

**PROBLEMS OF METHODS IN TEACHING INDUSTRIAL ARTS**

PROBLEMS OF METHODS IN TEACHING INDUSTRIAL ARTS

By

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## CHAPTER I

### PRELIMINARY STATEMENTS

Industrial education has expanded considerably since the start of this century, and this has resulted in an expansion of Industrial Arts Education and a broadening of the program of shop activities. This, in turn, has increased the demand for better trained teachers and has focused attention on improved methods of teaching shopwork classes. ✓

#### Origin and Purpose of the Problem

In 1945, in a course in "Special Problems of Teaching Industrial Arts," under the direction of Dr. DeWitt Hunt, considerable discussion of the problems faced by Industrial Arts teachers revealed a need for a manual on teaching methods. Though there are books and articles which treat various phases of teaching Industrial Arts, there is no publication which has for its sole purpose the presentation of teaching methods in all its phases. Thus arose the need for this thesis which discusses those teaching methods which have proved successful in Industrial Arts classes in the public secondary schools.

It is the purpose of this study to present a correlation of the thinking in Industrial Arts education as it pertains to teaching methods, and to organize and summarize for beginning teachers the accepted methods of teaching in Industrial Arts classes. ✓

#### Definition of Special Terms Used

The term Industrial Arts refers to all classes and courses of shopwork and industrial drawing taught in junior or senior high school for general education and guidance purposes. Its purposes are primarily to orient the student in our current industrial civilization by means of



experiences in working with as many of the materials common to everyday life as possible. Industrial Arts, as a school subject, may be defined as a study of the machines, tools, and processes by means of which the forces of nature are utilized and the raw materials of nature are changed by man to make them more valuable and pleasing. It includes an understanding of the native qualities of raw materials and of the natural forces, together with a knowledge of the methods and practices of utilizing and changing these materials and forces. It is also concerned with the social and economic problems incident to these changes.

By method is meant those organized processes and procedures used in giving instruction to students in the classroom or shop. These procedures can be applied to groups or individuals as the problems at hand necessitate.

✓ The place of method in teaching has been recognized for many years and its importance cannot be minimized. Many times the difference in good and poor teaching is a difference in method. To have a method of accomplishment is one of the surest ways of insuring that the objectives are fulfilled.

#### Limitations of the Study

The scope of material on teaching Industrial Arts is voluminous with many applications, therefore, it is necessary to limit this study to an investigation of the bases of certification of Industrial Arts teachers and to teaching methods used in Industrial Arts classes.

#### Techniques of Research Used in This Study

The topics discussed in the class in "Special Problems of Teaching Industrial Arts," under the direction of Dr. DeWitt Hunt, have been used

as the basis for the content and organization of the materials presented in this thesis. Published books and professional periodicals dealing with teaching methods constitute the sources of data used in this research.

#### The Plan of the Study

The historical background of Industrial Arts education is presented in the following chapter, and Chapter III is devoted to a discussion of the requirements for certification of Industrial Arts teachers in Oklahoma and 13 other states. Chapter IV is given to a discussion of those methods of teaching Industrial Arts which have proved successful in the public secondary schools, and the final chapter summarizes and gives recommendations.

## CHAPTER II

## THE HISTORICAL BACKGROUND

In the latter part of the eighteenth century and the first quarter of the nineteenth, the Swiss reformer Pestalozzi advanced a step farther than writers the preceding century had done. He based his instruction on the object method and insisted upon observation and handling of the objects themselves. He contended that the child develops mentally through impressions and experiences, not through words.

European Techniques

Pestalozzi advocated and practiced the plan of having pupils engage in occupations such as farming, spinning, and weaving, but never conceived that these had any relation whatever to intellectual development. They were used as tasks for the pupils of his "industrial school for the poor."

Three European countries, Finland, Sweden, and Russia preceded the United States in recognizing manual training as an educational tool. Finland was the first to propose such courses as a part of school instruction. In 1858 the Emperor of Russia appointed Uno Cygnaeus to reorganize the primary schools of Finland, which he did along Froebelian lines. He proposed courses in woodwork, metalwork, basketry, and pottery. In 1866 some form of manual work was made compulsory for all boys in the rural communities and teacher training schools for men, however, it was not compulsory in the cities.

Swedish Contributions

The second to make handwork a part of the educational system was Sweden. Vaughn and Mays describe the Swedish Sloyd system in these words:



(22, page 25)<sup>1</sup>

Sloyd at first received the attention of the Swedish government not as a means of education, but as a means of furnishing the leisure hours in the rural home with interesting occupation, of reviving the rapidly disappearing handicrafts among the people, and of checking the rapid movement of families from the country to the cities. So, in 1870, the government urged upon the rural homes that they devote some time to the various handicrafts such as carpentry, carving, stonework, basketry, etc.

In 1872 special schools were established for the purpose of teaching Sloyd which had much to do with the establishment and practice of manual work in other countries.

#### Russia and Technical Education

The Russian system was next. As early as 1868 Victor Della Vos, director of the St. Petersburg Imperial Technical School for government engineers, introduced shop instruction and tool work into that school thus starting what has since been known as the Russian system of manual training.

This system undertook to give scientific tool instruction by a series of exercises that involved in a systematic and sequential way the fundamental tool processes. Della Vos conceived that the way to do this was to analyze the tools, the processes, the crafts, trades, and materials into their elements and to arrange these elements in methodical courses of instruction. (22, page 26)

Cabinet making was analyzed into its various forms of construction, which resulted in a long list of the different kinds of joints used in cabinet work. The pupil was given models and drawings of joints, detailed explanations of their construction, and demonstrations of the tool processes involved.

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<sup>1</sup> Each reference will be in this form. The first figure refers to the number of the book or magazine in the bibliography, and the page number is then indicated.

The theory of the Russian work was expressed in their slogan, "Instruction before construction." The course for government engineers required six years for completion, three for instruction and three for construction. In the United States the slogan might fittingly be, "Construction accompanied by instruction."

#### Industrial Education in the United States

In 1876, at the Centennial Exposition in Philadelphia, there was an exhibition of work which had been done in the Russian Imperial Technical Schools. This exhibit attracted attention of Professor John D. Runkle of the Massachusetts Institute of Technology, Boston, and Dr. Calvin M. Woodward of Washington University, St. Louis.

In 1879, through the influence of Dr. Woodward, who has been titled by Friese as "the real father of manual training," (6, page 13) money was raised from private sources with which to purchase the ground, and build and equip a building for the St. Louis Manual Training School, as a preparatory school for Washington University. This school opened in 1880 as the first manual training school in America. Courses were organized consisting of exercises in joinery, forging, pattern-making, and drafting.

In 1884, three other cities, Chicago, Toledo, and Baltimore, organized manual training schools. Private corporations furnished the funds with which to build the schools in Chicago and Toledo, but Baltimore established the first manual training school as an integral part of the public school system. Philadelphia and Omaha were next, but after 1886 public manual training high schools grew very rapidly in number, in size, and in influence.

#### Sloyd in America

An event which had much to do with the nature of the manual training

work in this country was the bringing of Mr. Gustaf Larsson from Sweden to introduce Swedish Sloyd into the Boston schools in 1889. Up to this time manual training had been crude and unorganized and inclined to copy the work of the Russian schools. But Mr. Larsson's work began to conform to the principle of the Swedish Sloyd, which provided projects for construction in the nature of articles for actual use in the homes. At first most of the projects, though they may have had some use in a Swedish home, were of little use in an American home. However, the system was soon adjusted to the needs of American youth and the American home which greatly modified the character of the work in both the elementary and secondary schools.

#### Four Stages of Manual Training in the United States

The first stage of manual training in the United States was the abstract exercise stage. It was the type of work developed in the St. Louis Manual Training School and was based upon the Russian system.

The early advocates of manual training probably would have qualified very materially their acceptance of the extreme implications of this doctrine, but they emphasized that manual training was for general training, for culture, for discipline, and indignantly resented the charge that such courses were for trade or practical purposes. (22, page 33)

So the formal doctrine of mediaeval scholasticism was revived. Again quoting from Vaughn and Mays, it was claimed "that the important thing in education is not the thing learned, but the process of learning." (22, page 33)

Soon after the introduction of the Russian system into some American schools came the influence of Swedish Sloyd. Prominent among the objectives of this work were the following: "to instill a love and a respect for labor; to develop self-reliance; to train in habits of order,



exactness, neatness, industry, and patience; to give dexterity in the use of tools; and to promote physical development." (22, page 34) Sloyd introduced the idea of practical use in manual training and this made it more interesting to both the pupils and the public.

The Arts and Crafts movement is the third stage. It was not until the latter part of the nineteenth century that the emphasis in manual training changed from the purely mechanical aspects to a consideration of beauty and an artistic expression in the objects made.

The machine was proclaimed the basest of all devilish inventions, and anything 'handmade' was looked upon as the acme of correctness and refinement, while tool marks, inaccuracy and general crudeness were evidence of genuineness and superiority. Homes were filled with massive, straight-lined, ill-proportioned 'mission' furniture. (22, page 36)

The products of the Arts and Crafts were based on originality of thought and planning, variety in the products, and effort at good proportion and artistic design. This made the manual training teachers aware of such things as good taste, artistic ideals, beauty in simplicity, originality in design, and honest construction.

The fourth stage is the attempt to industrialize and vocationalize shopwork instruction, and was the forerunner of what is now common thought and practice among industrial arts teachers. The movement began with a new conviction that shop courses should bear a more intimate and definite relation to the industrial world according to Vaughn and Mays: (22, page 37)

The feeling became rather pronounced that the school shopwork should provide a fund of information and experience relating to materials, processes, methods of manufacture, opportunities for employment and success of certain fundamental industries. Thus the term Industrial Arts supplanted Manual Training.

