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Standardization Of Industrial Arts Courses In Texas

Franklyn D. Wesley
Prairie View University

STANDARDIZATION OF INDUSTRIAL ARTS COURSES IN TEXAS

WESLEY

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by

Franklyn D. Wesley

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BIOGRAPHY

Franklyn D. Wesley was born October 19, 1918, in the town of Seguin, Texas. He was the second child of Reverend and Mrs. J. W. Wesley. Two years later his parents moved to San Antonio, Texas. There he received his kindergarten and secondary school training. His remaining secondary training was received at San Marcos and Temple, Texas, respectively. He was graduated from the Dunbar High School in May, 1934.

For two years he worked in a local cafe. Then in the summer term of 1936 he entered Prairie View State College. After three years and a summer he received his Bachelor of Science degree in the Division of Mechanic Arts with a major in Industrial Education. Because of his B average he was given a scholarship to attend graduate school at Prairie View. In September, 1940, he was employed at the Dunbar High School, Temple, Texas, as a mathematics instructor. After one semester he was employed at Prairie View State College as a drawing instructor.

Because of his desire to serve his country in time of war he went to work for the Signal Corps as a radio instructor. He had gained the necessary training and experience for this position through related courses taken at Prairie View and his hobby as an amateur radio operator. He was later sent by the Signal Corps to take training in the newly-developed and highly secret radar devices. After this training he was employed as an assistant engineer at the Western Electric Company, Chicago, Illinois, where he did important research and development work on newer radar devices. At the termination of the war he returned to Prairie View University to become an instructor of radio and complete his graduate work. During his stay in Chicago he attended the Illinois Institute of Technology.

CHAPTER I

INTRODUCTION

A study of the historical development of industrial arts and industrial education is of great importance in leading up to a study of standards in present day industrial arts courses in Texas.

The date of the birth of manual occupation as a feature of school work has not been definitely located by writers of educational history. Probably it will never be determined. Like many other civilizing forces, this one appears to have been at work for generations, if not centuries, before anyone recognized its importance or the direction of its tendency.

Egyptian Civilization

The civilization of anyone of the ancient peoples is marvelously suggestive in this connection. Notice for one example the first people known to have organized themselves into a settled nation, the Egyptians. Very early records, dating nearly 2,000 years before the Christian era, show them to have been a people of versatile power and skill. Their masonry has never been surpassed. They had a decimal system of numbers, and a system of well adjusted weights and measures. In mechanic arts we have evidence of the skill of the carpenter, the book-binder, the potter, and others. In fine arts, their statuary and painting, their ornaments of gold and silver, their musical instruments, their engraving, their inlaying, all bear witness to a high stage of development in these arts and processes. How had it come about? They were without books or a literature, except in a very narrow sense. How had these people been educated? There appears but one answer. They had developed their powers through their efforts to manipulate material things as a means of satisfying their felt needs and desires.[1]

Catholic Missionaries

The Catholic missionaries were emphasizing the manual aspect of education in America as early as 1629. The earliest schools within the present limits of the United States were established by the Franciscans in Florida and New Mexico.

While the European pedagogues of the seventeenth and eighteenth centuries emphasized the educational side of manual work, other efforts based chiefly upon social and economic grounds resulted in the realization of many industrial schools. The first of these was opened by Kinderman, a Bohemian clergyman in Kaplitz, near Budeweis in 1773. In a short time over two hundred such schools were scattered over Bohemia.

The story of Pestalozzi's life is a life of unceasing devotion and self-sacrifice to a cause of which he consecrated himself. It was his aim to help the poverty-stricken children particularly and, by the aid of his educational scheme, to aid and uplift them and prepare them for their proper places in society. When Pestalozzi was given charge of the poorhouse at Stanz, his plan was warmly recommended by the members of the Directory, which issued a decree which provided among other things that "the time of the pupils will be divided between field work, housework, and study.

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[1]Row, R. K., The Educational Meaning of Manual Arts and Industries, p. 21.

An attempt will be made to develop in the pupils as much skill and as many useful powers as the funds of the establishment will allow."[1]

Fallenberg established an agricultural and industrial colony on his estate, Hofwije, a few miles north of Berne, Switzerland. A feature of this colony was known as the "Poor School", having for its motto, "Pray and Work". In this school it is said that the children were chiefly occupied in the fields, in shops, and with housework. Their recreation was instruction in theoretical studies.[2]

Froebel believed that every child, boy and youth, whatever his condition or position in life, should devote daily at least one or two hours to some serious activity in the production of some definite external piece of work. His attitude towards the relation of manual work to education is expressed in this single sentence of his: "Man understands thoroughly only that which he is able to produce".[3]

The Movement of Industrial Education

During the latter part of the nineteenth century a new type of school work was making its appearance in Europe. Russia was developing a new technical school in which shopwork was emphasized. Emphasis was placed upon skill of hand and eye in the processes of industry. Tool instruction was the keynote of this work. Its popular appeal caused samples of manual training work to be placed on exhibit at the Centennial Exposition held in

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[1]DeGuimps, Pestalozzi: His Life and Works, p. 57.
[2]Hoffman, B. B., The Sloyd System of Wood Working, pp. 70 f.
[3]Froebel, T., The Education of Man, Translated from German by W. N. Hailman, p. 34.

Philadelphia in 1876. As a result of this display at the Exposition, St. Louis opened a manual training school in 1879. The objectives of this school were "to train the head and hand", and to determine whether or not the pupil was "well fitted to become a mechanic". There was no thought that manual training work prepared boys to earn a living.

In the meantime, in Sweden home industry was flourishing. From boys' work in the home were selected certain tool processes which were organized into a course of study and taught in a few private schools. Out of this movement emerged the Swedish Sloyd work as a series of specific wood working models.

Both of these movements are traceable either directly or indirectly to Pestalozzi or Froebel. The influence of Pestalozzi was felt by Dr. E. A. Sheldon of Oswego, who introduced many of his ideas as well as those of Froebel.

From 1890 to 1915, manual training developed rapidly in America. Many schools opened manual training shops and many people saw in it an opportunity to learn a trade. This particular idea generated considerable momentum due to the decline of the Guilds and the apprenticeship plan of learning trades.

