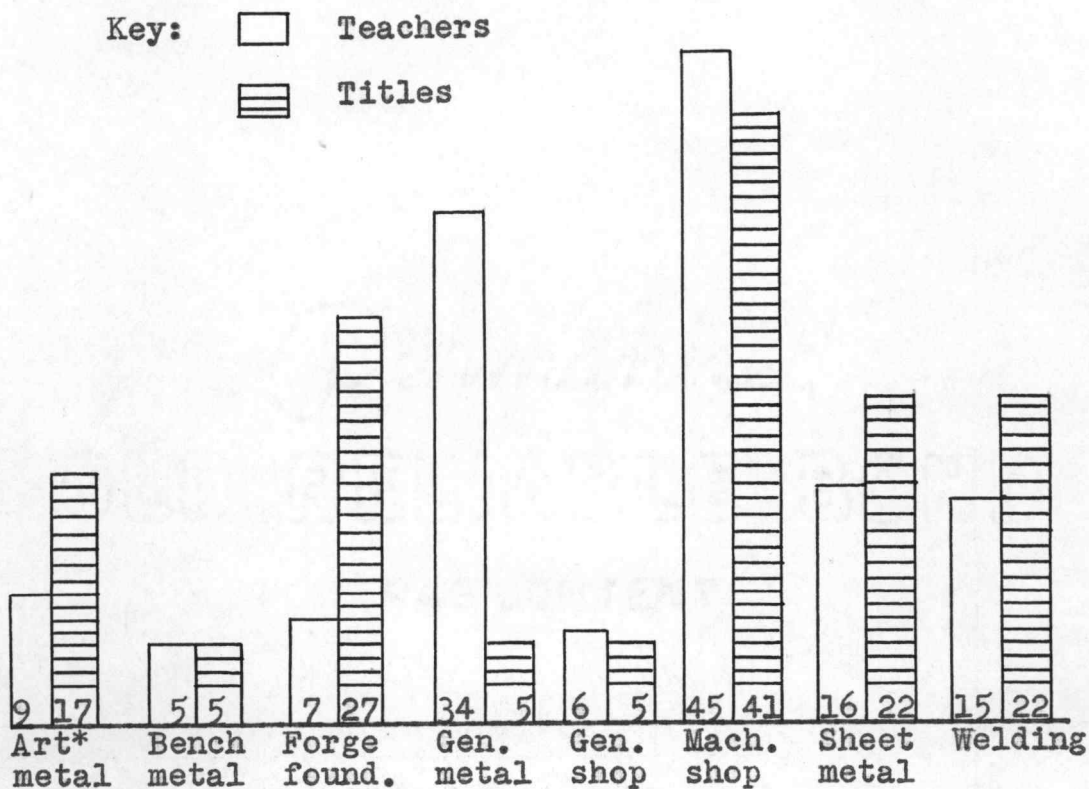
Comparison between the Effect of Trade  
Experience on the Student's Mark in the Course

Trade Experience	0%	5%	10%	20%	25%	30%	mean
not any	2	5	13	5	1	0	10.87
year or less	1	0	1	2	1	1	17.5
1-5 years	0	0	8	7	2	2	17.3
over 5 yrs	1	13	10	8	6	5	14.7
Total	4	18	32	22	10	8	14.2

In the marking of pupils, the weight given by instructors with trade experience to the student's marks for book instruction is very close to the reported average weight for all teachers, regardless of the teacher's previous trade experiences.

Figure 6

Number of Titles Reported in Each  
Subject and the Number of Men  
Teaching the Subject



\*Read: In art metalworking, there were nine teachers and 17 different titles reported in this subject.

The largest single group of persons reporting were the teachers of machine shop. Figure 6 shows that the number of titles reported in that subject was forty-one and the number of teachers was forty-five. This means that the forty-five teachers might have any number of different machine shop books, up to and including forty-one books.

An analysis of the books themselves is in the remaining pages of this study. The list on the following page, Figure 7, includes all books checked by at least five per cent of the teachers.

Figure 7

Comparative List of Books Checked Five or More Times

*****	48	Harcourt - Elementary Forge Practice
*****	47	Bollinger - Elementary Wrought Iron
*****	46	Burghardt - Machine Tool Operation, Book I
*****	43	Burghardt - Machine Tool Operation, Book II
*****	41	Jones - Machine Shop Practice, Book I
*****	40	Ford Trade School - Shop Theory
*****	38	Colvin & Stanley - American Machinist Handbook
*****	37	Jones - Machine Shop Practice, Book II
*****	37	Peterson - One Hundred One Metalwork Problems
*****	33	Bollinger - A Course in Sheet Metalwork
*****	32	Lukowitz - Interesting Art Metalwork
*****	32	Smith - Units in Sheet Metal Work
*****	31	Broemel - Sheet Metalworkers Manual
*****	30	Smith - Units in Bench Metal Work

(Continued)



# Figure 7 (Continued)

*****	Daugherty - Sheet Metal Pattern Drafting and
30	Shop Problems
*****	Berg & Wing - Essentials of Metalworking
29	
*****	Dragoo & Dragoo - General Shop Metalwork
29	
*****	Smith - Units in Forging and Welding
29	
*****	Tutison & Kranzusch - Metalwork Essentials
29	
*****	Smith - Units in Etching, Spinning, Raising and
28	Tooling Metal
*****	Welch - Elements of Sheet Metalwork
26	
*****	Jones - Metal Work
20	
*****	Bick - Artistic Metalwork
20	
*****	Giachino - Bench Metalwork
20	
*****	Colvin - Running an Engine Lathe
17	
*****	Smith - Units in Pattern Making and Foundry
17	
*****	Van Leuven - Cold Metalworking
16	
*****	Lincoln Electric Co - Lessons in Arc Welding
15	
*****	Jeffry & Cotter - Machine Shop Projects
14	
*****	Giachino - Oxy-Acetylene Welding for Beginners
13	

(Continued)

Figure 7 (Continued)

*****	Jennings - Gas and A.C. Arc Welding and Cutting
13	
*****	Rossi - Manual of Instruction in Welding and
12	Cutting
*****	South Bend Lathe Works - How to Run a Lathe
12	
*****	Linde Air Products Co - Oxywelders Handbook
11	
*****	Regan & Smith - Metal Spinning
11	
*****	Selvidge & Christy - Instruction Manual for
11	Sheet Metalworkers
*****	Butler - Problems in Metalwork
10	
*****	Harcourt - The Working and Heat Treating of Steel
10	
*****	Lincoln Electric Co - Procedure Handbook on Arc
10	Welding
*****	Payne - Art Metalwork
10	
*****	Smith - Units in the Machining of Metal
10	
*****	Smith - Textbook of Advanced Machine Work
10	
*****	Bell & Shaeffer - Introductory Metalworking
9	Problems
*****	Grayshon - General Metalwork
9	
*****	Norcross & Quinn - How to do Aircraft Sheet
9	Metal Work

(Continued)

Figure 7 (Continued)

*****	Potter - Electric Welding	9
*****	Air Reduction - Arc Welding Instruction Courses	7
*****	Oberg & Jones - Machinery's Handbook for Machine Shop	7
*****	Turner, Perrigo & Bertrand - Machine Shop Work	7
*****	Campbell - Metal Castings	6
*****	Lukowitz - 55 New Tin Can Projects	6
*****	Palmateer - Elementary Machine Shop Practice	6
*****	Stimpson & Gray - Foundry Work	6
****	Ashcroft & Easton - General Shop Work	5

In order to show the various books by subject classification, the lists covering the five most-used books, are presented. In the first column of Table XVIII is the rank in popularity of each text, taken from Figure 7. In column two, the number of teachers having the text is recorded.

TABLE XVIII

## Book List by Subjects

Art Metal

Rank	Checked	Author	Title
11	32	Lukowitz	Interesting Art Metal Work
20	28	Smith	Units in Etching, Spinning, Raising and Tooling Metal
22	19	Bick	Artistic Metalwork
34	10	Payne	Art Metalwork

Bench Metal

13	31	Smith	Units in Bench Metalwork
16	29	Berg & Wing	Essentials of Metal Working
22	19	Giachino	Bench Metalwork
27	16	Van Leuven	Cold Metalworking
37	10	Butler	Problems in Metalwork

Note: Bench metal and general metal are placed together because of the difficulty of separating the two topics. Some books might be classified in either group.