This conception offered the means of providing for pupil participation in certain phases of the real work of the world. It held out the



hope of breaking away from the formal abstractions of text books and cut-and-dried shop work. But the fact remains that most shop courses in the schools today have been industrialized to their enrichment and improvement.

#### Methods of Teaching in Early Manual Training Classes

The type of instruction which was used in the early manual training classes was that of emphasizing instruction about tools and tool processes. For example, before any student could start a piece of cabinet work he had to construct a specified number of different types of joints. These joints were abstracted from the objects of which they were parts and were arranged in a series to give a progressive sequence in tool processes. This method emphasized general training and discipline. It was not until the idea that interest is just as important as effort that the emphasis was placed upon constructing simple and practical objects early in the course. When this idea gained recognition, the application of what was first learned was sought before introducing the study of the more difficult principles.

#### History of Books on Methods of Teaching Shopwork

Probably the first book containing chapters on methods of teaching Industrial Arts was Griffith's Correlated Courses in Woodwork and Mechanical Drawing, (8) which was published in 1916. The author intended that this book should "prove helpful to young instructors in their first year of teaching, assisting them over many of the petty details which spell success or failure." (8, page 2)

Allen's book, The Instructor, The Man, and The Job, (1) which was published in 1919 was intended to serve two purposes: "to serve as a

handbook to instructors in industrial plants and also to serve as 'instruction notes' in instructor training courses." (1, page iv) This book deals with training in the plant, the analysis and classification of trade knowledge, establishing an effective instructional order, methods of instruction, and lesson planning.

Probably the third book on methods was by McMurry, Eggers, and McMurry. This book, Teaching of Industrial Arts in The Elementary School, (11) was published in 1923 and had for its purpose the improvement of instruction in the Industrial Arts classes of the elementary public schools.

The following year, 1924, Content and Methods of The Industrial Arts by Vaughn and Mays (22) was published. This book purposes to aid all teachers who in any way come in contact with the industrial education field "to see more clearly the purposes of shop courses in the schools, to understand more completely the means and methods by which such purposes can be carried out, and to appreciate more fully the relation of industrial work to the general scheme of education." (22, preface)

In 1926 Exploring The Manual Arts by Friese (6) was published. This book takes up manual arts at the junior high school level. "It does so on the basis of boy interest, physiology and psychology between the ages of twelve and fifteen. Exploratory manipulative aims have been quite generally accepted and common practices established." (6, page x)

In this same year, 1926, Payne's book, Methods of Teaching Industrial Subjects (14) was published. This book is divided into two main divisions: the first dealing with technical education in the United States, and the second division dealing with vocational education in the United States.

In 1929 was published Industrial Arts in Education by Schweickhard.

(16) This book was intended for three groups: "school administrators, teachers in service, and teachers in preparation." (16, page 5) The philosophy of education, bases of organization for industrial education, objectives of Industrial Arts, and personal qualities of Industrial Arts teachers are discussed.

Ericson's Teaching Problems in Industrial Arts (4) was published in 1930. This book is divided into three parts: procedure in teaching shopwork; content and underlying conceptions, the "what and why"; and the teacher, his attitudes toward himself, his profession and his fellow-workers.

The book, Principles of Trade and Industrial Teaching by Selvidge and Fryklund (19) was published in 1930. This book was written:

To meet the needs of teachers in service and to give prospective teachers a clearer view of what is required of the profession, a sound method of selection and organization of subject matter and practical methods of individual instruction. In addition it gives the fundamental psychological principles upon which the teaching methods are based. (19, preface)

Struck's Creative Teaching (21) was published in 1938. It is one of the most complete treatments of teaching methods. The book begins with a consideration of the larger goals and then treats with the development of specific skills, knowledges, and appreciations. In the preface, Struck says, "creative work calls for discriminating thinking, wide reading, thoughtful planning, and critical evaluation of results." (21, preface)

One of the most recent handbooks on teaching methods is 250 Teaching Techniques by Karch and Estabrooke (10) which was published in 1943. The book is intended to serve as a ready reference book, as a guide for the tradesman-instructor, as an instructor rating scale for supervisors and teachers, and as a textbook for formal teacher-training classes.

### Early Work in Education of Shopwork Teachers

In 1872, special schools were established in Sweden for the purpose of teaching Sloyd. One of these schools, which was established at Näs "developed into the Sloyd Seminarium in 1874 and under the inspiration and guidance of Otto Salomon, this teacher training school became the dominating influence in Swedish Sloyd work." (22, page 25)

The Oswego State Normal School was one of the first normal schools in this country to give instruction in manual training. At first the work was informal and on purely a voluntary basis but regular classes were established in 1893; in this year shops and equipment were provided and a technically trained teacher was employed.

In 1903 the legislature of Kansas passed an act establishing the State Normal School of Manual Training at Pittsburg. This school was for the purpose of training special teachers of practical arts subjects and was at first a branch of the State Normal School at Emporia and was controlled by the same board of regents. This was one of the most progressive schools in the training of Industrial Arts teachers, and today is one of the leading colleges in Industrial Arts education in this part of the United States.

This chapter has presented the historical background of Industrial Arts education. The following chapter will discuss certification of Industrial Arts teachers.

## CHAPTER III

CERTIFICATION OF INDUSTRIAL ARTS TEACHERS AND COURSES  
IN METHODS OF TEACHING INDUSTRIAL ARTS  
REQUIRED FOR CERTIFICATES

In Oklahoma a life certificate for teaching Industrial Arts in high school is granted if the applicant has a bachelor's degree with 24 semester hours credit in the Industrial Arts teaching field. Of these 24 hours 4 hours may be electives in shop work but the remaining 20 must be in designated courses. In addition to these requirements a candidate for a life teaching certificate must complete 21 semester hours in certain specified education courses including 6 semester hours of student teaching, 8 semester hours of English, 6 hours in history and government, and must satisfy the Oklahoma history and agriculture requirement. (XII, page 24) (The references in this chapter refer to the State certification publication as listed in the Appendix B. Roman numerals were used to distinguish them from the references to the bibliography which are numbered with Arabic numerals.)

Letters were written to the State Departments of Education in 13 states in addition to Oklahoma inquiring as to the requirements for a life certificate to teach Industrial Arts in the high schools of those states; all of the states which border on Oklahoma were included. The course work requirements in the field of Industrial Arts for these 13 states and for Oklahoma are shown in Table I.

In Arkansas the certificate is valid for six years and may be re-issued under any of the following options: (I, page 23)

TABLE 1

SEMESTER HOURS CREDIT REQUIRED FOR LIFE CERTIFICATE TO TEACH  
INDUSTRIAL ARTS IN 14 STATES

Courses Required	Name of State													
	Arkansas	California	Colorado *	Illinois	Indiana	Iowa	Kansas	Missouri	Nebraska	New York	Ohio	Oklahoma	Pennsylvania	Texas
Teaching Methods	2	3	9	2	3	3	3			4	2			2
Practice Teaching	5	6	3	5	3	3	4		3	4	3	6	6	
Graduate Credit									18	30	30		6	
Automobile-Trans.		3												
Arch. Drawing												2		
Bench Woodwork		3								5		4		
Cabinet Making												4		
Care of Equipment												2		
Electricity & Radio		3								3				
General Shop	2													
Home Mechanics	6													
Ind. Arts Design												2		
Ind. Arts Educ.													6	
Machine Drawing												2		
Mechanical Drawing	6	3	5							4		2	10	
Occupation Guidance	2		3											
Metal Work		3								5				
Printing										3				
Shop Management	2													
Shop Mathematics			4											
Wood & Metal Finish.												2		
Electives in Shop	8	25	16	36	24	15	40	24	15	16	24	4	30	24
Total hours in Shop	26	40	40	36	24	15	40	24	15	36	24	24	40	24

\* Colorado figures are given in quarter hours.

1. Completion of six semester hours of work in an approved institution during the life of the certificate.
2. Successful teaching experience during three years of the life of the certificate.
3. Successful teaching experience during the entire school term of the last year of the life of the certificate.

The applicant for a certificate to teach in the high schools of California must have completed a four-year college course with a Bachelor's Degree and 15 semester hours of professional work in education, including 6 semester hours in directed teaching and 3 semester hours in teaching methods in Industrial Arts. An applicant for a life certificate must submit "original letters of recommendation verifying at least forty-eight months of successful school experience including twenty-one months in the public schools of California." (II, page 43)

Colorado requires a minimum of four years of collegiate training which must have been completed in accredited institutions of higher learning. The applicant must have at least 20 semester hours of credit in education including the 6 hours in teaching methods in Industrial Arts. "The requirement in Practice Teaching may be waived by the issuing authority on evidence of at least three years of successful experience in teaching the subject under supervision." (III, page 1)

A certificate to teach Industrial Arts in Illinois is issued only to those with Bachelor's Degrees and is valid for a period of four years. It is renewable "in periods of four years upon successful teaching and professional growth satisfactory to the county superintendent of schools." (IV, page 24)

The regular high school teachers' license in Indiana is granted only to those who hold a baccalaureate degree from a standard or approved college or university with a minimum of 120 semester hours of credit. It



is further recommended that "the 24 semester hours of required credit should be devoted principally to woodwork, mechanical drawing, and mechanics." (V, page 26)

In the state of Iowa a five-year provisional certificate is issued and may be renewed for life after "five years' successful teaching experience, two of which must have occurred during the term of the certificate offered for life renewal." A certificate which is renewed for life remains in force only as long as the holder permits no five-year period to pass in which he has not been employed in school work for at least one school year. A life certificate which has lapsed may be reinstated as a term certificate "upon filing 10 semester hours of college credit earned in an approved institution since the date of issuance of the life certificate." (VI, page 18)