Thus we see growing out of the engineering shop work of Russia and the home industries of Sweden the manual theories of America. These in turn have been divided into two types, namely, Industrial Arts and Vocational Industrial Trade.

The criticism of industrial arts since 1907 is not so much an attack upon the principles underlying industrial arts but rather an attack upon industrial arts as ordinarily provided. In some cases this criticism was made by those who believed most heartily in some form of constructive work. The criticism assumed two forms: 1. A demand for courses which, as phases of general education, shall have more educative value than the formal schemes of exercises that have prevailed in the past, and 2. A demand for substitution of special training for those intending to become industrial workers in place of the formal general courses that have existed.

The movement for industrial education was a part of a great educational advance which extended over the whole civilized world. It resulted from the attempt to bring about universal and appropriate education. It frankly recognized that all could not have and did not need the same education. Industrial education meant complete and appropriate education of industrial workers of whatever grade. It, therefore, meant much more than the introduction of shop work into the curriculum. It meant a thorough revision of our school system with the purpose of furnishing for the working classes an education which bears somewhat the same relation to their prospective life work as does the college education of the future work of the professional and managerial classes.

It was not until the National Education Association met in St. Paul in 1914 that a true index as to what turn the educators in industrial education would take. These previous opposing factors for industrial education, facing the graveness of the situation, decided to harmonize their views. The result of this was a united agreement on certain fundamentals:

1. There could not be separate schools for industrial education.
2. The fact was recognized that all did not need the same amount of education.
3. Revision of the school system was found necessary.

Statement of Problem

It is the purpose of this study to investigate standards of industrial arts courses, to study conditions as they now exist in high schools in Texas, and finally, to propose standards for industrial arts courses for these high schools.

Several years ago in looking over the units offered in the industrial arts shop of a certain high school, the writer became interested in making certain comparisons of the courses offered by many schools in the state on a sufficiently comprehensive scale as to afford a reliable measure of the existing relations of the industrial arts shops throughout the whole state.

The great variety of shops, together with the dual school system in use in Texas, immediately focuses one's attention upon the following questions: How can students transferring between high schools expect to continue training in a particular course, when that course may not be offered at the next school? Do the courses offered take into consideration the meeting of college requirements? Is a Negro boy exposed to equal educational opportunities in Industrial Arts? Granting that these questions are of sufficient concern to justify a careful investigation, we will attempt to establish, at least in part, the answers to these questions.

Definition of Terms

When examining the present trend of Industrial Arts in the United States, one is confronted by the difficult task of discovering what is going on in different sections of the country, as well as following the literature of the field. Terms such as "Industrial Arts", "Manual Training", "Manual Education", "Mechanic Arts", and "Industrial Science" only lead to confusion and lack clearly defined purposes. This is rather well illustrated in one of the central states where among one thousand teachers, the work is referred to by twelve different terms. Therefore, to prevent any confusion in this study, we are defining terms that will be used repeatedly.

Standardization: To bring to a certain level or to make uniform.

The definition of industrial arts given by Bonser and Mossman expresses the growing trend of that movement in the United States better, probably, than any of several other definitions that have been given by various writers. To quote the definition, "as a subject for educative purposes, industrial arts is a study of the changes made in the forms of materials to increase their values, and of the problems of life related to these changes."

Course: In this study it may be defined as a method of procedure or a succession; series as a course of lectures.

Standardization of industrial arts courses, then, is taken to mean a conforming to a set model on a certain level certain industrial arts experiences.

Scope of Investigation

This study includes 120 high schools of Texas. Of this number, 100 are white and 20 are Negro high schools. There were approximately 27,000 students involved in the study. However, the unit of study is the industrial arts course, rather than the student. On the basis of the scholastic distribution of counties (in which Negro and white schools were studied) this number, 120, was considered a fair group for random sampling.[1] Figure 1 is a map of Texas showing the approximate location of the cities where the schools used in this study are located. Junior high schools as well as senior high schools were studied. The name of each of the schools appears in the appendix for reference. Since the study is intended to be as impersonal as possible, the schools will be divided into three groups depending on the size of town in which the school is located. Cities with populations of 100,000 and above are placed in class A. Cities with populations between 100,000 and 15,000 will be placed in class B, and cities with populations less than 15,000 in class C. Names, then, will not be used. A number of replies to the questionnaire from schools purely technical in nature were received. Since we are interested in schools whose main purpose is not the teaching of purely technical courses, these schools were eliminated.