General Metal

2	47	Bollinger - Elementary Wrought Iron
8	37	Peterson - 101 Metalwork Problems
16	29	Dragoo and Dragoo - General Shop Metal Work
16	29	Tustison & Kranzusch - Metalwork Essentials
22	20	Jones - Metal Work

Forge

1	48	Harcourt - Elementary Forge Practice
16	29	Smith - Units in Forging and Welding
37	10	Harcourt - The Working and Heat Treating of Steel
59	3	Schwarzkopf - Plain and Ornamental Forging
59	3	Wendt - Forging

Foundry

25	17	Smith - Units in Pattern Making and Founding
50	6	Campbell - Metal Castings
50	6	Stimpson & Gray - Foundry Work
70	1	Palmer - Foundry Practice

Machine Shop

3	46	Burghardt - Machine Tool Operation, Part I
4	43	Burghardt - Machine Tool Operation, Part II
5	41	Jones - Machine Shop Practice, Book I
6	40	Ford Trade School - Shop Theory
7	38	Colvin & Stanley - American Machinists Hand Book

Sheet Metal

10	33	Bollinger - A Course in Sheet Metal Work
11	32	Smith - Units in Sheet Metal Work
13	31	Broemel - Sheet Metal Workers' Manual
14	30	Daugherty - Essentials of Sheet and Pattern Drafting
21	26	Welch - Elements of Sheet Metal Work

Welding

16	29	Smith - Units in Forging and Welding
28	15	Lincoln - Lessons in Arc Welding
30	13	Giachino - Oxy-Acetylene Welding for Beginners
30	13	Jennings - Gas and A.C. Arc Welding and Cutting
32	12	Rossi - Manual of Instruction in Welding and Cutting

Note: The frequency of incidence does not necessarily qualify the publication as the best in a field.

In Table X it was shown that fifty-one per cent of the teachers used a textbook in their classes. Table XIX which follows, shows the number of teachers having each of the books listed on the questionnaire.

TABLE XIX

## List of Textbooks Used

Times Checked	Author	Title
1	Barrett	Machine Shop Operations
9	Berg & Wing	Essentials of Metalworking

- 1 Bick - Artistic Metalwork
- 1 Bollinger - A Course in Sheet Metalwork
- 3 Broemel - Sheet Metal Workers' Manual
- 1 Brown & Sharpe Co - Machinists Handbook
- 17 Burghardt - Machine Tool Operation, Book I
- 15 Burghardt - Machine Tool Operation, Book II
- 1 Colvin & Stanley - American Machinist  
Handbook
- 3 Daugherty - Sheet Metal Pattern Drafting  
and Shop Problems
- 1 Dragoo & Dragoo - General Shop Metalwork
- 1 Fellocrafters - Orange Book
- 9 Ford Trade School - Shop Theory
- 1 Fortman & McKinney - Blueprint Reading
- 1 Giachino - Bench Metalwork
- 1 Giachino - Oxy-Acetylene Welding for  
Beginners
- 1 Grayshon - General Metalwork
- 9 Harcourt - Elementary Forge Practice
- 2 Harcourt - The Working and Heat Treating of  
Steel
- 2 Hobart Bros. - Electric Welding
- 10 Jones - Machine Shop Practice, Book I
- 8 Jones - Machine Shop Practice, Book II
- 1 Jones - Metal Work
- 3 Lincoln Elect. Co. - Lessons in Arc Welding
- 3 Linde Air Products Co. - Oxxwelders Handbook
- 2 Lukowitz - Interesting Art Metalwork
- 1 Norcross & Quinn - How to do Aircraft Sheet  
Metal Work

- 1 O'Brien & O'Brien - How to Run a Lathe
- 1 Peterson - 101 Metalwork Problems
- 1 Potter - Procedures Handbook for Arc Welding
- 2 Regan & Smith - Metal Spinning
- 1 Robson - Aircraft Sheet Metal
- 1 Rose - Copper Work
- 1 Selvidge & Christy - Instruction Manual for  
Sheet Metal Workers
- 1 Slade & Margolis - Math for Technicraft
- 4 Smith - Units in Bench Metal Work
- 3 Smith - Units in Sheet Metal Work
- 2 Smith - Units in Etching, Spinning, Raising  
and Tooling Metal
- 2 Smith - Units in Pattern Making and Foundry
- 5 Smith - Units in Forging and Welding
- 1 Smith - Units in the Machining of Metal
- 1 Smith - Advanced Machine Work
- 1 South Bend Lathe Works - Machine Shop Course
- 1 South Bend Lathe Works - How to Run a Lathe
- 1 Stimpson & Gray - Foundry Work
- 1 Tilterton - Aircraft Materials and Processes
- 3 Tutison & Kranzusch - Metalwork Essentials
- 2 Van Leuven - Cold Metalworking
- 1 Waggner & Arthur - Machine Shop Theory and  
Practice
- 4 Welch - Elements of Sheet Metal Work

Many of the authors of shop texts have several books on the market; either under their own name or as



co-authors. In going over the list of books checked on the questionnaire, those of F. C. Colvin and R. E. Smith head the list, as indicated below. Mr. Colvin is the author of a large number of books that do not appear in this study, as are several other writers.

TABLE XX

## Showing the Most Popular Authors

No. of books in  
this study

8	Colvin, F. H.	Editor Emeritus, American Machinist. Fellow Am. Soc. of Mech. Eng. Member Franklin Institute.
6	Smith, R. E.	Prof. of I.A. & V.E. Ohio State Univ.
5	*Linde Air Products Co - Mfg. of gas welding equipment	
4	*Lincoln Electric Co - Mfg. of electric welding equipment	
3	*Air Reduction Sales Co - Mfg. of gas welding equipment	
3	Jones, H. A.	Machine shop instructor Technical School, Vancouver, B. C.
3	Bacon, J. L.	Member of A.S.M.E., Construction Engineer. Formerly Forge and Mach. Design Instructor Lewis Institute, Chicago
2	Barritt, J. W.	Formerly Supervisor of Apprentices at Westinghouse Elec. Mfg.Co., Philadelphia. Mem. Am. Soc. Mech. Eng.

- |   |   |  |
|---|---|--|
| 2 | Bollinger, J. W.                            | Instructor Theodore<br>Roosevelt Jr. High School,<br>Tulsa, Okla.                  |
| 2 | *Brown & Sharpe - Mfg. of tools             |  |
| 2 | Burghardt, H. D.                            | Instructor of machine work<br>Wm.L.Dickinson High school,<br>Jersey City, N. J.    |
| 2 | Campbell, H. L.                             | Metallurgical Eng. Amer.<br>Hoist & Derrick Co. St.<br>Paul, Minn.                 |
| 2 | Giachino, J. W.                             | Instructor of metalwork<br>and welding, Hamtramck high<br>school, Hamtramck, Mich. |
| 2 | Harcourt, R. H.                             | Instructor in forge prac-<br>tice, Leland Stanford Jr.<br>Univ., Palo Alto, Calif. |
| 2 | *I. C. S. Staff                             | International Correspondence<br>Schools, Scranton, Pa.                             |
| 2 | Logue, C. H.                                | Former Asst. Ed. Amer. Mach.<br>Mech. Eng. R. D. Nuttal Co.                        |
| 2 | Lukowitz, J. J.                             | Instructor of Ind. Arts,<br>Milwaukee Public Schools.                              |
| 2 | Norcross, Carl                              | Managing Ed., Aviation.  |
| 2 | *South Bend Lathe Co - Lathe Manufacturers. |  |

Note: An additional 146 individual authors and  
companies were checked once.

\*Author unknown

If the question were asked of a shop teacher,  
"Who publishes the most books in metalworking?" he  
would probably mention one of three publishers. These  
three publishers head the list given.