In Kansas a provisional two-year special certificate is issued and at the expiration of this certificate "the Life Special Certificate may be issued provided the holder of the certificate holds a baccalaureate degree and has completed two years of successful teaching experience during the term for which the certificate is valid." (VII, page 4)

In Missouri "a life certificate to teach in high school may be secured after teaching for a period of five years in the State and on recommendation of the local superintendent of schools." (VIII, page 1)

The five-year provisional certificate is issued in the state of Nebraska to candidates who satisfy the requirements as shown in Table 1. To receive a life certificate one must complete "18 hours of graduate credit including 6 in education, and complete 3 years of teaching experience." (IX, page 1)

The holder of a provisional certificate in the state of New York is

eligible for the permanent certificate upon the completion of 30 semester hours of work above the baccalaureate degree. (X, page 2)

The holder of a permanent certificate shall during each successive ten-year period from date of issuance complete six semester hours in approved courses or the equivalent in approved professional activity other than classroom teaching such as membership in study groups for professional and cultural improvement, travel, educational research, authorship, cooperating critic and demonstration teaching, occupational experience, leadership in extraschool activities, leadership in professional associations and leadership in appropriate community activities. The permanent certificate shall be valid continuously except when the holder thereof has not been regularly employed in a teaching, supervisory or administrative position in the public schools of New York State within a five-year period and has not satisfied the in-service study and training requirement. (X, page 2)

In the state of Ohio an eight-year professional high school certificate may be converted into a permanent certificate upon evidence of:

"forty months of successful experience under the eight-year certificate to be converted and the completion of an appropriate Master's degree or the equivalent." (XI, page 27)

In Pennsylvania a provisional certificate is issued to an applicant who has completed an approved four-year teacher education curriculum and has been granted a baccalaureate degree in an accredited college or university. It is valid for three years and may be renewed for three years on a teacher rating of "satisfactory" and the completion of six semester hours of advanced education subsequent to the baccalaureate degree. The permanent certificate requires three full years of successful teaching experience in the public schools of the Commonwealth of Pennsylvania in addition to the six semester hours credit above the baccalaureate degree. (XIII, page 2)

It is observed from Table 1 that a course in teaching methods in Industrial Arts is required in 10 of the 14 states; it is significant that there is no requirement in methods of teaching Industrial Arts in

Oklahoma. Practice teaching in Industrial Arts is required in 11 states (in Kansas and Colorado the practice teaching requirement may be waived if the candidate has had 3 years of successful teaching experience.) Four states, Nebraska, New York, Ohio, and Pennsylvania require that the applicant for a life certificate have some graduate work; New York and Ohio require a whole year of graduate work. Seven states, California, Iowa, Kansas, Missouri, Nebraska, Ohio, and Pennsylvania require from 2 to 5 years of successful teaching experience before a life certificate will be issued. A provisional certificate is issued and when the teaching requirement is met the teacher may apply for the life certificate.

In five states specific courses in the Industrial Arts teaching field are required while in the remaining nine states, though certain courses are recommended, no specific course is required. It is evident that there is considerable variation in both the specific requirements and the number of semester hours of credit which is required in the specified courses in the Industrial Arts teaching field. Oklahoma specifies the courses which one must take to a greater degree than does any other state, allowing but 4 semester hours of electives as compared to an average of 22 semester hours for the other 13 states investigated.

This chapter has discussed the requirements for certification of Industrial Arts teachers in Oklahoma and 13 additional states. The following chapter will discuss the various teaching methods which have proved successful in the teaching of Industrial Arts.

## CHAPTER IV

## TEACHING METHODS IN INDUSTRIAL ARTS

A satisfactory method should provide opportunities for the development of initiative and originality in pupils. It should stimulate interest and cause the student to want to accomplish the goals assigned. The pupils should understand the purpose of the lesson being studied and feel that the goal to be accomplished is his own goal.

There are many methods of teaching which can be used effectively in teaching Industrial Arts classes, and it is the purpose of this chapter to discuss these methods.

Class Demonstration

Probably one of the first methods to be used and still among the best methods available is the demonstration. It is not only an effective method of teaching but one which can be used on a class, group, or individual basis. Ericson, in discussing the class demonstration as a teaching method, says: (4, page 57)

The demonstration, then, is probably the teacher's greatest asset in arriving at certain fundamental skills and practices, and in the shortest possible time. It may well be said without fear of contradiction that for the average school shop the quality and quantity of work produced will depend greatly upon the instructor's use of the demonstration. . . . the outstanding mark of teaching ability is effectiveness in giving demonstrations.

There are many advantages of the demonstration. Those given by Struck are as follows: (21, page 348)

1. The visual sense perception comes to the aid of the sense of hearing.
2. The demonstration is adaptable to greatly varying circumstances.
3. It is objective and concrete.
4. It can be readily employed in unison with other methods.
5. It combines theory and practice closely.

According to Karch and Estabrooke the following points should be

kept in mind when making preparation for the class demonstration: (10, pages 59-60)

1. Plan a demonstration of the proper length.
2. Have tools and materials at hand.
3. Use the same kinds of materials and same quality of tools that the pupils are to use.
4. Practice the demonstration privately.
5. Confine the demonstration to a single unit of work.

According to the same authors the following factors are important and should govern one's procedure during the demonstration. (10, pages 60-64)

1. Explain the objectives to the students.
2. Mention the important points to look for.
3. Explain new terms.
4. Present the material step by step.
5. Teach only the best procedure for each step.
6. Do not perform work for students.
7. Do not quit too soon.
8. Beware of related information.
9. Stress safety rules and precautions.
10. Select students to aid with demonstrations when feasible.

A brief summary of key points will help to emphasize them. The use of well selected questions will enable the teacher to locate the students who need additional help. After the completion of the demonstration the teacher will aid these students. Opportunity should be provided for the students to go to work immediately after the completion of the demonstration while the procedures are clear in their minds.

#### Individual Demonstration

Instruction for the class as a whole usually does not cover the needs of all students. There are variations among students in mechanical ability and in general learning ability, irregularities in attendance, and differences in speed. Individual demonstration is one of the best ways to show in detail the procedure to be followed for a certain accomplishment in manual work. Ericson emphasizes these needs in the following

words: (4, page 63)

A conscientious follow-up of the general demonstration, and close individual touch with students at all times, will determine how much individual demonstration is needed. . . . But since many factors come in to diversify the work of the class as the time goes on, the time spent with individual students and their problems will probably increase.

### Instruction Sheets

Instruction sheets are written instructions for directing study, imparting information, and for instruction in matters of skill. They center attention on a particular thing to be learned. They are not intended as a substitute for the instructor but to supplement teaching.

In order to make instruction sheets most useful they should be illustrated with sketches or photographs wherever possible. They should be durable enough to withstand constant handling by students and should be revised as needed.

The chief advantages of instruction sheets as given by Karch and Estabrooke are: (10, pages 119-120)

1. They provide a basis for common knowledge of all students especially helpful in large classes.
2. They provide for uniform instructions.
3. They provide practice in following written instructions.
4. They help care for individual differences.
5. They are an aid for students who enter the course late.
6. They are valuable for review purposes.

Karch and Estabrooke suggest the following procedure in writing instruction sheets: (10, pages 122-127)

1. Title--the title should be specific and descriptive.
2. What is to be done--this should be a brief and clear statement of the purpose to be accomplished.
3. Specific directions--the steps to be followed should be clearly stated, numbered, and arranged in logical sequence.
4. References--books, manuals, and trade journals should be listed with page references given.



### Operation Sheets

Operation sheets are a form of instruction sheets which deal with the learning units involving the manipulative operations being taught. Such operations as how to saw to a line, how to center a piece of stock in a lathe, etc. are skills which are involved in many jobs, and instructions prepared for any such unit may be used on any job in which that particular skill is involved. It is preferable to teach these skills in relation to a particular job rather than as unrelated units.

Selvidge and Fryklund suggest the following points as those which are to be observed in preparing instructions dealing with skilled operations: (19, page 139)

1. The title should clearly indicate what instructions are given.
2. The instructions should deal with the learning units involved in work jobs, but without respect to any particular job.
3. The instructions for performing the operations should be given step by step in a very complete form.
4. In general, it is not advisable to explain why an operation is performed in a certain way.
5. Illustrations should be given to clarify written instructions.
6. Give only the information necessary in performing the operation.
7. In most instances it is well to add questions to an operation sheet in order to encourage the student to seek the reason for doing things in a particular way.

### Information Sheets

Information sheets deal with those units of instruction represented by simple statements of fact which one is expected to know. These units may be matters of general information, or they may deal with facts that are important in planning jobs. The title should clearly indicate the subject treated, the information should be given in brief statements, questions should be given to act as a guide in reading and observation, and references to additional sources of information which are available should be given.



### Assignment Sheets

Assignment sheets are used in the presentation of an assignment for further investigation. They are used to good advantage in self-study and frequently give a list of questions to guide the student's thinking. According to Selvidge and Fryklund the assignment sheet "usually involves a definite statement of the principle it is desired to teach, together with examples of its application. . . . These examples are followed by a number of problems or jobs involving the application." (19, page 142)

### Job Sheets

A job sheet is a form of instruction sheet which tells how to do a whole job or project. It can be built upon a series of operations which are necessary to carry on an activity to completion. Job sheets can be used in two important ways according to an analysis by Karch and Estabrooke: (10, page 123)

When prepared by the instructor it may be used as a guide for students to follow in doing a job. This use of the job sheet does not contribute much to the development of the students' resourcefulness. Its main purpose is to point the way to do a job. When prepared by the student it serves as a challenge to his ability to analyze the job and plan his own procedure. This type of job sheet contributes directly to the development of self-reliance and resourcefulness of the student when carefully checked by the teacher before he proceeds with the job.