Table I shows the distribution of the schools in the study as to the

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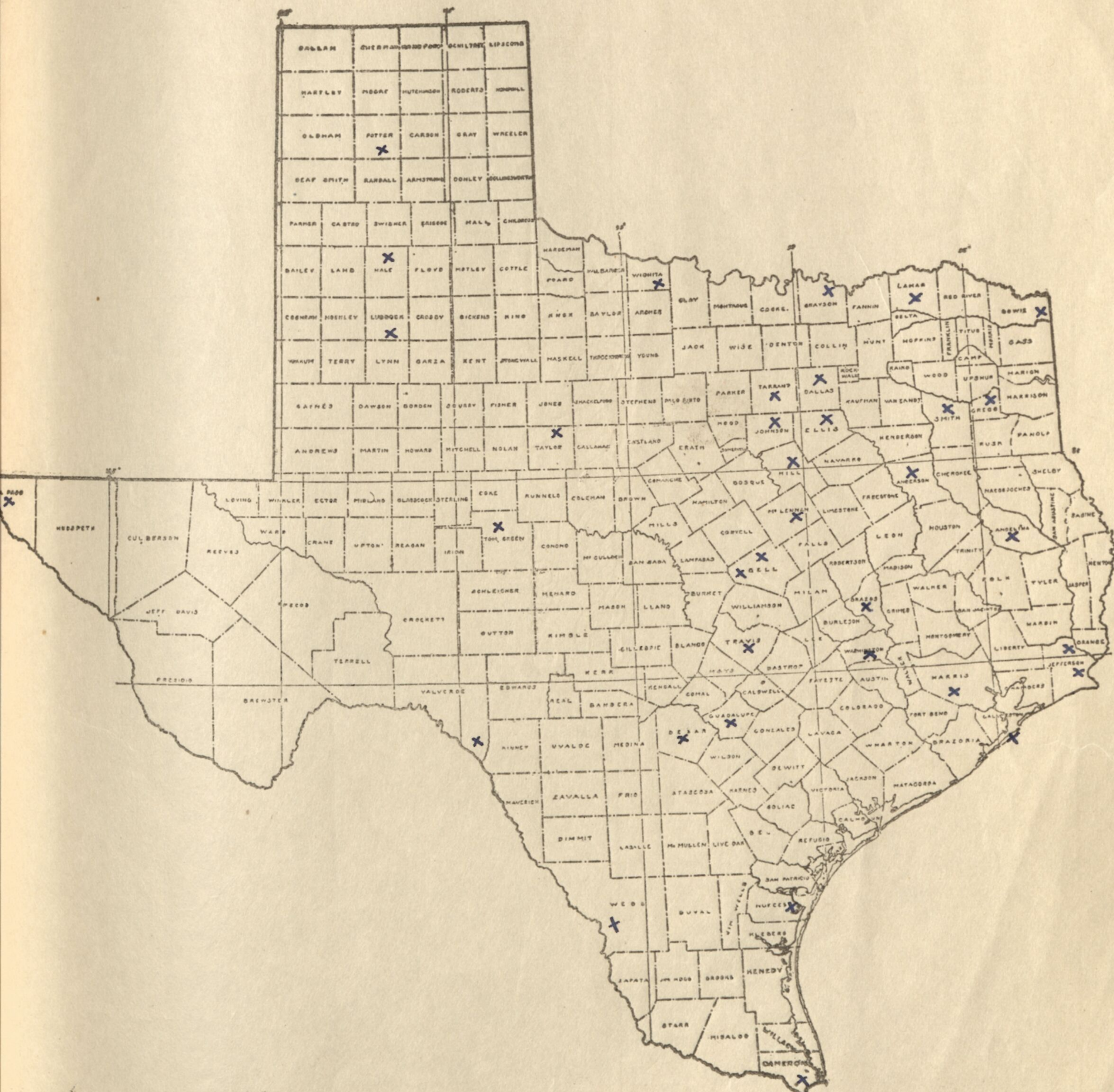
[1] High School Directory, 1941-42.

LOCATION OF SHOPS STUDIED



Classes A, B, and C as explained above.

TABLE I

NUMERICAL DISTRIBUTION OF 120 SCHOOLS AS TO SIZE OF TOWN IN WHICH THEY ARE LOCATED

Size of Town	Negro	White	Total
Class A 100,000 and above	8	52	60
Class B 15,000 to 100,000	10	32	42
Class C 15,000 and below	2	16	18

CHAPTER II

REVIEW OF LITERATURE

Before the main study was begun the writer made an investigation of the State Boards of Industrial Education. The main purpose was to find out if other states had attempted to standardize their industrial arts shops. Letters were sent to the forty-eight states requesting that they send any bulletins or other published material covering their industrial arts department. This request drew replies from thirty-eight states, most of which sent bulletins. The table below shows the results of this investigation.

TABLE II

RESULTS OF INVESTIGATION OF STATES CONCERNING THE STANDARDIZATION OF COURSES

States with Standard Courses	4
States with Suggested Courses	16
States without Standard Courses	18
No Reply	10

A number of very excellent suggested outlines have been prepared by various states. However, only a few have set up any particular standards by which all schools are to meet. Of this group Oklahoma seems to have made the greatest amount of progress. At the time of the investigation, standards had been set up in the following courses:

1. Electrical Work 1 A and 1 B
2. Hand Woodworking 1 A and 1 B

These courses of study are for one year. In addition to these two courses ten others are now being prepared. They are as follows:

1. Arts and Crafts
2. Machine Shop
3. Industrial Drawing
4. Foundry
5. Welding
6. Ornamental Iron Work
7. Automobile Maintenance
8. Sheet Metal
9. Printing
10. Machine Woodworking.

The State Department of Education for Kentucky has set up standards in the following courses:

1. Mechanical Drawing and House Planning
2. Woodworking
3. Metalworking
    - A. Sheet Metal
    - B. Foundry and Heat Treating
    - C. Welding
4. Machine Shop
5. Electric Shop
6. Automotive Shop
7. Printing.

The course outlines are for the <u>general shop in a major area</u> which is one of three main types of shops in Kentucky. The other two are called <u>composite general shop</u> and the <u>farm shop</u>.

All of the phases of mechanical drawing: machine, architectural, structural, sheet metal, furniture, aviation, map, chart, and pictorial drawing are introduced in the course. The course covers work for four semesters, beginning with the ninth grade or with the first year of the three year senior high school. The work is planned for five one-hour periods per week.

The woodworking course of study is divided into three groups: A, B, and C. Group A included fundamental learning units. Groups B and C include operational and informational units requiring a greater degree of experience.

The machine shop course outline provides for two semesters of work. The electric and automotive shop courses provide two semesters of work also.

Standards in Nebraska

All phases of the school work is standardized. Industrial Arts courses are no exception. To become standardized they must meet certain minimum requirements. When a school reaches these minimum requirements, the teacher or school officers first score the industrial arts courses and then request the county superintendent or State Department to inspect and score the courses. If the courses justify a score of 75 points, they are classed as standard courses, and a standard plat is sent by the State Department to the superintendent for the school. If the courses justify a score of 95 points, they are classed as superior courses and recognition is sent by the State Department to the superintendent for the school.

Standards in Texas

In 1938 the Texas State Planning Committee for Industrial Arts Education and the Practical Arts Production Committee of the Texas State Curriculum Revision Program offered to the junior and senior high schools of Texas several standard courses of a practical nature. The program is divided into three levels called the period of self-awakening, period of self-discovery, and period of tentative choice.

Level one, popularly known as the "Laboratory of Industries" is offered in the seventh or eighth years in a twelve year system. The work of the ninth year includes four elective divisions of nine weeks each and is organized for a minimum of thirty-six weeks. Included in their bulletin are units in concrete work, drawing and planning industries, electrical industries, metal industries, and wood industries.

Level two consists of a group of Industrial Arts courses in which the pupil receives a training that has more specific objectives than the "Laboratory of Industries" but not such specific objectives as the Unit Craft Courses in Level three. Such general industries, as electrical industries, metal industries, wood industries, or others that can be completed in eighteen weeks of work, are taught.