TABLE XXI

## Ranking of Book Publishers

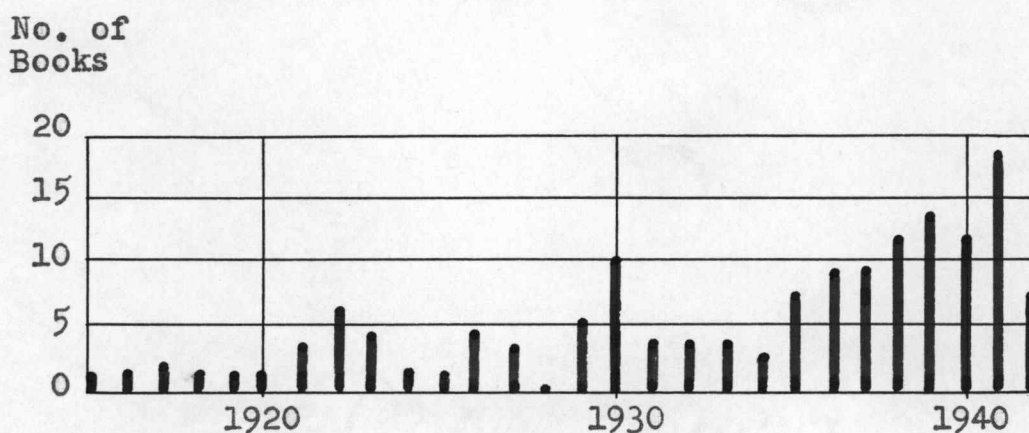
No. of books reported	Publisher
26	McGraw-Hill Book Co.
21	Bruce Publishing Co.
19	Manual Arts Press
11	American Technical Society
8	J. Wiley & Sons
6	McCormick-Mathers Publishing Co.
5	*Linde Air Products
5	D. Van Nostrand & Co.
4	International Textbook Co.
4	*Lincoln Electric Co.
3	*Air Reduction Co.
3	Sir I. Pitman & Sons
2	*Atlas Tool Co.
2	Beacon Press
2	*Brown and Sharpe
2	Macmillan
2	McKnight & McKnight
2	*South Bend Lathe Co.
2	Stanford University Press

Note: There were 24 other publishing companies listed and five (\*) tool and machine companies.

The next table is included to show the latest publishing date of the books reported and indicates that the majority of books used are being kept up-to-date by revising and reprinting.

Figure 8

Showing Date of Publication in Relation to Years



Read: The height of each line indicates the number of books, as reported in this study, which bear a copyright in each year from 1915 to 1942.

It is of interest to note that there are so many of the 1942 books in circulation among shop teachers. It is evident that the teachers obtain new books as they are published.

The extensive book list that follows is included because:

1. It shows a tabulation of book titles obtained through this study



2. It is a valuable source of material pertaining to the books in metal work

This list of books was compiled from:

1. Gray and Hunter (11:44-52)
2. Culmative Index (6)
3. Standard Catalog for high school libraries (28)
4. Books named in the study by the responding teachers

The books in classification 4 are designated by a prefix as follows:

P before a title indicates that it was in a list sent by its publisher in answer to a letter (see appendix) asking for the names of books that had shown their worth by a good sales record.

C indicates that the book appeared on the California State textbook list for 1941 (5).

Q shows that the book was placed on the questionnaire check-list. The number indicates the number of times it was checked by the 100 teachers reported in this study.

T before the name of a book indicates that it was added by teachers returning the questionnaire. The number shows how many teachers added the book.

Example: The designation PCQ46 Burghardt ---- indicates that author Burghardt's book was recommended by the publisher, was on the California Textbook list, was placed on the questionnaire check-list and checked by 46% of the teachers reporting. If only T4 appears before a title, that book was added to the original list by 4% of the teachers returning the questionnaire. Books not marked are from classification 1, 2, or 3.

## TABLE XXII

## Books on Metalworking

- ABC of Iron and Steel. Cleveland, Pelton Pub. Co.
- Adams, H. M., and Evans, J. H. Metal work. 3rd ed. New York, Longmans, Green & Co., 1939.
- Adams, J. D. Metalwork and etching. Chicago, Popular Mechanics Co., 1911.
- T7 Air Reduction. Arc welding instruction courses. (Lecture and Exercise) New York, The Company, 1940.
- T1 Air Reduction. Welding procedures. New York, The Company, 1941.
- T1 Air Reduction. Instruction in oxyacetylene welding and cutting. New York, The Company
- Aitchison, Leslie, and Barclay, Wm. R. Engineering non-ferrous metals and alloys. London, Harry Frowde & Hodden & Stoughton, 1923.
- Aluminum Co. of America. Working of aluminum alloys. Pittsburg, The Company, 1940.

- American Foundrymen's Association. Cast metals handbook. Chicago, The Association, 1940.
- American Society for Metals. Working of Metals. Cleveland, The Society, June 1940.
- American Society for Metals. Surface treatment of metals. Cleveland, The Society, 1941.
- American Technical Society. Lathe job training units. Chicago, 1942.
- American Technical Society. Shaper and planer job training units. Chicago, 1942.
- American Technical Society. Shipbuilding terms. Chicago, 1942.
- Anderson, R. J. Metallurgy of aluminum and aluminum alloys. New York, H. C. Baird & Co.
- T1 Anderson, Newton H. Aircraft layout and detail design. New York, McGraw-Hill, 1941.
- Armytage, G. J. Metalwork for schools and colleges. 4th ed. London, Oxford University Press, 1939.
- T5 Ashcroft, C. C., and Easton, J. A. G. General shop work. Toronto, Macmillan, 1940.
- Aston, James, and Story, Edward B. Wrought iron, its manufacture, characteristics and applications. 2nd ed. Pittsburg, Pa., A. B. Byers Co., 1939.
- Atkins, E. A. Practical sheet and plate metal work. London, Sir I. Pitman & Sons, Ltd., 1939.
- Atkins, E. A. Electric arc and oxy-acetylene welding. London, Sir I. Pitman & Sons, Ltd., 1923.
- T2 Atlas Tool Co., Lathe operation. Kalamazo, The Company, 1937.
- Austin, Leonard S. The metallurgy of the common metals. New York, John Wiley & Sons, 1926.

- Ayrton, M., and Silcock, A. Wrought iron and its decorative use. New York, Charles Scribner's Sons, 1929.
- T2 Bacon, J. L. Forge practice and heat treating of steel. New York, J. Wiley & Sons, 1919.
- Bacon, J. L. Forge practice (elementary). New York, J. Wiley & Sons, 1912.
- T1 Bacon, J. L., and Johnson, C. G. Forging. Chicago, The American Technical Soc., 1933.
- Bale, G. R. Modern iron foundry practice. New York, D. Van Nostrand Company.
- Barnard, Charles. Tools and machines. New York, Silver, Burdett & Co., 1903.
- T4 Barnwell, Geo. W. New encyclopedia of machine shop practice.
- Barritt, J. W. Drill press job sheets. Chicago, American School of Correspondence, 1928.
- CT2 Barritt, J. W. The care and operation of machine tools. New York, J. Wiley & Sons, 1927.
- CT2 Barritt, J. W. Machine shop operations. Chicago, American Technical Society, 1941.
- Baxter, E. W. Useful tables for the metalworker. Pittsburg, Kansas, State Teachers College.
- T2 Baxter, W. T. Jewelry gem cutting metalcraft. New York, McGraw-Hill, 1938.
- Beaten metal work. New York, Pittman & Sons, or Wrought Iron Designers.
- T1 Becker, W. J. Metal projects index. New York, H. W. Wilson Co., 1939.
- P Becker, Wm. J. Metalworking made easy. Milwaukee, Bruce Pub. Co., 1942.