Selvidge and Fryklund suggest that job sheets should contain the following divisions: "Title, General Directions, Specifications, Information, Directions, Checking, Questions, and References." (19, page 143)

### Work-books

A work-book usually outlines units of work giving rather detailed suggestions for performing the assigned tasks; usually several instructional and testing aids are included. Work-books are intended as

supplementary aids in much the same manner as instruction sheets. They constitute another means of meeting the individual differences of the students. The elements of pre-testing and self-testing usually appeal to both the students and the teacher and are worthwhile techniques.

#### Talks by Businessmen

It is good practice to have a lumber dealer, hardware merchant, or contractor or other men from industry speak to the class whenever the material being studied lends itself to this procedure. Not only does this lend variety to the class work but in many instances ideas presented by an outsider are received better by some students than the same ideas are when presented by the regular instructor.

#### Trade Literature

Most units of work can be made more interesting by referring the pupils to a wide range of educationally valuable trade literature which is issued by businesses or industries. Frequently industrial firms have a large supply of interesting pamphlets which are prepared especially for free distribution to public high schools. The instructor should watch the professional and technical magazines for advertisements of such literature. According to Struck it is good practice "to encourage the tool-room boy to study trade literature when he is not busy handing out tools. This reading is a part of his assignment." (21, page 380) Other students enjoy browsing through this material whenever they complete their projects ahead of the other members of the class.

#### Collateral Readings

Well chosen collateral reading will clarify the students' understandings and deepen their appreciations. Struck says: "Through guiding

the reading interests of pupils, the teacher may do much to develop in learners, a taste for literature that is distinctly helpful, constructive, and worthwhile." (21, page 136) It is most important that students be guided to read voluntarily literature which will stimulate them to creative thinking and to their best efforts.

#### Research

Doing research is a technique which can sometimes be used with extremely good results. When a student who plans to build a desk or some other project visits a down-town business firm to examine the desks which are in use there, and to make comparisons and suggest improvements, he feels that he is working on a project which is superior to those normally carried out because it is the result of his own research, thinking, and planning. The instructor should watch for opportunities to use this technique in his industrial arts classes.

#### Oral Questioning

Though the many different projects found in industrial arts require a somewhat different approach as to the teaching methods to be used, oral questioning will be effective in a high majority of instructional activities. Questions may be used for the purpose of stimulating interest on the part of the pupils and determining their knowledge of the topic. The right kind of questions will stimulate students to thinking and planning their own work so that it will portray the important points of the lesson as applied to a logical procedure of work. They aid in organizing knowledge and tying together units of learning. Struck emphasizes the value of this technique of questioning and says: (21, page 201)

Rightly used the question will bring the minds of the learner and of the teacher into closest touch; good questioning will be a means of

motivating mental effort, of stimulating reflective thinking, and of leading learners to creative effort. Good questions, by their very nature, are educative, and they have a very prominent place in all kinds of learning. If used in the right way, at the proper time, questions lead to new realms of understanding; they serve as a means of organizing knowledge; of correlating the results of educative experiences; of tying together units of learning; and of integrating personality. Good questions lead to deeper appreciations and to clearer understandings; they lead also to socially valuable insights and to constructive attitudes.

According to Karch and Estabrooke, "The instructor's ability to use this method effectively is one of the prerequisites of good teaching.

This technique may be used to advantage for many purposes:" (10, page 66)

1. To motivate assignments.
2. To assist students in understanding their work.
3. To stimulate interest.
4. To review important points in the lesson.
5. To test the student's knowledge.
6. To check for effectiveness of instruction.

In asking questions the instructor should be careful to use correct diction, correct grammar, and a simple vocabulary. The questions should be clear and definite and should be adapted to individual differences. Both informational and thought-provoking questions should be used, and the students should be encouraged to ask questions also. Above all questioning should result in reaching a definite conclusion.

#### Work Experience

Frequently opportunities are afforded for industrial arts students to work on the job for a short time in connection with their school training. Supervised occupational experience will teach students something about performance, it will demonstrate employers' expectations and will demonstrate to students what a day's work really means. It will also make students conscious of the necessity for personal efficiency, will acquaint them with methods that are actually used on the job, and will emphasize the necessity for team work. Work experience will serve to

supplement the instruction of the classroom and teach the students many of the fine points that theoretical presentation does not make clear.

### The Educational Trip

Educational trips are sometimes conducted as a part of school work. These trips have for their purpose the furthering of general learning and usually serve to stimulate vocational interests on the part of the students. It is good practice to prepare the students before the trip for what they are to observe. Again, Struck is quoted to indicate the value of this method: (21, page 237)

If possible, pupils should have fairly good ideas about what they will see, what it is all about, and how it relates to what is being studied in school. As soon after the trip as can be arranged, there should, if possible, be group discussion with the emphasis upon what was learned as a result of the trip. In some instances written reports or themes are appropriate and help to make more permanent the impressions gained through first-hand observation.

It is important that some evaluation of what the students have gained from the trip should be made. This evaluation may be made through class discussion, testing, oral or written reports.

### Written Reports

Written reports when properly organized and properly guided are very valuable to the student. References should be suggested and the teacher will need to explain to the student how to prepare and write the report. Every student needs to learn to use the library correctly, how to find information on various subjects, and how to organize this information in a logical manner. The written report affords an excellent means of encouraging the student to develop and apply his command of the English language. These reports can and should be done during time outside of regularly scheduled classes in shopwork.

### Oral Reports

In addition to those factors which were mentioned in the discussion of written reports, the oral report affords the pupil an opportunity to stand before a group of his associates and to express his thoughts. This is valuable training and the Industrial Arts program supplies many opportunities for this type of pupil participation.

### The Round-table Discussion

This informal method of discussion is well suited to small groups; the best results can be achieved when the number in the discussion group is kept under 15 or 20 pupils. Struck advises: "By keeping the number small there is better opportunity to get relatively frequent participation from all individuals represented." (21, page 261) In some instances it is practical to permit additional auditors to be present but as a general rule they do not participate in the discussion unless called upon.

### Panel Discussions

This is a variation of the round-table discussion technique and can be used to advantage in teaching Industrial Arts. Struck describes the panel discussion method in these words: (21, page 269)

The panel discussion differs from the round-table method, and also from the lecture-discussion method, with both of which it has some features in common, by placing the discussion leadership in the hands of a small group of individuals--usually from four to eight--who constitute the 'panel.' They are preferably seated in front, and in plain sight of the general audience. A slightly raised platform, upon which tables and chairs are placed so that the panel will face the audience, and also one another to some extent, is desirable.

The chairman should take a few minutes to explain the purpose of the discussion before calling upon the various members of the panel. Set speeches are out of order, however, preparation is necessary. A preliminary meeting of the panel is very desirable so that every member will

understand just how each one is to fit into the discussion. This method of instruction will aid the students of average and high mental ability more than it will those of the lower intellectual levels.

#### Use of the Library

A definite location should be set aside for the shop library. If there is a planning center or a classroom adjacent to the shop such a place would be the logical location for the library. In this way reading can be done away from direct contact with shop activities. It is important that the books be located within easy reach of the students. Ericson is quoted here on techniques of using the library method: (4, page 139)

Suitable cases should by all means be provided for the books, and under no circumstances should careless handling of reference material be allowed. Order in the use of this material is absolutely essential, and order will be greatly promoted by having a definite place for the books. Whenever books are to be taken for home use, a checking system or card system should be used. The charging of such books can be taken care of by a student who may be appointed librarian and have full responsibility for the reference shelves. The duties for this office should be rotated as in the case of the tool-room clerk.

#### Arithmetic Contests

Secondary school pupils enjoy a good contest. Where the Industrial Arts teacher has a classroom with blackboard space he can make use of the arithmetic contest. The class may be divided into two sides with a captain for each team. One member of each team goes to the blackboard and the teacher gives a problem such as the price of so many board feet of lumber at a certain price per foot. The individual who first gets the correct answer scores a point for his team. This type of friendly rivalry not only develops interest but supplies an opportunity for the teaching of sportsmanlike qualities and character building.

### Assemblies

School assemblies afford another opportunity to strengthen enthusiasm for the Industrial Arts department. A student demonstration of what he is doing in some shop class makes a worthy contribution to a school assembly program and one which not only is of interest to those who are not enrolled in shop work but gives the class members something to look forward to and an incentive for improving their workmanship.

### Assignments

Selvidge and Fryklund emphasize the importance of assignments when they say: "One of the most fundamental things in good teaching is the definite and proper assignment of the lesson." (19, page 96) The pupil is entitled to know what is expected of him; he is given the assignment not because the teacher wants something made, but because he will have an opportunity to learn things while doing a job. With more and more emphasis being placed upon attitudes in learning, and the significance of interest in learning, it can be seen that the assignment can become the means of a right start. Struck believes that the assignment is important and says: (21, page 37)

The desire to learn is more important than are methods of teaching. Where there is a will, the way will be found. But where there is indifference to learning, no method will be effective. The pupil's attitude toward learning is more important than well-organized courses of instruction. It is precisely for these reasons that the assignment is educationally important. Through it the teacher has the opportunity to so influence pupil attitude that effective learning will result. 'Mental-set' is recognized as vital to learning; interest is crucial to educational achievement. The assignment is the means of arousing interest and of bringing mind-set into action.