Level three is offered for one-half to two years during the years eleven and twelve, following at least one year of laboratory of industries and one year of general industries. The specific craft courses are advanced unit courses of eighteen weeks, as machine shop practice, cabinet making, machine drawing, or architectural drawing.

Because of the large number of units to be taught on the three levels it is suggested that the teacher makes use of the pupil-driected organization. It is primarily intended as a plan for enabling the instructor to devote his major effort to actual instruction and take care to avoid the extreme that makes a class a ritual instead of a means of instruction.

Courses of instruction are for the first two levels;the third level outline is left for the schools to work out.

Significance of Study

In the United States, some 25 or 30 years ago, the problem of industrial arts education was simple and little correlation between what was offered at different schools was necessary. But with the phenomenal growth in the fields of electricity, aeronautics, automotive engineering, metallurgy, and other industries during the past twenty years, the life of the average American citizen has been revolutionized and instead of a school offering only traditional woodworking, today we find schools offering many different courses. There are at present eighty different types of shop work being offered in the United States. A study of standards already established shows, however, that many things are common to all shops. The problem is to organize the information within the industrial field in such a way as to make it valuable, first, in the education of the masses, and second, in technical training for specific vocations. The public, in giving support to industrial arts undoubtedly intends these subjects to promote closer relationship between the school and vocational life; some teachers of these subjects unquestionably do use them with precisely this intent; but efficient instruction presupposes something definite to teach and a consistent and standard way of teaching it.

Obviously one of the first steps to be taken toward the effective direction of these factors is a determination of the actual existing condition as regards to the correlation or lack or relation between the different industrial arts units in the states' educational systems. One of the readiest means of estimating the existing relations is through a study of the courses in a sample of the schools in the state.

If the schools offer the same courses and teach the same amount of material in the Industrial Arts Department, this is good evidence that the work in the schools concerned is closely related; and it will be one object of this thesis to try to establish this contention.

This study will provide the need for some literature on this subject, for no study of this kind has been made of the Texas high schools in which Negro high schools were included. There is a possibility that this study will form a basis for a more thorough future investigation.

Limitations of Study

The study has certain limitations; an obvious one is the fact that a complete standard course cannot be had as the results of only one study. A more complete standardization of industrial arts courses in the state will need to be based upon a series of investigations. Such a study as the present one, the writer believes, has value in establishing a more scientific attitude in the analysis of practical industrial arts problems. To get a balance estimate of the standards, it will be necessary to carry out other studies supplementary to this one. It would be very profitable if some such problems dealing with the relative standing of pupils who have and have not attended industrial arts courses in high school and are now in industrial arts in colleges could be worked over in detail in the light of our needs in industrial arts education.

CHAPTER III

METHODS AND PROCEDURES

The information for this study for the most part was obtained through the use of questionnaires, interviews, visits to schools, intermediary contacts, and published bulletins.

Questionnaire

One method of obtaining information was through the use of a questionnaire together with a letter of explanation. They were sent to all schools where personal visits could not be made. The response from the schools so contacted was very gratifying, averaging about 75 per cent. A sample questionnaire is reproduced in the appendix for reference.

Visits to Cities

Visits were made to several cities. About twenty school shops were observed. Whenever these visits were made, the supervisor or director of Industrial Arts for that city was contacted. From him we secured permission to visit the schools. In some instances, some course outlines and equipment invenotires were obtained.

Once at the school's shop, the principal, instructors, and sometimes students were interviewed. Where conditions permitted pictures of the various shops were made. Many questions which could not be easily included in the questionnaire were asked of the instructors and principals. The writer recognized the importance of these visits and as many of them as possible were made.

Intermediary Contacts

In two instances where the cities visited were large and consequently the number of schools were large, the supervisor of Industrial Arts was the only person visited. He was given letters for each school under his supervision. These letters were similar to the ones mailed to other schools. It was felt that a greater percentage of returns could be expected by using this method. And in both instances, the returns were about 95 per cent of the total sent.

As previously stated both Negro and white schools are included in this study. Personal visits were made to all the Negro schools that appear in the study, and a large number of visits were made to the white schools. In one of these actual teaching procedures were observed.

CHAPTER IV

PRESENTATION AND DISCUSSION OF DATA

In the preceding chapters an attempt has been made to introduce the problem and form a basis for a careful analysis and interpretation of the problem. From this we enter into a more detailed discussion of the problem with emphasis on facts as they now exist.

The writer realized the importance of the selection of the schools to be studied, the creation of the data included, and the creation of schedules of investigation; hence, much time was spent in these selections.

In this study 120 high schools were used and an attempt is made to find out what standard, if any, is now in existence in them.

What about the courses offered? Are they standard for each of these schools? Are all schools agreed on the physical plant to use? Are the classes taught in a separate building or is part of the main building preferred? Are the qualifications of teacher fixed? What are the various type shops in use? These and other questions are answered as a results of the data here presented.

General Information

There are two types of high schools in Texas: general high schools, and technical high schools.

The general high school provides as a part of its work those phases of the industrial arts which are primarily educational.

The technical high school provides for specialized training whose chief end point is a high degree of skill and technical efficiency.

There are no technical high schools for Negro boys. Therefore, a boy wanting specialized training in some particular field has only two alternatives: 1. to wait until he finishes high school and then enter the state university for Negroes, Prairie View University, or 2. to get as much as he can from the general high school's industrial arts shop. That is assuming that the school offers the course in which the boy is interested.

Courses Taught

Table III shows the frequency at which the courses appear in the three classes of schools in Texas. It will be noticed that the woodwork course appears in each of the 120 high schools. Mechanical drawing appears 83 times. It is interesting to note that mechanical drawing is offered in all but three of the 60 class A schools. It then has almost as much popularity as woodwork. It appears in half of the class C schools. The next course appearing the most number of times is metal work. Of the 120 schools, 45 of them offer this course. Again, the largest percentage is in the A class. Architectural drawing appears 37 times; however, class B schools seem to offer the course more than the other classes. It is possible that some schools may offer this course as an integral part of the general mechanical drawing course. Auto mechanics ranks fifth in frequency, twenty-eight schools offering it. Class B schools offer this course more than Class A schools as indicated by the table. The remaining six courses in the order of importance are as follows; Electricity, 16; Machine Shop, 10; Landscaping, 5; Printing, 4; Practical Arts, 2; and Handicraft, 1.