- PT2 Bedell, Earl L., and Gardner, Ernest. Household mechanics - industrial arts for the general shop. Scranton, Pa., International Textbook Co., 1937.
- Bell, E. Tin-craft as a hobby. New York, Harper & Brothers, 2nd ed. 1935.
- PCQ9 Bell, L. C., and Shaeffer, G. N. Introductory metalworking problems. Peoria, Ill., Manual Arts Press, 1934.
- PCQ29 Berg, E., and Wing, B. E. Essentials of metal working. Peoria, Ill., The Manual Arts Press, 1927.
- Bethlehem Steel Co. Bethlehem alloy and special steel catalog 107. Bethlehem, Pa., 1936.
- PQ19 Bick, A. F. Artistic metalwork. Milwaukee, Bruce Publishing Co., 1940.
- Binn, L. J. Tin, sheet-iron and copper-plate worker. New York, H. C. Baird & Co., 1920.
- Blum, W., and Hogaboom. Principles of electroplating and electroforming. New York, McGraw-Hill, 1930.
- PCQ33 Bollinger, J. W. A course in sheet metal work for junior high schools. Milwaukee, The Bruce Publishing Co., 1926.
- PCQ47 Bollinger, J. W. Elementary wrought iron. Milwaukee, The Bruce Pub. Co., 1930.
- PQO Boston, O. W. Metal processing. New York, J. Wiley & Sons, 1941.
- Brannt, W. T. Ed. Metal worker's handybook of receipts and processes. New York, H. C. Baird & Co., 1919.
- Brett, Thomas J. Air conditioning design and construction of ducts. Chicago, American Technical Society, 1937.

- Brimm, D. J. Aircraft metalwork. Scranton, Pa., International Textbook Co., 1939.
- T1 Brimm and Boggess. Aircraft maintenance. Chicago, Pitman, 1939.
- Q31 Broemel, L. Sheet metal workers' manual. Chicago, F. J. Drake & Co., 1941.
- Brown, W. N. Principles and practice of dipping, burnishing, lacquering and bronzing brassware. New York, D. Van Nostrand Co.
- Brown & Sharp Mfg. Co. Handbook. Providence, R. I., The Company, 1938.
- T2 Brown & Sharp Co. Treatise on milling. Providence, R. I., The Company.
- T1 Bruce Publishing Co. School shop annual. Milwaukee, 1930.
- Buchanan, H. F. Practical alloying. Cleveland, Ohio, The Penton Publishing Co., 1920.
- Buchanan, J. F. Comp. Moulder's dictionary (foundry nomenclature). New York, Spon & Chamberlain, 1912.
- Bullens, D. K. Steel and its heat treatment. New York, J. Wiley & Sons, 1935.
- PCQ46 Burghardt, H. D. Machine tool operation, Part I. New York, McGraw-Hill Book Co., 1941.
- PCQ43 Burghardt, H. D. Machine tool operation, Part II. New York, McGraw-Hill Book Co., 1937.
- PQ10 Butler, J. B. Problems in metalwork. Peoria, Ill., The Manual Arts Press, 1929.
- Byers, A. M. Co. Wrought iron. Pittsburg, Pa., 1936.
- Camm, F. J. Dictionary of metals and their alloys. Cleveland, Ohio, Chemical Pub. Co., 1940.

Camp, J. M., and Francis, C. B. The making, shaping and treating of steel. Pittsburgh, Pa., Carnegie Steel Co., 1925.

Campbell, L. Oxy-acetylene welding manual. New York, J. Wiley & Sons, 1919.

PQ4 Campbell, Harry L. The working, heat treating and welding of steel. New York, J. Wiley & Sons, 1935.

PQ6 Campbell, Harry L. Metal castings. New York, J. Wiley & Sons, 1936.

Carman, E. S. Foundry moulding machines and pattern equipment. Cleveland, Penton Publishing Co., 1920.

Casterlin, W. S. Steel working and tool dressing. New York, M. T. Richardson Co., 1914.

Cathcart, W. H. Value of science in the smithy and forge. Philadelphia, J. B. Lippincott Co.

Chafee, W. J. Practical arc welding. Troy, Ohio, Hobart Bros. Co., 1942.

Chambers, Bruce. The physical examination of metals, Vol. I. London, Edward Arnold & Co., 1939.

Charnock, G. F. Mechanical technology. New York, D. Van Nostrand Co., 1934.

T2 Christman, J. M. Shop mathematics. New York, MacMillan Co., 1922.

T1 Clapp, W. H., and Clark, D. S. Engineering materials and processes. New York, International Textbook Co., 1938.

Clark, M. W. Manual of mechanical movements. South Orange, N. J., The Author.

Cleveland Twist Drill Co. Handbook for drillers. Cleveland, The Company, National Defense Ed. 1942.

Clow, G. B. Practical up-to-date plumbing. Chicago, F. J. Drake & Co., 1914.

- T1 Cole, C. B. Tool design. Chicago, American Technical Society, 1942.
- PT2 Coleman, G. J. Forge note book. Milwaukee, Bruce Publishing Co., 1921.
- Collins, A. F. Amateur machinist. New York, Appleton Century, 1934.
- Collins, A. F. The metals, their alloys, amalgams and compounds. New York, D. Appleton & Co., 1932.
- Colvin, F. H. Machine shop mechanics. New York, McGraw-Hill Book Co., 1913.
- PQ17 Colvin, Fred H. Running an engine lathe. New York, McGraw-Hill Book Co., 1941.
- P Colvin, Fred H. Running a milling machine. New York, McGraw-Hill Book Co., 1941.
- Q38 Colvin, F. H., and Stanley, F. A. American machinists handbook and dictionary of shop terms. 7th ed. New York, McGraw-Hill Book Co., 1940.
- PT1 Colvin, F. H., and Haas, L. L. Jigs and fixtures. New York, McGraw-Hill Book Co., 1937.
- Colvin, F. H., and Stanley, F. A. Machine shop primer. New York, McGraw-Hill Book Co., 1910.
- T1 Colvin, F. H., and Stanley, F. A. Machine tools and their operation. New York, McGraw-Hill Book Co., 1922.
- T1 Colvin, F. H., and Juthe, K. A. The working of steel. New York, McGraw-Hill Book Co., 1922.
- Colvin, F. H., and Stanley, F. A. Running a machine shop. New York, McGraw-Hill Book Co., 1941.
- T1 Colvin, F. H., and Stanley, F. A. Library of machine shop practices. New York, McGraw-Hill Book Co.



- T1 Colvin, F. H., and Stanley, F. A. Drawing room practice. New York, McGraw-Hill Book Co.
- P Colvin, Fred H., and Stanley, Frank A. Turning and boring practice. New York, McGraw-Hill Book Co., 1935.
- P Colvin, Fred H., and Stanley, Frank A. Gear cutting practice. New York, McGraw-Hill Book Co., 1937.
- P Colvin, Fred H., and Stanley, Frank A. Drilling and surfacing practice. New York, McGraw-Hill Book Co., 1936.
- P Colvin, Fred H., and Stanley, Frank A. Grinding practice. New York, McGraw-Hill Book Co., 1937.
- T1 Colvin, Fred H. Aircraft handbook. New York, 5th ed. revised. McGraw-Hill Book Co., 1917.
- Coover, S. L. Industrial arts. California, Pa., The Author, 1938.
- Corbishley, H. Iron foundry practice. New York, Funk & Wagnalls Co., 1924.
- Cosgrove, J. J. Principles and practice of plumbing. Chicago, Domestic Engineering Co., 1906.
- Crane, E. V. Plastic working of metals and power press operations. New York, Wiley, 1938.
- Cravens, G. W. Welding. Chicago, American Technical Society, 1921.
- Crawshaw, F. D. Metal spinning. Chicago, Popular Mechanics Co., 1909.
- T1 Crispin, C. E. Dictionary of technical terms. Milwaukee, Bruce Publishing Co.
- Crossland, L. A. Individual work in art metalwork. London, Pitman, 1935.
- Crowe, C. P. Forgecraft. Columbus, Ohio, R. G. Adams & Co., 1913.

Cruzner, B. Decorative metal overlay. Peoria, Ill., Manual Arts Press, 1931.

Cumming, W. C. Course outline in metallography for welders. Lincoln, Nebraska Dept. of Voc. Ed.

Dalby, W. E. Strength and structure of steel and other metals. New York, Longmans, Green & Co., 1923.

PQ30 Daugherty, J. S. Sheet-metal pattern drafting. Peoria, Ill., Manual Arts Press, 1922.