Struck analyzes the technique and says that a good assignment will possess the following important characteristics: (21, page 373)

1. It should be related to previous learning.
2. It should be definite and clear.



3. It will indicate sources of reference materials.
4. It should stimulate interest.
5. It should guide learning.

#### Check-lists

Check-lists can be used effectively as a teaching aid in Industrial Arts classes. The magazine School Management has featured check-lists of aids to teachers in each monthly publication. These lists contain a number of references that are valuable to teachers and administrators of industrial education.

#### Current Events

Current events are always of interest to secondary school pupils. They can be used either orally or be posted on the bulletin boards and pupil interest is strengthened through their use. The teacher should guard against too frequent use of this teaching aid, so as not to weaken the interest which it can create when it is used wisely.

#### Debating

Debating has long been considered a desirable form of development and it is a technique which can be used in Industrial Arts courses. Struck enumerates 27 advantages to be gained from the pupils' participation in this form of discussion. (21, page 275)

#### Drill

There are relationships between skills and habits. Skills are grounded in purposeful habits; skill implies ability to do something unusually well, it calls for intelligently directed habit formation. Struck has written these helpful statements about habit formation: (21, pages 385-389)

The procedure of habit-building is simple enough. It consists in repeating correctly what is to be learned until the response is automatic. This repetition is known as drill. . . . Although it is impossible to anticipate all problems that arise in practice, the following points may be suggestive.

1. See that the learner starts correctly.
2. Permit no errors to occur.
3. Encourage practice.
4. Suit the length of the drill to requirements.
5. Quality comes first.
6. Teach skills through individual instruction.
7. Awareness of achievement.
8. Drill discriminately.

One must keep constantly in mind the difficulty of the material to be learned and remember that individual differences are important factors in determining the amount of drill that should be given.

#### Experimentation

The Industrial Arts classes are ideally suited to learning through experimentation. Experimentation is learning through doing, and the wise teacher will take advantage of the opportunities which are presented daily for using this method of teaching.

#### Home-Workshop

Extra-curricular activities give satisfactions that arise from creative effort exerted in response to strong behavior tendencies and play situations. One of the best ways that the Industrial Arts teacher can help here is through the home-workshop. The home-workshop can be encouraged through parents, school clubs, displays and exhibits, and through visual aids. E. D. Phillips, in the publication *School Shop*, writes about model yachts as follows: (15, page 5)

Model yacht building is an excellent medium for developing exacting skills, pride, group participation, constructive rivalry, and exhilarating recreational interest. This writer highly recommends it as a means for bringing the home, the community, the school system, and school shop work in close cooperation through the extracurricular activity which model yacht building inevitably introduces.

### Hobby Clubs

Teachers who wish to lead school craft clubs or hobby craft clubs can render service by first discovering the pupil's present interest, deepening this interest, broadening his horizon, making success probable, and teaching pupils to select constructive activities. Satisfaction is usually related to the degree of success one has in what is undertaken.

### The Forum Discussion

The forum technique can be used effectively to clarify perplexing problems in industrial education. Struck suggests these uses for the Forum method: (21, page 261)

Among the problems that industrial arts and vocational industrial pupils may find worth tackling through forum procedure are such as these: employment conditions; labor problems; occupational studies; the craft unions; employers' associations; ethics in industry; safety; first-aid; workmen's compensation; industrial poisons; the place of part-time education; evening classes; slack-season instruction; labor-saving machinery; new materials of industry.

### Group Discussion

Though the major portion of the time devoted to Industrial Arts is spent in work which is manipulative in character, there is still need for discussion. "Group discussion methods are just as effective in the area of industrial education on the high school level as they are in other phases of secondary education." This quotation is taken from one of Struck's books. (21, page 276) Group discussion is one of the basic methods of teaching and is excellent for presenting new materials and for checking on the degree of understanding among the pupils.

### Home Visitation

The pupils who are enrolled in Industrial Arts Classes are not unlike those in the remainder of the school courses, and home visitation

is therefore just as important and just as valuable for the teacher of Industrial Arts as it is for any of the other members of the faculty. The home visit not only affords the shopwork instructor an opportunity to meet the parents but to evaluate the home environment as well. Struck suggests that if suitable records are kept in the office and made accessible to all the faculty it would suffice to have each pupil visited by some teacher only once a year. These home visits should not just happen; they should be planned beforehand and there should be definite objectives to be accomplished by them. The teacher should remember that such visits afford him an excellent opportunity to interpret the school to the parents. Such visits should not only strengthen the bonds of friendship between parents and teachers, but should further a more sympathetic understanding of the pupils and bring about better cooperation between the school and the home.

#### Teaching Through Illustration

Illustrations are excellent aids in teaching; there are many instances when sketches, pictures, or graphs are more understandable than the objects themselves. Every writer on methods emphasizes the importance of the use of illustrations but Struck summarizes the values as follows: (21, page 353)

It is desirable to use illustrations whenever a sketch, a graph, a drawing, or a picture will best help the pupils to understand more readily what they are trying to master. Illustrations may be used to advantage before, during, and after discussion and shop periods. Since pictorial illustrations and the various forms of conventionalized mechanical and architectural drafting speak a universal language, it will be seen that in the practical arts it is distinctly worth while for persons to be able to express themselves through illustrations.

#### The Conference Method

The conference method reverses the lecture method in that the

chairman or leader aims to "draw out" of those present what they know instead of telling them what he knows. Struck has characterized the conference leader "essentially a traffic officer of ideas." (21, page 262)

Banks comments on the conference method as follows: (2, page 7) The conference plan refers to a systematic analysis and 'thinking through' of problems by a group of individuals with a background of experience and with the necessary information required to solve the problems that are presented to the group. Their experience forms the basis for discussion, which is essentially a pooling of thought of a number of individuals, the purpose of which is to assist in solving problems . . . . The conference method is an effective technique when a problem needs to be defined or an issue clarified. It is useful when the object is to improve cooperation in an organization or to work out clear understanding or responsibility.

The conference method is effectively used when individuals in a group possess knowledge pertaining to the problem involved, and wish to pool the experiences and knowledge of the group for discussion and evaluation.

#### Individual Instruction

Individual instruction is usually given when group instruction is not feasible; it is used advantageously to supplement group instruction. Among the characteristics of good individual teaching the following points deserve to be mentioned according to Struck: (21, page 330)

1. The individual differences of the pupil should serve as points of departure.
2. The personality traits of learners should be diagnosed and used toward educational growth.
3. The previous background of education and experience should be recognized.
4. It should seek to integrate experiences, knowledge, and appreciates into units instead of exposing the individual to too many vaguely related elements of learning.
5. Good individual instruction has order, sequence, and continuity.
6. It is challenging, thought-provoking, and educative.

#### Laboratory Work

Industrial Arts education consists of much laboratory work. The



wise teacher realizes that the students are not to be left to proceed during the laboratory period in their own manner and at their own pace. The teacher supervises this laboratory work closely and uses this time to supplement group explanations with individual instruction, individual conference, and individual demonstration.

#### The Lecture Method

Though there has been much criticism of the lecture method it has its place in Industrial Arts instruction. To tell facts to students it is probably the shortest way and an efficient way. It is especially useful when the teacher is presenting materials not contained in the textbook and which he does not wish to have included in a student report.

Ericson says: "In the shop it is useful provided its place and function are known and appreciated." (4, page 64) Struck expands on this thought when he says: (21, page 255)

In industrial arts and in trade education there are times when the instructor can well amplify orally the information that is available from other sources. If the lecture is restricted to short periods of from five to fifteen minutes, and especially if it is supplemented by demonstrations, illustrations, or other appropriate procedures, there can be little question of its suitability as one method among many, all of which have their place.

#### Notebooks

Notebooks are valuable teaching aids and should contain both material which has been prepared and distributed by the teacher and material assembled by the students. Frequently there is some important outline or set of instructions which the teacher may want to duplicate and distribute to each student. When students are led to take an interest in creating a notebook of which they can be justly proud they are being drilled in the habits of good workmanship.

### Observation

Frequently students learn well by observing the teacher or some other student at work, and then imitating his procedure. This is an especially valuable technique for "slow" students who seem unable to grasp the idea from a verbal explanation, or from written instructions.

### Plays

An occasional play given either in the classroom or in an assembly serves to develop interest in Industrial Arts classes. An especially important phase of the giving of plays is the construction of the property for use on the stage. Frequently members of shop classes can greatly benefit from serving as members of the stage crew in making preparation for school plays.

### Problem Solving

The basis of problem solving lies in the "felt need" on the part of the student; this applies to both the group and individual instruction. According to Struck the steps in problem solving are as follows: (21, page 337)

1. A felt difficulty.
2. Analysis and location of the difficulty.
3. Suggestions for possible solutions.
4. Development by reasoning of the implications and bearings of what was suggested.
5. Further observations and sometimes experimentation which lead to acceptance or rejection.

### The Project Method

The basic elements of the project method are: pupil purposing, planning, executing, and judging. The first step in the employment of the project method is to get the pupils to see the need of something to be made or done in the shop. Ericson and Friese make these statements

about the project method:

If the purpose for the work is to be conceived and declared by the students, it will of necessity mean that the instructor will be put in the position of a guide, an inspiration, in causing the learners to think in the right direction rather than the one to announce the purpose for their thinking. (4, page 77)

It is just as much the duty of junior high school teachers to imbue pupils with worthy purposes as it is to teach subject-matter. A teacher must be an expert in both. Purposes must not only be recognized and accepted by the teacher, but also by the pupils. Unless the latter accept and appropriate the purposes as their own, this first important step in the project method will fail. (6, page 267)

The planning adds interest to the purpose, develops initiative and responsibility. Friese says: "It requires creative or constructive thinking or reasoning." (6, page 269) The Industrial Arts program is one in which the third step, that of execution takes definite form and is carried through to completion by the students themselves.