TABLE III

INDUSTRIAL ARTS COURSES OFFERED IN TEXAS

Name of Courses Offered	Negro Class			White Class			Total Class		
	A	B	C	A	B	C	A	B	C
Architectural Drawing		1		10	25		10	26	
Mechanical Drawing	7	4		50	20	8	57	24	8
Auto Mechanics	4	1		10	15		14	16	
Electricity		1			5			6	
Woodwork	8	10	2	52	32	16	60	42	18
Metal Work	3	1		30	9	2	33	10	2
Landscaping					3	2		3	2
Printing				3	1		3	1	
Machine Shop				5	5		5	5	
Handicraft					1			1	
Practical Arts				2			2		

Since the beginning of manual training back in 1879, woodwork has played a dominant role in the shops. When manual training was first offered it consisted of a woodwork shop with instruction in wood and cabinet making. Without an exception this was the pattern followed. It, therefore, is not surprising to find that today the woodwork course is found in all of the industrial arts shops. In most of the shops visited by the writer the woodwork shop had more emphasis placed upon it than all the others. This may indicate that the newer ideas of industrial arts have not been fully grasped as yet. From the bulletin Occupational Statistics, we find that of the 40,000 apprentices listed, only 4,000 or one-tenth are engaged in the industries requiring wood as the core; and of the 14,000,000 adult workers, 1,000,000 are engaged in wood, 1,200,000 in metals, and the remainder of more than 11,000,000 are occupied in work not related to wood or metal. It is apparent from this that appreciation and evaluation of industrial products must be distributed in proportion to the numbers engaged in their production. Placing most emphasis on woodwork rather than other courses is not desirable.

Number of Years Each Course Has Been Taught

An idea as to how long each course has been taught was attempted to be ascertained. But due to the lack of records and the number of "no replies" this was not possible. However, Table IV shows the number of years that the industrial arts course in general has been offered at each school. The writer tried to find out from the schools visited whether or not records had been kept as to when each course was added. In most cases if the principal or industrial arts instructor had not been at the school since the beginning of the course, no records were obtainable.

TABLE IV

NUMBER OF YEARS INDUSTRIAL ARTS COURSES HAVE BEEN TAUGHT IN TEXAS

Number of Years	Frequency		
	Negro	White	Total
1 to 4	4	10	14
5 to 9	2	10	12
10 to 14	2	10	12
15 to 19	4	20	24
20 and above	6	20	26
No Reply	2	30	32

From Table IV an idea of how long the courses have been taught in the high schools of Texas is obtained. No attempt has been made to show when new courses were added to the original courses. The stubs are in intervals of five year ranges and the data is divided into Negro, white and total. Some of the returned questionnaires did not have a record of how long the course had been taught. This accounts for the 32 "no replies". Twenty-six schools had taught industrial arts for over twenty years. One school had taught the course for forty-six years. The second highest number appeared between the years of 15 and 19, while the third highest fell between 1 to 4 years.

Table V shows the number of periods per day the courses are taught in the class A high schools. In the questionnaire sent to all the high schools in Texas the question pertaining to the following table asked for the number of hours per day the course was taught, but because the time varied from 45 minutes to two hours it was decided to interpret these various times in terms of periods. By so doing, a better consistency of times was possible. The trend seems to favor one period for all courses. However, about one-half of the schools give double periods for Mechanical Drawing and about one fourth allot two periods to Woodwork.

In the Class B schools (Table VI) the allotment of time is quite varied. It is not possible to determine which way the trend is in these schools. Double periods appear about as frequently as single periods. Even three periods are allotted to architectural and mechanical drawing. Class B schools represent the major type of schools in Texas. Most of the cities in Texas have populations between 100,000 and 15,000. Therefore, what is characteristic of these schools is usually characteristic of the majority of schools. This seems to indicate then that no uniformity exists in the allotment of time per day for industrial arts courses.

TABLE V

LENGTH OF CLASS PERIODS FOR CLASS A SCHOOLS

Periods	A. D.		M. D.		A. M.		W.		M. W.*	
Per Day	Negro	White	Negro	White	Negro	White	Negro	White	Negro	White
1		10	5	32		10	1	42	1	18
2			2	18	4		7	10	2	12
3										

*For convenience, the courses have been abbreviated as follows: A. D., Architectural Drawing; M. D., Mechanical Drawing; A. M., Auto Mechanics; W, Woodwork; M. W., Metal Work; E, Electricity.

TABLE VI

LENGTH OF CLASS PERIODS FOR CLASS B SCHOOLS

Periods	A. D.		M. D.		A. M.		W		M. W.		E	
Per Day	N	W	N	W	N	W	N	W	N	W	N	W*
1	1	15		15			1	21	1	9	1	5
2		5	4	2	1	15	8	12				
3		5		3			1					

*N - Negro; W - White.

Table VII for the class C schools also shows that both one and two period length classes are used. Many schools seem to have preferred the use of periods 45 minutes in length. However, there were many other times listed in the returned questionnaires. The class A schools seemed to have shorter periods, while class C schools seemed to have longer ones.

TABLE VII

LENGTH OF CLASS PERIODS FOR CLASS C SCHOOLS

Periods Per Day	A. D. Negro	A. D. White	M. D. Negro	M. D. White	A. M. Negro	A. M. White	W. Negro	W. White	M. W. Negro	M. W. White
1				7				5		
2				1				11		2
3							2			

All the schools offered the classes daily. This was the one point that was the same in all achools. However, there were several "no replies" to this question. This could have caused a change in the results; nevertheless, the trend is definitely established that these courses are offered daily irrespectively of what the "no replies" would have shown.

Table VIII shows that the courses are offered for one year in most of the schools, but in a few instances the courses are offered for two years. It is to be noted that in most of the courses that are two years or more in length they are in the Negro high schools.