Daugherty, J. S. Essentials of sheet metal and pattern drafting. Chicago, F. J. Drake & Co., 1926.

T1 Davidson, P. W. Educational metalcraft. London, Longmans, Green & Co., 1932.

Davidson, P. W. Applied design in precious metals. New York, Longmans, Green & Co., 1929.

Davis, A. F. Designing for arc welding. Cleveland, Ohio, Lincoln Electric Co.

Dawson, N. Goldsmith's and silversmith's work. New York, G. P. Putnam's Sons, 1907.

T1 DeLeeuw, A. L. Metal cutting tools. New York, McGraw-Hill Book Co., 1922.

Dibble, S. E. Elements of plumbing. New York, McGraw-Hill Book Co., 1918.

T1 Dixon, Wm., Inc. The Dixon manual of metal artists. Newark, N. J., The Company, 1937.

Dixon, Wm., Inc. Designs for piercing. Newark, N. J., The Company, 1937.

Dixon, Wm., Inc. Designs with instruction for simple projects in art metal and jewelry. Newark, N. J., The Company, 1940.

Dixon, Wm., Inc. Designs for artisans in wood and metal. Newark, N. J., The Company, 1939.

- Dixon, Wm., Inc. Operations and processes for art metal. Newark, N. J., The Company, 1940.
- Dixon, Wm., Inc. Projects with christian motives. Newark, N. J., The Company, 1940.
- T1 Dooley, W. H. Science training for metal and wood trades. New York, Ronald Press Co., 1937.
- Dowd, A. Tools, chucks and fixtures. New York, The Industrial Press, 1915.
- PCQ29 Dragoo, A. W., and K. L. General shop metalwork. Bloomington, Ill., McKnight & McKnight, 1939.
- Drew, James M. Blacksmithing. St. Paul, Minn., Webb Book Publishing Co., 1937.
- T1 Dull, C. E. Modern Physics. New York, H. Holt & Co., 1934.
- T1 Dunnwoody Institute. Job training units. Chicago, American Tech. Society.
- PCT1 Eaton, J. J., and Free, A. V. Machine shop mathematics and science. Peoria, Ill., Manual Arts Press, 1933.
- P Elzea, L. S. Aircraft welding. New York, McGraw-Hill Book Co., 1941.
- Evans, T. F. Hammered metalwork. London, University of London Press, 1936.
- Evans, J. H. Constructive metalwork. New York, Longmans, Green & Co., 1938.
- T3 Fairfield, H. P., and Dow, C. S. The Starrett book for machinists' apprentices. Athol, Mass., The L. S. Starrett Co., 1941.
- T2 Felker, C. A. Shop mathematics. Milwaukee, Bruce Publishing Co.
- T1 Fellowcrafters Guild. Metal tooling. Boston, Beacon Press.

- T1      Fellowcrafters Guild. Orange Book.  
Boston, Beacon Press.
- Ferrari, G. Italian iron work. New York,  
E. Weyhe, 1923.
- Fish, G. D. Arc welded steel frame structures.  
New York, McGraw-Hill Book Co.
- Fletcher Aircraft Schools. Standard aircraft  
workers manual. 6th ed. Burbank, Calif.,  
The School, 1941.
- Ford Trade School. Metallurgy and metallography.  
Dearborn, Mich., The School, 1941.
- PQ40    Ford Trade School. Shop theory. New York,  
McGraw-Hill Book Co., 1942.
- Forman, S. C. Stories of useful inventions.  
New York, The Century Co., 1914.
- Foundry, The. Foundrymen's handbook.  
Cleveland, Penton Pub. Co., 1922.
- Fox, G. F. P., and Bloor, F. Welding  
Technology and design. New York, Lippincott.
- PT2     Frazer, Russ, and Berthiaume, Orrin. Practical  
aircraft sheet metal work. New York, McGraw-  
Hill Book Co., 1942.
- T2      Friese, J. F. Farm blacksmithing. Peoria,  
Manual Arts Press, 1921
- Gardner, J. S. English iron work of the 17th  
& 18th centuries. New York, William Helburn,  
1911.
- T3      General Electric Co. Arc welding. Schenectady,  
N. Y., The Company.
- Georgi, F., and Shubert, A. Sheet metalwork.  
London, Scott, Greenwood & Sons, 1914.
- Giachino, J. W. Aircraft sheet metalwork.  
Peoria, Manual Arts Press, 1942.



- PCQ19 Giachino, J. W. Bench metalwork. Peoria, Manual Arts Press, 1935.
- PCQ13 Giachino, J. W. Oxy-acetylene welding for beginners. Peoria, Manual Arts Press, 1939.
- Gibson, K. The goldsmith of Florence, a book of great craftsmen. New York, The Macmillan Co., 1929.
- Gilderman, G. W. Foundry practice. Mishawaka, Ind., Dodge Manufacturing Corp.
- Glass, F. J. Jewelry craft. London, University of London Press, 1928.
- Goodale, S. L., and Hamsey, Speer. Chronology of iron and steel. Cleveland, The Penton Pub. Co., 1931.
- Goodger, C. A. Woodwork and metalwork for the school garden and small holding. Liecester, England, Dryad Press, 1940.
- T1 Goodrick, C. L., and Stanley, F. A. Accurate tool work. New York, McGraw-Hill Book Co., 1923.
- PT3 Googerty, Thos. F. Decorative wrought iron work. Peoria, Ill., Manual Arts Press, 1937.
- Googerty, T. F. Practical forging and art smithing. Milwaukee, The Bruce Pub. Co., 1915.
- Googerty, T. F. Hand-forging and wrought-iron ornamental work. Chicago, Popular Mechanics Co., 1911.
- Graham, David A. Students textbook on sheet metalwork, with technology of sheet metalwork. New York, Edwin A. Scott Pub. Co., 1939.
- Graham, E. C. Shop problems in sheet metal. Evansville, Ind., High School Press.
- T2 Graham, Frank D. Machinists and tool makers handy book. New York, Theo Andel & Co., 1941.

- Gray, B. L. Foundry work. Chicago, American Technical Society, 1920.
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T1

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Metal Crafts Publishing Co., 1941.

## CHAPTER IV

### SUMMARY

This study has been built around six problems given in Chapter I, namely: (1) the available books in metalworking; (2) the content of the books desired by the teachers of metalworking; (3) the comparative number of teachers using a textbook; (4) the best method for using books in metalworking; (5) the influence of books on the student's grade; and (6) the proper techniques for keeping books available for student use. The data assembled in Chapter III is from one hundred teachers of metalwork in as many school systems. All types of communities and sizes of schools were questioned. A general interest in the topic was indicated by the fact that seventy-one per cent of the teachers asked for a copy of the results.

#### Coverage

The first few tables and figures indicate the material covered in the questionnaire. The school sizes varied from an average daily attendance of 135 to 4638. The four-year high school predominated. Returns were made from men teaching nine different classifications of metalwork. Of these, machine shop (Figure 2) was

taught by the largest number of teachers, with general metal in second place. Eighty-five per cent of the teachers taught industrial arts classes, leaving only fifteen per cent in vocational work.

It was found that bench metal, forge, foundry, and general metal are usually taught in the first two years of high school, while machine shop, sheet metal, and welding are generally taught in the junior and senior years.

Forty-eight per cent of the teachers making returns have had over five years of trade experience. Only twenty-seven per cent indicate teaching without the help of some experience in the metal trade.

### Purchase of Books

Table VII reveals that forty-nine per cent of the teachers think that they have sufficient books on hand. Also only one-third of the schools are limited as to the amount of expenditures for books.

The features of a book that are considered most desirable by metalwork teachers are listed here in the order that they were rated, with the most desirable first: (1) working drawings of projects, (2) technical information, (3) pictures and illustrations, (4) related information, (5) a quantity of illustrated projects

(ideas), and (6) occupational information. The binding preferred by sixty per cent of the teachers would be a durable cloth.