No project is complete without a judgment of the final results. Friese suggests a series of questions which could very easily be used by the individual student or by the class in making the judgment of the results. (6, page 272)

The project method seeks to develop planning abilities, doing abilities, and teaches individuals to judge results; it places the major emphasis upon growth through activity on the part of the learner.

### Recitation

The present-day recitation has become a democratized and socialized group instructional procedure, in which many teaching devices are employed. It is a form of teaching which emphasizes pupil participation and pupil initiative under teacher guidance. Struck gives several suggestions which are helpful in guiding the pupil-recitation: (21, page 355)



1. Orient the instruction, tie it in with preceding lessons.
2. Develop a natural setting, encourage pupil activity.
3. Stimulate discriminating thinking, through good questioning.
4. Guide the development of expression.
5. Develop adaptability, strive for open mindedness.
6. Bring out relationships.

### Reference Materials

Students need to learn how to find supplementary materials to add to the material presented in the textbook. As a part of every assignment references are usually given which the student is to look up and read. It is a good idea to permit the students to find other materials in addition to those referred to by the instructor. In this way they develop a technique of doing supplementary reading that will assist them when they enter college, and one that will prove beneficial in the solution of problems in life.

### Self-Instruction

Any plan of individual instruction of appreciable scope should employ objective tests, graphic progress charts, and instructional material which is easily administered by the pupil himself. Individual instruction is quite common in Industrial Arts education. The following suggestions are given by Struck for improving individual self-instruction:

(21, pages 343-346)

1. Employ suitable pre-tests as a basis for proper pupil classification and as a means of revealing points of strength and weakness.
2. Stress the time element, as well as quality.
3. Use self-explanatory instruction sheets.
4. Use objective rating scales.
5. Use objective tests and examinations.
6. Have available suitable reference material.
7. Use work-books designed for individual work.
8. Use graphical job record cards.
9. Develop graphical summary records.
10. Make reports to parents that mean something.

### The Spelling Bee

The type of contest frequently found used in the spelling class where two sides attempt to spell-down each other can be used to increase the interest of the student in the Industrial Arts program. The procedure commonly used in the spelling class is followed and the material used can be the spelling of technical terms, the definitions of words, or descriptions of procedures.

### Supervised Study

It is just as important that pupils develop good study habits as it is that they master correct habits of manual skill. By supervising the study of the class members it is possible for the teacher to aid the pupils in the establishment of good study procedures. Observation of the following suggestions will aid in improving the study procedure of the average high-school student. Struck makes the following suggestions for effective study habits: (21, pages 159-163)

1. Conserve your health by assuring proper physical factors such as heat, light, and posture conducive to studying.
2. Employ a definite study schedule.
3. Do your most difficult studying when you are in the best condition.
4. Employ visual and sensory aids.
5. Concentrate on work at hand, forget other matters.
6. Create a study environment.
7. Look for the hearts of problems.
8. Learn to organize the essential ideas.
9. Apply what you learn.

### Textbooks

The textbook serves to give a body of common knowledge for all members of the class. When a student is absent from class, it is possible for him to keep up with the work of the class by reading the textbook material. It serves as a reference source for review and for the solution of problems which were studied early in the course and of which certain

phases have been forgotten. The only fair way to give a test is to make it cover a definite section of the textbook in use.

### Themes

The preparation of themes and term papers give the student an opportunity to develop a method of problem solving that he can use in almost any course and in everyday life. This activity trains the student in collateral reading, use of the library and reference materials, written expression, and organizational procedures. If an oral report is made in addition to the written theme he also gets training in verbal expression. Friese makes this statement about written reports: (6, page 334)

Term papers involving original study and research and possibly manipulative work have been satisfactorily substituted for both minor tests and final examinations. Various topics are provided for selection or are assigned. The results, all or mostly all different, are read to the class by the writers. In addition to forming an excellent thought question and problem such papers form a source of extensive instruction for the entire class.

### Audio Visual Aids as Teaching Techniques

Visual aids are not designed to replace other methods of instruction but to supplement them. They help to give meaning to words and phrases and thereby improve verbal instruction. Struck wisely says: "Psychologically, visual and sensory aids are valuable because we know that sense-participation strengthens memory." (21, page 226) Audio-visual aids can be used to introduce a subject, to arouse interest in a new field, foster attitudes that contribute to intelligent action, to present information essential to an understanding of important phases of life, and to provide reviews of the lesson materials which have been presented previously.

### The Blackboard

The blackboard is one of the most universally used visual aids and it is a valuable device for making instruction concrete and understandable. Struck makes this statement about the use of the blackboard: (21, page 228)

Individual as well as group work can often be done to advantage on the blackboard. It should be regarded as a medium to be used by both teacher and pupils. For the teacher it is a means of making instruction effective; for the pupil, a means of self-expression and sense-participation.

If the teacher is satisfied to do careless work before the students he can hardly insist upon a high standard from the pupils. The teacher should learn to stand at one side of the (work on the board when discussing it and should use a pointer.

### Bulletin Boards

The bulletin board has many excellent uses for posting notices about current items and for displaying newspaper and magazine clippings and sketches. The effective teacher will use his bulletin board for the dissemination of various kinds of information pertaining to the course work.

A well-kept bulletin board can be a helpful teaching device. Interesting and important material dealing with the instructional units being taught should be kept posted. One individual may be given the responsibility of keeping the bulletin board up to date. All types of printed, pictorial, and graphic materials may be displayed. A place should be reserved for official announcements and bulletins.

This quotation from Whalin shows clearly how important the bulletin board is as a teaching device. (23, page 9)

### The Camera

The camera is an excellent instrument for recording the many fine projects that pupils make in the shop, projects which are taken away

after they are completed. When pupils see photographs of shop projects which others have completed successfully they feel more certain that they too can do similar work. The camera can be used also for the purpose of showing scale in work and detail which would require hours to reproduce graphically by any other method.

### Charts and Diagrams

Charts and diagrams can be used for presenting figures in such a way that they are comprehended more readily than when written in paragraph form. Bar graphs, circle graphs, and line graphs are all adapted to Industrial Arts work. If charts and graphs are to be used in succeeding years the white or buff window shade makes a convenient base for the drawings and a convenient method of taking care of them. Whalin believes in the importance of charts and graphs and says: (23, page 9)

Charts are used to draw the attention of the class to important facts or ideas. Excellent charts can be made showing such things as functions of working parts, the care and servicing of equipment, and the outlining of an organization. Charts must be large enough to be seen from all parts of the room and clearly illustrated so that few words of explanation are necessary. Arrange the charts in such a manner that they may be displayed when needed, and then removed without distracting attention.

### Commercial Displays

Business firms from time to time prepare a limited number of wall-type displays showing the processes of manufacture of certain tools such as the file, hammer, shears, and pliers. They are usually available for short periods of time only and it is necessary for the teacher to watch trade journals and professional magazines for announcements of the availability of such materials. These displays have considerable educational value and the teacher should use them in his teaching.

### Exhibits

To have an exhibit of articles which the class members have constructed is a good means of motivation for it supplies an incentive for the pupils to take pride in their workmanship. In many modern schools there are display windows in the halls where the completed articles can be displayed. Another way in which displays can be used effectively is in connection with parents visitation; the Industrial Arts department usually cooperates with other school departments in sponsoring these events. This quotation from Ericson (4, page 365) indicates the importance of the school shop exhibit.

The prospect of the exhibit will stimulate to better effort on the part of practically all students. . . . New students are attracted through the proper type of exhibits, largely because they are inspired by the success of other students whom they know. . . . Exhibits stimulate the teacher to renewal of effort toward producing high-grade work. . . . The exhibits involve opportunities for special training and practice in spacing, arrangement, postermaking, and lettering; as well as meeting and dealing with the public and explaining the work.

### Film Strips

"Film strips are projected by means of film-strip projectors which are light in weight; compact, easy to handle and to transport, and relatively inexpensive." This statement by Struck (21, page 239) is further amplified by the following quotation from Karch and Hstabrooke: "It is important that the instructor stand in front of the room near the screen when film strips are presented. An instructor cannot present a lesson effectively unless he faces and talks directly to the students. He is able to emphasize certain words or phrases, and make sure that all students can hear clearly." (10, page 79) It is a good idea to have a black pointer about four feet long for indicating important parts of the images. It is also recommended that questions on important points be



asked as the showing of the film strip progresses.

### Lantern Slides

In those schools where a stereopticon is available, the lantern slide can be used to reproduce on the screen in large scale any number of smaller drawings. Being able to preserve sketches and drawings in the form of slides is an advantage in that they can be stored in small space and then one does not run the risk of having the paper on which larger drawings are made mutilated through use, or destroyed. It makes it possible, too, to throw the image on the screen where all the class can see it at once which is impossible to do when using the individual drawings on sheets of paper or cardboard. Struck makes these suggestions for using slides: (21, page 239)

In using slides for instructional purposes one should not attempt to use too many at any one time. It is better to use a few slides that have a direct bearing upon the lesson, and that will be discussed adequately, than to use so large a number that little is remembered about any of them.

### Models and Samples

Models and samples are essential aids to effective teaching in Industrial Arts. A model is a replica either in miniature or enlargement. A sample is a specimen of a class of objects and its purpose is to represent all the members of that class. Good planning consists in anticipating their use and in having them on hand when they are needed; good method consists in using them appropriately. The students' interest in these aids is usually deepened when they have a part in their collection. We are seeing the working model used to a great extent in modern museums and it is an excellent teaching method in the Industrial Arts classroom. Whalin makes the following suggestions in a recent magazine article: (23, page 9)

Excellent cutaway and section models are used in the shop or classroom to show the function of some part that is otherwise obscured. The use of such devices permits the teaching of functions and principles in the shortest possible time.