TABLE VIII

NUMBER OF SEMESTERS CLASSES ARE TAUGHT IN CLASS A SCHOOLS

Number of Semesters	A. D. Negro	A. D. White	M. D. Negro	M. D. White	A. M. Negro	A. M. White	W. Negro	W. White	M. W. Negro	M. W. White
1				6				4		15
2		5		35		3		40		15
3										
4		5	5	3		7		8	1	
Over			2	6	4		8		2	

It will be noticed from the tables that there has been added a column for "over" four semesters. For the class B schools, there were some that taught the course for three and four years. This was especially true of the Negro schools. This indicates that these are the old type of manual training shops. This is more pronounced in Table X. Where the courses offered by any particular school are small the indication is that the length of time given to those particular courses is longer. This is of course to be expected. It is to be further noted that there were only a few courses offered in some schools, and woodwork and mechanical drawing are among those few at all times.

TABLE IX

SEMESTERS CLASSES ARE TAUGHT IN CLASS B SCHOOLS

Number of Semesters	A. D.		M. D.		A. M.		E.		W.		M. W.	
	N	W	N	W	N	W	N	W	N	W	N	W
1	1	5								4		
2		15		16	1	9	1			20	1	4
3												
4				4		6		5		4		5
Over		5	4						10	4		

TABLE X

SEMESTERS CLASSES ARE TAUGHT IN CLASS C SCHOOLS

Number of Semesters	M. D.		W.		M. W.	
	Negro	White	Negro	White	Negro	White
1						
2						2
3						
4		8				
Over			2	16		

Physical Plant and Equipment

Table XI was constructed to show the number of schools using separate buildings for teaching industrial arts and the number of schools that have set aside some space in the main school building for this work. This table indicates that separate buildings are more popular especially among the larger school plants. Here, as the size of the school decreases the tendency is to place the shop within the main building. Perhaps this is to cut down on the cost of the course. However, most of the newer schools (1-4 years) whether they are class A, B, or C use separate buildings for the shops. This indicates that the importance of separate buildings is now being realized.

TABLE XI

LOCATION OF PHYSICAL PLANT FOR INDUSTRIAL ARTS COURSES*

Class of School	Negro		White		Total	
	Same Building	Separate Building	Same Bldg.	Separate Building	Same Bldg.	Separate Building
Class A	1	6	12	40	13	46
Class B	5	6	25	7	30	13
Class C	1	1	14	2	15	3

*With respect to main school building.

Every shop requires a certain amount of basic equipment to successfully teach a course. With this in mind an attempt was made to find out how much of this equipment was available in the various shops. Table XII (Appendix) shows a list of the equipment for the Drawing Shop, Woodwork Shop, and Auto Shop. These are the shops appearing the greatest number of times in Table III. In this table all the schools are treated together without regard to classes, since here we were only interested in the number of schools possessing this equipment. The questionnaire was arranged so that it would be as easy to fill out as possible. It would have been difficult to obtain an inventory of equipment from each school.

From that part of the table dealing with the drawing equipment we notice that of the total number of schools offering drawing (83) all have drawing boards while greater than 71 per cent of the total have all the other equipment listed with the one exception of wood models.

More than 61 per cent of the total schools have all the equipment listed for the Woodwork Shop. This percentage is not too low when it is realized that the equipment listed is rather expensive and out of the range of most of the smaller high schools. Of the 28 schools listed as offering the automobile course, most were well-equipped; although most of the equipment may be considered tools, they are more or less necessary for the successful teaching of the course. However, such equipment as wheel aligner, battery charger, welding outfit and pressure grease gun are well represented, too.

Such important information as the average number of students able to use this equipment at once and the amount of equipment not listed could not be obtained due to the limitations of the investigation.

Qualifications of Teachers

There were 202 teachers distributed among the 120 schools as indicated in Table XIII. As the size of school decreased, it was noticed that one instructor taught more than one subject. However, this was an exception, not a rule.

TABLE XIII

DISTRIBUTION OF 202 TEACHERS

Number of Teachers	Class of Schools A Negro	A White	B Negro	B White	C Negro	C White
1	1	15	7	19	2	16
2	3	29	3	5		
3	4	7		8		
Over				1		

Table XIV shows the educational qualifications of the teachers in the 120 high schools studied. By far the greater percentage of the total have a Bachelor of Science degree, and in some instances the degree was an engineering degree or degree from a college specializing in trades. Eighty-nine of the teachers had trade certificates; however, some may have obtained these certificates in addition to a degree in some other field.

TABLE XIV

EDUCATIONAL QUALIFICATIONS OF 202 TEACHERS

Formal Education	Number Negro	Number White
B S Degree	34	149
Higher Degree		36
Trade Certificate	20	79
No Reply		19

Course Materials and Organization

The writer made visits to all cities having populations over 100,000 for the purpose of obtaining course outlines and other information that was not obtainable through questionnaires. As many schools as possible were visited in each city. Not all instructors had course outlines in written-up forms. They taught the course by the project method. Projects were assigned to students to make; these projects were assigned in some predetermined order.

For example, the beginning student in woodwork learned how to saw a board across grain and with the grain. Then he learned how to plane a board. After these first two jobs he was assigned to make some simple project that would make use of these two skills. This project might be a bread board or small place mat. There was no class organization; the teacher did most of the work. When class came to order, he would call the roll, give out tools and then begin to give individual instruction to the students. A surprisingly large number of classes visited used this method. However, in some instances, lectures of varying length were given at various times during the week. Reasons given for not giving class lectures were usually based on the reason that since students advance at various rates of speed, it was difficult to give timely lectures to all the students at once. Certain skills and information were supposed to be learned. The skills were observed throughout the year and grades assigned accordingly. While at the close of each term a test covering the information to be learned was given, the grades were assigned accordingly.

At one of the larger Negro high schools in the northern part of the state the following course outline for mechanical drawing was obtained. This is for the tenth grade students.