The number of teachers using a textbook for regularly planned classwork amounted to only fifty-one per cent, which indicates a divergence of opinion in regard to the use of a textbook in shop classes. By considering the size of schools, it will be noted that sixty-three per cent of the large schools use a textbook, while only forty-one per cent of the small schools group indicate that they use a textbook. The medium-sized schools are quite evenly divided, with forty-eight per cent, saying yes and fifty-two per cent saying no.

The most desirable place for keeping books was shown to be in the shop, as reported by sixty-nine per cent of the teachers. A shop library and the main library were preferred in descending order of importance.

The teachers indicated that they used books most often for working directions and listed assignments as the second most important. Selection of projects was third, and questions to be looked up rated fourth. Note book and written reports were last on the list.

The effect on the pupil's mark of information



received from books varied from not any to thirty per cent. The mean of all reporting was thirteen per cent.

When one considers the books that were available for student use in the representative schools of California, it is found that the average teacher has thirteen different books on hand, and that it makes very little difference whether he is teaching in a small or a large school. It was considered that approximately fourteen different books were sufficient for any class. The number thought sufficient, varied from one to forty, indicating a wide divergence of opinions.

Those schools that reported a limit on expenditures for books average the same number of books on hand (14) as those who reported that they had sufficient books.

The teachers having trade experience report an average of thirteen books on hand. Those having more than five years of work in a trade only reported eleven books, indicating a slight decrease as the number of years in trade increases. In considering the effect of this trade experience on the marks given the pupils, it was shown that there was no significant effect, on an average, although there was a difference of three per cent between the marking methods of those without trade

experience and those who had it. The group with from one to five years of trade experience shows more emphasis on information received from books as far as grades are concerned than either of the extremes.

There is no evidence of a lack of number of available books in any field of the industrial arts. The general metal classes have a shortage of books written especially for them, but this will be compensated by purchases from the other fields. It is better to have a large variety of books written for different units of work, rather than a sketchy book covering a number of units.

Some of the outstanding features of the lengthy list of book titles (172) that were reported in this study are:

First, the ranking of the R. E. Smith series of six books at the top of the lists which may be due to the fact that they are inexpensive, as well as being excellent textbooks, written for the junior high school reading level. The first of the series appeared in 1939, and the latest in 1942.

Second, that the books of F. H. Colvin are very popular. He has been writing for a number of years in this field, some of his books dating back to 1910. Two of his latest books were written in 1941.

Third, that the machine and equipment companies are valuable sources of material, some of their publications being sent gratis to teachers while others compete with the regular publishers by selling books that have a minimum of advertising.

Fourth, that over half of the books reported were printed by three publishers. This indicates not only that they publish the largest percentage of books in the metalwork field, but also that they are getting the names of their books into the hands of shop teachers. Very few teachers indicated that they did not have information on books published.

Fifth, that the authors and publishers are keeping their book lists up-to-date.

Sixth, that the amount of space devoted to occupational information is extremely small. It does not compare with the percentage desired by the teacher.

### Trends in Books

It was noted from this study that the newer books have a larger percentage of pictures, and that these pictures are of much better quality. This makes a much more attractive book for boys to read. The outside cover is also made more attractive by the use of pictures and color.



A number of the books now have a larger page size employing two column printing, thus reducing the eye span necessary in reading. These books may have a ring binding or a paper cover, producing a book that will lie flat for shop use.

The unit method of instruction is being used to a large extent in the new books. Operation units, such as, "How to Harden Tool Steel", etc., are being used, as well as such information units as, "How Steel and Iron Are Made".

### Recommendations.

The material in this study seems to indicate that teachers of metalwork are making sufficient use of books in the imparting of occupational information. No books of this nature were reported, and there appears to be only a negligible amount of such information in the books analyzed. The lack of definite material in this aspect of industrial arts instruction may call for the use of occupational monographs and similar material, such as: The Commonwealth Vocational Guidance Monographs, Series B #9 Welding, #10 Tool and die maker, #11 Machine shop mechanics, published by the Commonwealth Book Company, Chicago; or Metallurgical Engineering as a Career, #76, published by the Institute



for Research, Chicago.

A shop library located in the shop, with facilities for caring for the books and a place for reading, is indicated as a desirable feature of our industrial arts classes. Books will be used by the students, if there is the right kind of books and encouragements given.

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APPENDIX

Concerning the Questionnaire



Bakersfield, Calif.,  
February 20, 1942.

The Bruce Publishing Company,  
540 North Milwaukee Street,  
Milwaukee, Wisconsin.

Gentlemen:

A study of text and reference material, used in Senior High School Metalworking classes, is contemplated at Oregon State College. As a preliminary to that survey it was thought best to find the most popular books as indicated by retail sales.

As one of the better known publishers in that field, any information you can furnish will be greatly appreciated. Please list below the more important books in metalworking published by your organization, showing the title, date of publication, and listing first the book that has sold the most copies and so on.

Thank you very much for your cooperation.

Very truly yours,

JD/IEL

Author	Title	Date of Publication
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Bakersfield, California.

March 14, 1942.

Dear Metalwork Teacher:

For a number of years the writer has been interested in the text and reference material used in metalworking classes. Because of a belief in the value of such a study, a survey is proposed, in cooperation with Oregon State College, to determine the most useful books, how they are selected and the most effective manner of using them.

This letter is sent to you as one of a selected group of California Senior High School teachers, to enlist your help in gathering firsthand information. Please give it an A-1 priority rating.

Kindly fill out the questionnaire and return it in the enclosed envelope. It should take only ten or fifteen minutes of your time. An extra copy is enclosed for your files.

The results of the survey will be made available to all who participate, either through a professional magazine, or direct if you will include your name when returning the questionnaire. Personal comments will be appreciated.

Thank you very much for your cooperation and prompt response.

Very truly yours,

I. E. Lane,  
Department Chairman

QUESTIONNAIRE ON TEXT AND REFERENCE MATERIAL  
USED IN METAL WORKING CLASSES

1. Please list the METAL WORKING subjects taught in your school. Circle Grade and Classification
 

\_\_\_\_\_ 9-10-11-12 Ind. Arts -- Voc.  
 \_\_\_\_\_ 9-10-11-12 Ind. Arts -- Voc.  
 \_\_\_\_\_ 9-10-11-12 Ind. Arts -- Voc.  
 \_\_\_\_\_ 9-10-11-12 Ind. Arts -- Voc.
2. How much trade experience in metalwork have you had? Underline. (Not any) (Year or less) (1-5 years) (Over 5 years)
3. Do you make regular use of a textbook in your shop classes? (Yes) (No)
4. Check the following items that limit your purchase of books.
 

☐ School has sufficient text and reference material on hand.  
☐ Expenditures limited.  
☐ Lack of up-to-date book information.  
☐ Books offered for sale are too advanced.  
☐ Books offered for sale are too elementary.  
☐ Lack of books in \_\_\_\_\_ field.
5. If books were selected by an organized appraisal, what items would be most valuable? Number in order of importance.
 

☐ Working drawings of project.  
☐ Pictures and illustrations.  
☐ Quantity of illustrated projects.  
☐ Occupational information (about the related vocations).  
☐ Technical information (describing operations).  
☐ Related information (materials).  
☐ \_\_\_\_\_
6. Would you prefer a book with paper cover for 80¢ ( ) or with cloth binding for \$1.25 ( )?