### Motion Pictures

Most students learn easily and quickly through the eye and a motion picture presents material faster and frequently more clearly than either written or verbal language. Struck believes in motion pictures and makes these suggestions: (21, page 240)

Motion pictures can be made to serve as valuable aids to shop and classroom instruction. Through them an over-view is obtained which serves to unify and correlate learning secured in other ways. It is possible to bring out the most important features in a naturally arranged order which helps to enrich and to round out what has been acquired in something of a fragmentary fashion, through reading, discussion, experience, and in other ways.

The teacher must keep in mind that the motion picture is not intended as a substitute for the teacher but as a teaching aid. Therefore, it is essential that the teacher prepare a lesson plan for this type of lesson in much the same manner as for any other type of lesson. Karch and Estabrooke suggest several factors in making preparation for presenting the motion picture: (10, page 73)

1. Prepare a lesson plan.
2. Preview the picture before showing it.
3. Provide a study guide for the students.
4. Provide proper physical factors.

Karch and Estabrooke suggest that the instructor observe the following suggestions while presenting the picture: (10, page 79)

1. Stand at the rear of the room.
2. Run the whole film without stopping.
3. Re-run those parts needed for clarification.
4. Avoid loss of time between reels.

After the showing of the film there should be a definitely planned follow-up of the presentation. According to Struck the following suggestions should be observed: (21, page 81)

1. Encourage class discussion when time permits.
2. Supplement if necessary.
3. Explain any errors found in the picture.
4. Summarize the lesson presented.
5. Test for learning and understanding.

The University of Oklahoma Bulletin for Visual Education, dated September 15, 1945 gives a list of films which are available through the University of Oklahoma film library. The title of the film, a brief description of it, and the rental fee is given for each film. This rental fee varies from 25¢ to \$1.50 for most films.

Courses of study for several Industrial Arts subjects for the State of Oklahoma give comprehensive lists of films available for use in the respective types of classes. Examples of these bulletins are:

Bulletin 42-C-2 (May, 1942) Sheet Metal Work, pp. 24-33.

Bulletin 43-C-6 (1943) Home Mechanics, pp. 38-41.

Bulletin 42-C-3 (July, 1942) Machine Woodworking, pp. 81-84.

(June, 1944) Hand Woodworking, pp. 35-38.

From time to time the monthly publication Industrial Arts and Vocational Education, gives a list of films available for use in Industrial Arts classes. An article by Groneman in the April, May, and June, 1945 issues list hundreds of films by title and length, and in many cases the rental fees; most of these fees vary from 60¢ to \$1.50. (9, pages 200 and 251)

#### Pictorial Representation

Through pictures many things are brought to us that formerly were seen by the few. According to Struck: "For purposes of vocational education, clippings from trade periodicals, pamphlets, and catalogs are very helpful." (21, page 234) In order to prolong the usefulness of this type of teaching aids they should be protected by being mounted and

covered by a coat of white shellac.

### Using the Radio

Occasionally the radio can be used effectively in the Industrial Arts classroom. In order to benefit from a radio broadcast to the fullest possible extent it is essential that the pupils study the topic to be discussed before the actual broadcast begins. The teacher should suggest definite things for the pupils to listen for and follow-up the program by a discussion or some other type of evaluation procedure.

### Sketches and Drawings

Free-hand sketches and working drawings are used extensively in Industrial Arts courses. Both imitation and original design are important phases of this type of work and the pupils should be encouraged to develop their skill in this field.

### Tests in Industrial Arts

Scientific education aims to base its major decisions upon objective, reliable, valid data and upon information which is impersonal, unbiased, accurate, and worthwhile. In brief, that is the primary purpose of the testing movement in modern education. There are several phases of testing which can be used advantageously in teaching Industrial Arts subjects; these are discussed here.

### Attitude Tests

The progressive school of today is expected to develop each child to his utmost capacity along the lines of his own particular interests, aptitudes, and abilities. Many Industrial Arts teachers are interested in prognostic tests which will help in predicting at the beginning of a

course the aptitude of each individual pupil enrolled. Newkirk and Greene suggest that: (13, page 83)

An aptitude may be thought of as the capacity of an individual for the development of some special ability or skill. Mechanical aptitude is the capacity of an individual to deal successfully with mechanical devices, and to acquire the knowledge essential to their selection and operation after suitable training has been given.

Among the tests of mechanical aptitude are the Minnesota Mechanical Ability Tests (University of Minnesota Press), the Stenquist Mechanical Aptitude Tests (World Book Company), and the MacQuarrie Test for Mechanical Ability (Educational Test Bureau, Minneapolis). Struck, who suggested these tests, goes on to say: (21, page 428)

It is probable that the judgment of a competent shop teacher, who has had an individual in his classes for a half year or more, is more reliable than the score in a mechanical aptitude test, in determining probable future occupational success in mechanical or manufacturing pursuits.

It is well known that success in mechanical pursuits requires many things other than mechanical aptitude. It calls for diligence, perseverance, cooperativeness, and other traits which are not measured by such tests but which teachers can observe.

#### Diagnostic Tests

One of the first steps in planning effective teaching is to learn about special abilities which the student may possess. In pretesting the teacher endeavors to ascertain what the present experimental background of the pupils is as it relates to the new unit of subject matter. According to Newkirk and Greene, diagnostic tests are designed to "discover the exact identity and location of the pupils' strengths and weaknesses in subject-matter mastery." (13, page 14)

Struck says: (21, page 429)

A diagnostic test in mechanical drawing will reveal the points of

strength or weakness in various specific elements, such as lettering, accuracy of measurements, correctness of conventions, arrangement, weight of lines, neatness, and the like. Such a test can be diagnostic from the standpoint of the learner. It may likewise be diagnostic for the teacher in that it can show in what respects the instruction was 'put over' successfully and in what respects it was faulty.

Examples of tests having diagnostic value are the Hunter Shop Tests (The Manual Arts Press, Peoria, Illinois) and the Newkirk-Stoddard Home Mechanics Test (Bureau of Educational Research and Service, State University of Iowa).

Every diagnostic test should be followed by immediate correction and immediate tabulation of errors. Unless the results of each test are followed up, they are not worth the time and trouble which they require.

#### Essay-Type Test

The essay-type test is easy to construct and easy to give, and they are usually graded on a percentage basis. The difficulty of each question is determined by the teacher at the time of making the test, and a value assigned to it. The chief objection to the use of the essay-type test is its subjectivity. However, Newkirk and Greene, give five suggestions for scoring essay-type exercises which if followed will make them "more objective and the subjectivity of the teacher's marks can be significantly reduced." (13, page 128)

1. Tests should be scored by the one who makes out the questions. He should know what responses are intended and write them down.
2. Each pupil taking the test should write his name on the back of the test paper, and the scorer should disregard the name until the test is scored.
3. The scorer should not mark off for misspelled words, sentence structure, paragraphing, poor writing, etc.
4. Essay tests exercises can be corrected most simply by correcting each item on all the tests rather than by correcting the entire tests separately.
5. Rate each question on a scale of 10 or 20 and then add the ratings on all the test exercises to get the mark for the paper.

### Identification Tests

Identification exercises are very useful for testing the pupil's ability to recognize materials, instruments and tools. They are easy to use and are objective in scoring. Karch and Estabrooke are responsible for this statement: "A whole object may be shown with parts marked; or the parts themselves may be pictured for identification." (10, page 91)

The following principles for constructing identification exercises are suggested by Newkirk and Greene: (13, page 118)

1. Provide a representative sample of the objectives to be identified.
2. Suspend materials so that they can readily be examined.
3. Score the items by checking the objective written responses.

### Objective Tests

Objectivity is that characteristic or quality of measurement which causes it to yield the same results regardless of the influence of the person scoring it. A test is objective if there is agreement among all competent scorers as to the correctness or incorrectness of all possible answers. Some very valuable suggestions for the preparation of objective tests are given by both Karch and Estabrooke (10, pages 85-93) and Struck (21, pages 435-447).

Most of the "objective" tests are what are sometimes termed "short-answer" tests. They are easily and quickly scored and make it possible to examine the students on many items in a relative short period of time.

### Trade Tests

Trade tests are of value to Industrial Arts teachers for they are useful in measuring trade proficiency. They are of four general types--oral, picture, performance, and written group tests. Struck describes trade tests in these words: (21, page 430)



A trade test is designed to measure a number of factors, which together are indicative of trade competency. Such a test is intended to be diagnostic and it is also a measure of achievement. Trade examinations of the comprehensive type are designed to measure more than trade knowledge and skills. A written examination, comprehensive and diagnostic in nature, is used to measure the individual's familiarity with trade understanding and trade theory.

Examples of trade tests are the Chapman Trade Tests (Henry Holt and Company) and the University of Pittsburgh Trade Tests (University of Pittsburgh).

### Vocational Interest Tests

According to Struck: "These tests aim to compare the student's vocational interests with patterns of interest which are typical of occupational groups." (21, page 448) They are intended to reveal how nearly an individual's interests coincide with those of the average person successfully engaged in certain occupations. Examples of vocational interest tests are the Strong "Vocational Interest Blank for Men," and the Strong "Vocational Interest Blank for Women" (Stanford University Press), and the Cleeton "Vocational Interest Inventory:" Form A for men and Form B for women (McKnight and McKnight, Bloomington, Illinois).

### School Marks

Test results are expressed in raw scores which do not make suitable report card marks. In general there are two kinds of marking systems: those that use percentile marks and those that use letters, or numbers, which stand for degrees of excellence. The percentile rank plan is desirable for the percentile assigned each pupil indicates by what percentage of the group each pupil was excelled and the percentage of the class which each excelled.