Outline of Instruction

A. Manipulative Subject Matter of the Course

Part I. Elements of Mechanical Drawing

Unit 1. Plate Layout

1. Information Sheet for Unit 1

Unit 2. Lettering

1. Lettering Sheet No. 1

2. Lettering Test

Unit 3. Practice Drawing

1. Instruction Sheet, Unit III, Problem 2

Unit 4. Orthographic Projection

Part II. Pictorial Drawing

Unit 1. Perspective Drawing

Unit 2. Oblique Drawing

Unit 3. Isometric Drawing

Part III. Freehand Sketching

Unit 1. Practice Sketching

Unit 2. Orthographic Sketching

Unit 3. Pictorial Sketching

Part IV. Furniture Drawing

Unit 1. Working Drawing

B. Related Subject Matter of the Course

Part I. Occupation Study for Guidance

Part II. Educational Guidance

Part III. Technical Information

Time Available

The periods for mechanical drawing are ninety minutes in length, and the class meets every day that school is in session. This allows the class to meet for a total of eighty-six periods or about one hundred thirty clock hours.

Equipment Available

Due to the lack of room the drawing must be done on the woodworking benches. Support for the drawing boards which clamp in the vise are furnished. Each pupil furnishes the following equipment on payment of a rental fee of $1.00:

Set of drawing instruments

Drawing board

T-Square

45-degree triangle

35-60-degree triangle

Scale

Irregular curve.

Shop Controls Under Direction of the Teacher

The teacher controls the opening and closing of class. The pupils are given three minutes at the close of the period for putting away their tools and materials.

Shop Controls Delegated to the Pupils

The pupils alternate at performing the following duties under the supervision of the teacher: checking attendance, distributing and collecting T-squares, distributing and collecting triangles, distributing and collecting notebooks, and checking the instruments.

Text and Reference Books

General and Mechanical Drawing by McGee and Sturtevant is used as a text. The following reference books are in the room for use by the pupils: French, Engineering Drawing; French and Svensen, Mechanical Drawing.

Class Enrollment

Room facilities accommodate eighteen pupils. If twenty-five to thirty pupils enter the class, it is divided into two sections.

Another Typical Course of Study

A. White class B. School in Central Texas

Manual training is required of all boys. Five 75-minute periods per week throughout the eighth and ninth grades are provided and they are elective in the tenth, eleventh and twelfth grades.

In the eighth, ninth and tenth grades a variety of short courses in fundamental industrial materials and processes are offered to assist the pupil in the choice of his future school course and location. The work offered in the several grades is as follows:

Grade Eight:

Drawing - One-fourth year

Woodshop - One-fourth year

Elementary iron work - One-fourth year

Printing - One-fourth year

Grade Nine:

Drawing - One-fourth year

Woodshop - One-fourth year

Electrical Construction - One-fourth year

Printing - One-fourth year

Grade Ten:

Drawing - Fourteen weeks

Woodshop - Eighteen weeks

Forging - Six weeks

Types of Shops

Two distinct types of industrial arts shops were observed in Texas. They are the composite general shop and the general shop in a major area. The composite general shop provides pupils with experiences in a number of different industrial activities carried on simultaneously in one room under the direction of one teacher. The general shop in a major area is one in which the subject experiences are confined to one field of industry, such as woodwork, metal work, etc. This type of shop is by far the most frequently found shop in Texas. Some are exceptionally well equipped and the artistic treatment of the projects are excellent. But subtract from these shops that which is essentially applied design and those exercises which are intended to afford motor expression in the learning of other subjects in the curriculum, what is left is an incoherent, unorganized series of projects without purposes or educational value. However good the artistic treatment, and however desirable the assistance given in acquiring knowledge of other subjects, the results now obtained cannot compare with what might be secured from a series of projects organized to attain a standard end.

Other Significant Factors

It will be noted from Table XV that in the large cities an industrial arts course that is elective in nature is the most frequent. While in class B cities this popularity is not so marked, in class C cities the tendency is definitely towards a compulsory course. It was noted that as the number of students increased there was a tendency for the course to be elective. This might be caused by the fact that the instructors felt that as the enrollment increased students would voluntarily take it; hence, it is made elective.

TABLE XV

RELATIONSHIP OF COMPULSORY COURSES TO ELECTIVE COURSES

	Negro		White		Total	
Size of Town	Elective	Comp.*	Elective	Comp.	Elective	Comp.
Class A	6	1	37	15	43	16
Class B	3	8	26	6	29	14
Class C		2	6	10	6	12

*Compulsory.

CHAPTER V

PROPOSED STANDARDS FOR INDUSTRIAL ARTS COURSES IN THE HIGH SCHOOLS OF TEXAS

In Chapter IV data were presented showing the results of the investigation of 120 high schools in Texas. As has been mentioned, these schools were selected at random from various areas throughout the state and they typify the industrial arts offerings of the state as a whole. On the basis of these data this chapter sets forth the standards already in use, together with additional standards that the author has selected from recognized authorities and bulletins from states now offering standard courses.

An important problem has become apparent as the result of data presented in Chapter IV. This problem tends to limit the scope of any standard course that may be set up in Texas that fails to recognize it. This problem grows out of the dual educational system of Texas which has made no provision for Negro boys to attend technical high schools. But since nearly the entire race makes its living through manual labor in industry represented in the courses taught in the technical high schools and since less than 20 per cent of the Negro boys enter colleges where specialized training can be obtained, some provision should be made for this technical training on the high school level. However, until this is provided for the aims and objectives of the industrial arts shop in the general high schools for the Negro boy must be different from those of the general high school for the white boy. As a compromise the author presents a course outline that is flexible and lends itself to use in both high schools (Negro and white) with what is felt to be the best method possible at this time.

Table III, Chapter IV, shows that the courses being offered the greatest number of times are:

1. Woodwork
2. Mechanical Drawing
3. Metal Work
4. Architectural Drawing
5. Auto Mechanics.

Consequently, course outlines will be set up in these five areas. However, since architectural drawing is a form of mechanical drawing these two courses will be combined into one. Tables VIII, IX, and X show that there is considerable difference in the length of time during which the courses are offered. Only the class C white schools offer courses in excess of two years, it being general that the others are of shorter length. On the other hand Negro schools, regardless of the size of the town, favor courses of longer periods, usually the entire four years of high school. Especially is this true of woodwork and mechanical drawing

Standard Course of Study in Mechanical Drawing

Mechanical drawing is considered in this course of study to be a part of general education for all students for general and non-vocational purposes. For that reason the course is planned to introduce elements from all the main phases of mechanical drawing. Machine, architectural, and structural drawing are all introduced in the course.