7. Where are your books kept? Underline.  
 (In main library) (In shop library) (In shop)  
 ( )
8. How do you use books in your metalworking classes?  
 ( ) For assignments and discussions.  
 ( ) For written report or outline.  
 ( ) Note book report.  
 ( ) Lists of questions to be looked up.  
 ( ) For selection of projects.  
 ( ) For working directions.  
 ( )
9. Approximately what percentage of the student's grade indicates the achievement of information through use of books? Please circle.  
 0          5%          10%          20%          25%          30%
10. Please check which books in the following list are available for student use in your school.
- ( ) Bell & Shaeffer - INTRODUCTORY METALWORKING PROBLEMS
  - ( ) Berg & Wing - ESSENTIALS OF METALWORKING
  - ( ) Bick - ARTISTIC METALWORK
  - ( ) Bollinger - ELEMENTARY WROUGHT IRON
  - ( ) Boston - METAL PROCESSING
  - ( ) Broemel - SHEET METALWORKERS MANUAL
  - ( ) Burghardt - MACHINE TOOL OPERATION, BOOK I
  - ( ) Burghardt - MACHINE TOOL OPERATION, BOOK II
  - ( ) Butler - PROBLEMS IN METALWORK
  - ( ) Campbell - THE WORKING, HEAT TREATING, AND WELDING OF STEEL
  - ( ) Campbell - METAL CASTINGS
  - ( ) Colvin - RUNNING AN ENGINE LATHE
  - ( ) Colvin & Stanley - AMERICAN MACHINIST HANDBOOK
  - ( ) Daugherty - SHEET METAL PATTERN DRAFTING AND SHOP PROBLEMS
  - ( ) Dragoo & Dragoo - GENERAL SHOP METALWORK
  - ( ) Ford Trade School - SHOP THEORY
  - ( ) Giachino - BENCH METALWORK
  - ( ) Giachino - OXY-ACETYLENE WELDING FOR BEGINNERS
  - ( ) Grayshon - GENERAL METALWORK
  - ( ) Harcourt - ELEMENTARY FORGE PRACTICE
  - ( ) Harcourt - THE WORKING AND HEAT TREATING OF STEEL
  - ( ) Jeffry & Cotter - MACHINE SHOP PROJECTS
  - ( ) Jennings - GAS AND A.C. ARC WELDING AND CUTTING
  - ( ) Jones - MACHINE SHOP PRACTICE, BOOK I
  - ( ) Jones - MACHINE SHOP PRACTICE, BOOK II



- ( ) Jones - METAL WORK
- ( ) Lukowitz - INTERESTING ART METALWORK
- ( ) Norcross & Quinn - HOW TO DO AIRCRAFT SHEET METAL WORK
- ( ) Peterson - ONE HUNDRED ONE METALWORK PROBLEMS
- ( ) Potter - ELECTRIC WELDING
- ( ) Rossi - MANUAL OF INSTRUCTION IN WELDING AND CUTTING
- ( ) Selvidge & Christy - INSTRUCTION MANUAL FOR SHEET-METALWORKERS
- ( ) Smith - UNITS IN BENCH METAL WORK
- ( ) Smith - UNITS IN SHEET METAL WORK
- ( ) Smith - UNITS IN ETCHING, SPINNING, RAISING AND TOOLING METAL
- ( ) Smith - UNITS IN PATTERN MAKING AND FOUNDRY
- ( ) Smith - UNITS IN FORGING AND WELDING
- ( ) Smith - UNITS IN THE MACHING OF METAL
- ( ) Stimpson & Gray - FOUNDRY WORK
- ( ) Turner, Perrigo & Bertrand - MACHINE SHOP WORK
- ( ) Tutison & Kranzusch - METALWORK ESSENTIALS
- ( ) Van Leuven - COLD METALWORKING
- ( ) Welch - ELEMENTS OF SHEET METAL WORK
- ( ) (others) \_\_\_\_\_

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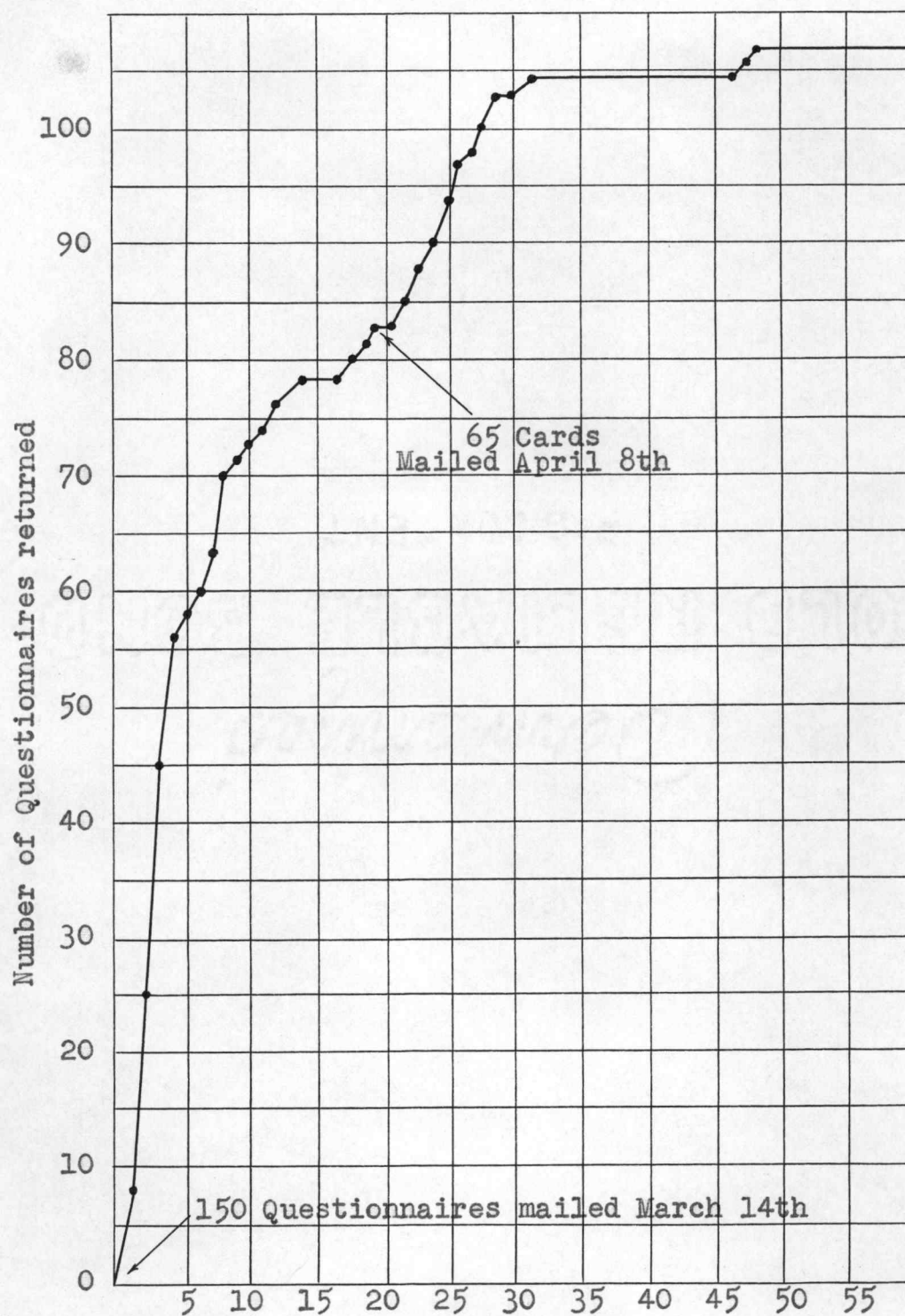
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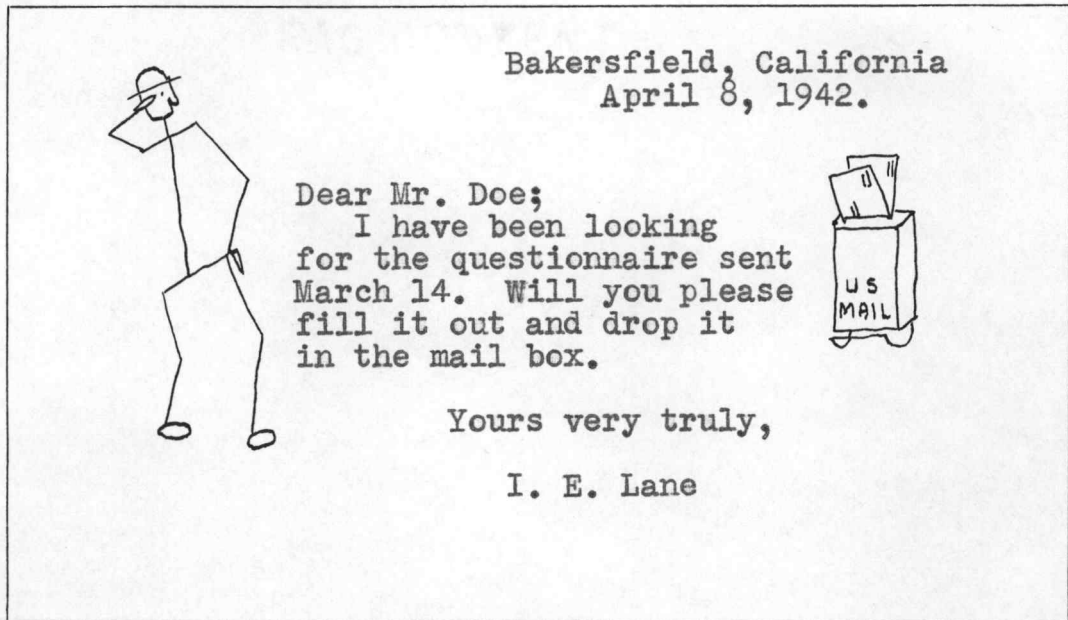
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11. Underline those books in question ten which you use for a class TEXT, if any.
12. Use the back of this sheet for any questions or comments concerning textbooks, or write to  
I. E. Lane, 2621 Sunset Avenue, Bakersfield, Calif.