Ericson says that "efficient grading of work is a distinct factor in

efficient teaching," and gives six desirable characteristics of a suitable system of grading for Industrial Arts classes. (4, page 222)

1. It should be economical of the teacher's time.
2. It should be based upon a wide scope of student responses and attainment.
3. The grading should be frequent.
4. Uniform standard for grading should be applied.
5. Students should have access to their grades.
6. Grades should be made permanent.

Newkirk and Greene give the following eight suggestions which they recommend will eliminate many of the unsatisfactory features of present methods of assigning marks: (13, pages 235-238)

1. Discard the practice of marking pupils in percentages.
2. Each mark assigned to a pupil should be a symbol designed to indicate his power to do.
3. Each teacher should give objective examinations or quizzes frequently throughout the term, and the scores from these tests should afford the major basis for his marks.
4. Require teachers to prepare in advance for each six-weeks period carefully worded statements of the objectives of each subject for that period.
5. Work prepared for daily assignments should be treated as a requirement of the course, but marks assigned should be determined by numerous brief objective tests upon the work assigned.
6. Credit should be deducted for notebook and laboratory work which is unsatisfactory or incomplete.
7. Assign marks on "accomplishment" or "performance" rather than on indefinite subjective factors such as effort, attitude, ability, etc.
8. Final grades summarizing all the test grades for the course can be obtained readily by assigning point values to each letter grade, computing the actual average for each pupil, and then re-assigning the class marks on the basis of these averages.

This chapter has been devoted to a discussion of methods of teaching in Industrial Arts classes. The following chapter summarizes and gives recommendations.

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The findings of this study are presented in this chapter in two divisions: (1) summary of the discussion, and (2) a statement of the conclusions made on the basis of information presented. In addition to the brief summarization of the material and the statement of conclusions, a few recommendations are given in this final chapter.

### A Summary of the Findings

In summarizing this study the significant data and other informational background will be presented in a manner that will give a perspective of the problem as a whole.

In the early history of Industrial Arts or Manual Training, the people were slow in allowing it to enter the educational system. On such leaders as Pestalozzi, Froebel, Sloyd, and Della Vos, fell the responsibility of recognizing manual training as educationally important. At first it was merely an obligation to be performed in the schools for the poor, but later as a means of furnishing the leisure hours in the rural home with interesting occupation, and to revive the rapidly disappearing handicrafts among the people. The first courses were organized so as to analyze tools, processes, crafts, trades, and materials into their elements; and to arrange these elements in methodical courses of instruction.

Dr. Woodward established the first manual training school in America at St. Louis, but Baltimore established the first manual training school as an integral part of the public school system.

The first book containing chapters on methods, Correlated Courses in Woodwork and Mechanical Drawing, by Ira S. Griffith, was published in 1916. Other books followed, but there is no publication which has

for its chief objective, the presentation of teaching methods in the Industrial Arts department. Therefore this thesis was written to organize these teaching methods into a form useful to Industrial Arts teachers. The available literature in the field, both books and professional periodicals, was surveyed for data bearing upon the subject.

In the study of requirements for certification to teach Industrial Arts in the high schools in fourteen states, Oklahoma was found to be one of four states which do not require credit in teaching methods in Industrial Arts, and one of three which do not require practice teaching to be done in the Industrial Arts field. Oklahoma requires 6 semester hours of practice teaching but it does not have to be in Industrial Arts.

\* In the study of the different methods of teaching Industrial Arts, there were fifty commonly used methods, thirteen visual aids methods, and eight testing methods useful in Industrial Arts.

The commonly used methods are divided chiefly into two divisions: (1) group or class instruction, and (2) individual instruction. Group methods of instruction are most useful when all of the group need to know certain fundamental factors in order to start their work, and it is a matter of economy to present these factors to the entire group at one time. It is effective when members of the class are near the same level with respect to the content of the course which is being studied. These class meetings will be of great value in establishing ideals and points of view with respect to accuracy and methods of procedure. \*A successful class demonstration requires careful preparation, and the greatest possible alertness on the part of the teacher.

There are differences among individuals with respect to the majority of human characteristics. Heredity and environment are casual factors,

and affect the most minute part of the human mechanism; neither mental nor physical characteristics are free from their influence. This fact suggests a tremendous problem with individual teaching methods. Individual differences is not one of getting all pupils to learn equally, but rather to give instruction in such a way that each one will develop to his full capacity. A combination of group, individual, and printed instructions is the best means of providing a variety of stimuli that will enable each learner to achieve to his own limit.

Written instructions are not a labor-saving device for the teacher. Instruction, or job-sheets will not reduce the work of the teacher, but will make his work more effective. They are in no sense a substitute for other teaching devices and materials but are a means of making such materials and devices more effective. With them a genuine relation can be established between the subject-matter and the practical job. Written instructions should not be regarded as the only means of giving individual instruction; the individual demonstration, for example, is an excellent means of giving individual instruction.

The visual-sensory aids are helpful to those who are seeking to master the techniques of objective teaching. These aids are most effective when they are correlated with the daily units of work and when pupils are held responsible for the results. They are most helpful when used as a tool for accomplishing definite goals. They stress ability to analyze, summarize, and generalize what is taught through concrete experiences and visual-sensory responses.

### Conclusions

Class instruction is neither superior nor inferior to individual instruction. Each form is best under certain circumstances; they supple-

ment each other. Individualized instruction need not lack socializing values; wherever possible it should be supplemented by reading, and group contacts in order to provide the broadening and socializing influences.

In teaching how to make something, demonstration, where it can be carried out to advantage, is superior to the film, but the film is superior to many other methods. The value of visual aids lies in their ability to furnish a teaching content that is difficult to provide in other ways; they appear to have exceptional value for purposes of motivation and explanation. In selecting sensory aids, those should be used which have inherent quality to bring out effectively what is being taught, especially what is inaccessible in other forms of instruction.

Tests are needed to supplement the many subjective judgments that teachers make regarding achievements of pupils. Grades in Industrial Arts classes should be based on related knowledge, appreciations, and understandings as well as on manipulative skill. They are needed to test comprehensively and with greater validity than is possible through marks based on shopwork and subjective estimates. A teacher's mark, based on observation covering a term, may be more reliable as an index of mechanical aptitude than the score made by the pupil on any standardized mechanical ability test so far available, but a more valid and reliable measure is secured by using both means of measurement.

#### Recommendations

1. It is recommended that a three-hour course in methods of teaching Industrial Arts be required of those who are granted a life certificate for teaching Industrial Arts in high school. Methods of teaching Industrial Arts should be a prerequisite to practice teaching in Industrial Arts.

2. It is recommended that the six semester hours of practice teaching which are now required for a life certificate to teach Industrial Arts must be taken in the Industrial Arts field.

3. It is recommended that a four-year provisional certificate be issued at first; that this certificate be renewable for life after four years of successful teaching experience. Two years of teaching experience must have occurred during the term of the certificate offered for life renewal. This life certificate should remain in force only as long as the holder permits no five-year period to pass during which he has not been employed in school work for at least nine months. A life certificate which has lapsed may be reinstated as a provisional certificate, upon the filing of eight semester hours of college credit earned in an approved institution since the date of issuance of the life certificate which has lapsed.

PARCHMENT

U.S.A.



**APPENDICES**

**Appendix A - A Selected Bibliography**

**Appendix B - A List of States from which Certification Data Were  
Obtained**

**Appendix C - Documentation of Methods Discussed**

## APPENDIX A

## A Selected Bibliography

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## APPENDIX B

## List of States from which Certification Data Were Obtained:

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- II California--Bulletin of the California State Department of Education, Volume XV, No. 1.
- III Colorado--Colorado Requirements for Certificates for Teaching Manual Training, Mimeographed.
- IV Illinois--V. L. Nicholl. Illinois State Examining Board, Circular Series A, No. 15.
- V Indiana--Regular High School Teachers' Licenses.
- VI Iowa--Certification of Teachers, Bulletin No. 7.
- VII Kansas--Certificate Handbook, L. W. Brooks.
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- IX Nebraska--W. C. Reed, Certification Digest of Teachers' Certificates.
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- XIII Pennsylvania--Certification of Industrial Arts Teachers, Mimeographed.
- XIV Texas--Texas Certificates Issued Upon College Credits, Mimeographed.

## APPENDIX C

## Documentation of Methods Discussed

Name of Method	Ericson	Friese	Karch & Estabrooke	Newkirk & Greene	Newkirk & Stoddard	Salvige & Fryklund	Struck	Vaughn & Mays
Aptitude Tests	257	151		83			428	
✓Arithmetic Contests								
✓Assemblies								
Assignments			54		49	96	371	
Assignment Sheets	71		126		49	141		
Blackboard							228	
Bulletin Boards	370							
Camera							237	
Charts & Diagrams					47		234	
Check Lists						163	407	
Class Demonstration	58	59			45	168	247	91
Collateral Readings							136	
Commercial Displays							402	
Conference Method							362	
✓Current Events								
Debating							275	
Diagnostic Tests				14	138	360	429	
Drill							384	
Educational Trip					48		236	
Essay Examinations			84	127		362		
Exhibits	365						246	
✓Experimentation								
Film Strips				79	47		239	
Forum Discussion							261	
Group Discussion					44	148	276	
Hobby Clubs							557	
Home Visitation							416	
Home Workshop	361						548	158
Identification Tests			91	118		385	440	
Illustration							352	
Individual Demonstration	63		59		45	161	247	101
Individual Instruction					44	147	330	
Information Sheets	71		126		49	140		
Instruction Sheets	65	75	119		48	165	332	
Job Sheets	70	75	123		53	142	195	



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