Daily record of questionnaire returns



Sample of card sent to remind teachers to return  
the questionnaire.

## APPENDIX

### Analysis of Books

The method used in this analysis is similar to that of Kefauver and Wiehoff (14:364) and more recently Coltharp (5:48), but simplified to give the busy shop teacher an idea of what the book contains.

## BOOK ANALYSIS

Author Harcourt  
Title Elementary Forge Practice  
Publisher Manual Arts Press Date Published 1920  
General Classification General Forge  
Material covered Materials and Equipment  
Drawing out, bending, twisting, welds-hammer  
work, annealing, hardening, tempering  
tool forging  
Working drawings of projects 34%  
Technical information 26%  
Pictures and illustrations Low 9%  
Related information 25%  
Quantity of illustrated projects 44  
Occupational information none  
Mathematics none Questions none  
Bibliography Yes short Index 4 pages  
Table of contents Yes Type Size 10 point  
Number of pages 154 Size 5½ x 7 3/4  
Binding Cloth Cost \$1.75

Additional Notes: Revised 1940. Added 60 illustrations.  
More related information.



## BOOK ANALYSIS

Author Bollinger  
Title Elementary Wrought Iron  
Publisher Bruce Date Published 1930  
General Classification Ornamental Bench & Forge  
Material covered Materials and tools - Operations  
Projects (Tools - Furniture - Andirons -  
candlesticks - lamps - Fill-ins)  

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Working drawings of projects 28%  
Technical information 39%  
Pictures and illustrations Drawings 15%  
Related information 15%  
Quantity of illustrated projects 68  
Occupational information None  
Mathematics None Questions None  
Bibliography None Index Yes  
Table of contents Yes Type size 10 pt. leaded  
Number of pages 139 Size 6x8 3/4  
Binding Cloth Cost \$1.32

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Additional Notes

## BOOK ANALYSIS

Author Burghardt  
Title Machine Tool Operation Part I  
Publisher McGraw-Hill Date Published 1919/1936  
General Classification Lathe and Benchwork, Forge  
Material covered The Machinists trade, Lathe  
construction and manipulation, Cutting tools, Layout  
tools, centering, facing, chuck work, taper and angles,  
threads, face plate, bench tools, forge work, solder-  
ing, brazing, etc.  
Working drawings of projects None  
Technical information 57%  
Pictures and illustrations 18%  
Related information 10%  
Quantity of illustrated projects none  
Occupational information 1%  
Mathematics 2% Questions 7%  
Bibliography none Index yes 2%  
Table of contents yes 2% Type Size 10 pt. Solid  
Number of pages 401 Size 5 x 7½  
Binding Cloth Cost \$2.25

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## Additional Notes

1941 Edition out

## BOOK ANALYSIS

Author Burghardt  
Title Machine Tool Operations Part II  
Publisher McGraw-Hill Date Published 1922/1937  
General Classification Advanced Machine Shop  
Material covered Drilling and drill press  
construction, shaper and shaper work, planer and  
planer work, miling machines and operation, grinding  
machines, hydraulics, gears, tables  
Working drawings of projects None  
Technical information 55%  
Pictures and illustrations Pictures & drawings 22%  
Related information 10%  
Quantity of illustrated projects none  
Occupational information none  
Mathematics tables only Questions 8%  
Bibliography very short Index yes  
Table of contents yes Type size 10 pt. leaded  
Number of pages 512 Size 5 x 7½  
Binding cloth Cost \$2.75

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## Additional Notes

1937 latest edition



## BOOK ANALYSIS

Author Jones, H. A.  
Title Machine-Shop Practice Book I  
Publisher Bruce Date Published 1926  
General Classification M. S. Instruction & Project  
Material covered Benchwork, drilling, lathe work,  
shaper, miller, grinding, shop math. shop science,  
terms and tables  

---

Working drawings of projects none  
Technical information 10%  
Pictures and illustrations drawings only 37%  
Related information 40%  
Quantity of illustrated projects 61  
Occupational information None  
Mathematics 6% Questions 5%  
Bibliography None Index Yes  
Table of contents yes Type size 10 pt. solid  
Number of pages 172 Size 6 x 9  
Binding Cloth Cost \$2.00

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## Additional Notes

Lesson diagrams on right hand page

Explanation on left side



## BOOK ANALYSIS

Author Ford Trade School  
 Title Shop Theory  
 Publisher McGraw-Hill Date Published 1934/ 1942 Revised  
 General Classification Machine Shop information  
 Material covered Formulas, small tools, rules  
micrometers, vernier gages, chisels, hacksaws, files  
soldering, drilling, tapers, threads, gearing,  
cutting tools, shaper, planed, lathes, milling,  
gages, heat treatment, abrasives, grinding  
 Working drawings of projects 1 only  
 Technical information 3%  
 Pictures and illustrations 46%  
 Related information 36%  
 Quantity of illustrated projects none  
 Occupational information none  
 Mathematics 10% Questions 3%  
 Bibliography none Index none  
 Table of contents yes Type Size Typed Elite  
 Number of pages 267 Size 8 3/8 x 10 3/4  
 Binding Card board Cost \$1.25

## Additional Notes

Mostly in question and answer form  
 Offset printing - double column

## BOOK ANALYSIS

Author Colvin and Stanley  
 Title American Machinists Handbook  
 Publisher McGraw-Hill Date Published 1940 7th ed.  
 General Classification Handbook  
 Material covered Screw threads, pipe, drilling,  
reamer, taps, files, babbitting, gearing, turning and  
boring, milling machine, grinding, screw machines,  
punch press, broaching, bolts, nuts, screws,  
measuring, taper  
 Working drawings of projects none  
 Technical information 46%  
 Pictures and illustrations Drawings 9%  
 Related information 60%  
 Quantity of illustrated projects none  
 Occupational information none  
 Mathematics 15% with tables Questions none  
 Bibliography none Index yes  
 Table of contents yes Type size 8 pt.  
 Number of pages 1366 Size 4 1/4 x 6 3/4  
 Binding Flexible Cost \$4.00

Additional Notes (continued from above)  
 shop and drawing, wire gauges, horsepower, belts  
 and shafting, metals, forging, knots and slings,  
 general reference tables, automotive data, railroad  
 shop data, shop trigonometry, dictionary of shop terms.

## BOOK ANALYSIS

Author Tustison and Kranzusch  
Title Metalwork Essentials  
Publisher Bruce Date Published 1936  
General Classification Unit Instruction Gen.Metal  
Material covered Art metal, bench metal  
Foundry, sheet metal  
  
  
  
Working drawings of projects none  
Technical information 29%  
Pictures and illustrations Very good 45%  
Related information 25%  
Quantity of illustrated projects 1%  
Occupational information none  
Mathematics none Questions 6%  
Bibliography none Index yes  
Table of contents yes Type size 10 pt.lead  
Number of pages 175 Size 6 x 9  
Binding Cloth Cost \$1.75

Additional Notes