Much stress is laid upon the informational side of drawing in addition to the acquisition of skills. This is the part of drawing which is least interesting and it usually will be slighted unless it is definitely planned.

From such a source a good student will acquire skills and information which will aid him if he should later enter drafting as an occupation, but such aid is incidental and is not the purpose of the course. The purpose of the course is to give the student a broad familiarity with mechanical drawing, "the language of industry", so that he may be able to read that language and better understand the industrial civilization in which he lives.

This course covers work for four semesters beginning with the ninth grade or the first year of the three-year senior high school. For each of these semesters the work is planned for five one-hour periods per week. This was decided upon as a result of the date in Tables V, VI, and VII. The amount and type of work planned will also require a limited amount of preparation outside of class. Where the time allotment varies, the amount of work taught will have to be varied accordingly.

As conditions vary from school to school it is not intended that all students should have four semesters' work in mechanical drawing, nor that the work be limited to that amount in Negro high schools. It is intended, however, that a student who has completed a certain number of semesters in mechanical drawing at any high school in the state shall have had approximately the same training as one who completed the same amount of work in any other high school in the state.

An introductory or exploratory course could be used in junior high schools. Such a course should be offered only in the eighth or ninth grade and preferably only after some shopwork has been given.

The course is organized in terms of Operation Units, the things which the student should be able to do; and Information Units, the things which the student should know. There is, of course, much overlapping between the two. This organization is based upon that used in the American Vocational Association's report on Standards of Attainment in Industrial Arts Teaching, but many of the Operation Units have been broken down into more specific ones, and the number of Information Units has been increased.

Operation Units and Information Units are listed in two groups, the recommended or ideal course, which each student should try to cover; and the minimum essentials which should be required for credit. Units which are not included in the minimum essentials are marked with an asterisk (*).

Problems to be drawn should be selected to illustrate certain one of the units, and the problems drawn in each semester should be carefully analyzed by the teacher to determine that they cover the minimum essentials for that semester's work.

A good recent textbook should be used and definite assignments made for textbook reading, study of mimeographed or printed information sheets, and examination of models and commercial drawings. Much of this study should be done outside of class. The consistent use of a notebook is essential if the student is to learn much more than the drawing of plates. In order to emphasize the importance of the related information and to determine the extent to which it has been learned, a systematic program of periodic testing is necessary.

Mechanical Drawing I

Five one-hour periods per week for one semester

Operation Units

1. Fasten the drawing paper onto the drawing board, using drafting tape or thumbtacks.
2. Sharpen the drawing pencil with knife and sandpaper.
3. Measure with the architect's scale.
4. Mark off points with the pencil.
5. Choose the necessary views of an object.
6. Plan a drawing and make a layout of the sheet.
7. Figure spacing.
8. Make freehand sketch of a simple straight line object.
9. Sketch circles and arc.
10. Make a complete sketch on cross-section paper, with dimensions and notes.
11. Use the T-square and pencils in making horizontal lines.
12. Use the T-square, triangles, and pencils in drawing vertical lines and lines at all common angles.
13. Use two triangles to draw a line through a given point, perpendicular to a given line.
14. Clean and care for drawing instruments.
15. Draw, and know when to use, the different kinds of lines used

in mechanical drawing: border line, visible edge line, invisible edge line, dimension line, center line, cutting plane lines.

16. Erase pencil lines.

17. Block out views.

18. Make a front view and a top view, and know the relationship between them.

19. Make a front view and an end view, and know the relationship between them.

20. Make three views, and know the relationship between them.

21. Pencil a drawing in correct order.

22. Draw views with hidden edges.

23. Dimension a drawing.

24. Use the pencil compass.

25. Make arrowheads.

26. Letter numerals.

27. Lay out a title.

28. Letter single stroke Gothic capital letters.

29. Make drawings to scale of full size, and scale 6" = 1'0".

30. Check a drawing using a checklist.

*31. Draw sectional views of an object and know when they are required; full sections, half sections of cylindrical objects, and revolved sections of spokes, ribs, or handles.

32. Letter notes and specifications.

33. Draw an octagon when the diameter of the inscribed circle is

given.

34. Draw an octagon when the short diameter (across flats) or the long diameter (across corners) is given.

*35. Indicate and dimension drilled holes.

*36. Indicate and dimension keyway for square key.

37. Draw a fillet (arc) tangent to two lines perpendicular to each other.

38. Draw a line through a given point tangent to a given circle.

39. Draw a line tangent to two circles of varying diameters.

*40. Crosshatch sectional surfaces to indicate wood, cast iron, or steel.

*41. Make a detail of a chambered, beveled, or other molded edge on a simple woodwork project.

42. Draw small fillets freehand.

43. Use conventional breaks to decrease space required or to enlarge scale used for representing long regular parts.

44. Use 45-degree line to project from top view to end view.

45. Project all details from one view to both the others.

46. Make an orthographic projection from an isometric drawing.

47. Make an orthographic projection from a model.

48. By the use of two triangles, draw a line through a given point, parallel to a given slant line.

*49. Divide a line into a given number of equal parts with the scale (parallel line method).

Mechanical Drawing I

Five one-hour periods per week for one semester

Information Units

1. The kinds of scales used in drafting and the purpose of each
2. Names and uses of drafting instruments
3. How to arrange work for proper lighting and care of the eyes; how to avoid fatigue and work most efficiently
*4. Kinds, standard sizes, and cost of drawing papers
*5. Conventional breaks and crosshatching symbols
6. Definition and spelling of a selected list of technical words and phrases
7. Review of fundamentals of arithmetic, particularly addition and subtraction of common fractions
8. Review of fundamentals of geometry
9. Principles of dimensioning
10. Purpose a construction of each of the projects drawn
*11. How to take notes on technical reading
12. Occupation information, opportunities, training, etc.
13. Kinds of pencils used in mechanical drawing
14. Erasers; methods of cleaning and caring for drawings
15. How to read a mechanical drawing

Suggested Problems - Mechanical Drawing I

Ten plates, size $9\frac{1}{2}$" x 12", each requiring approximately nine one-hour periods, each plate to be presented as a problem, to be worked out by the student. Select one problem similar to those suggested for each plate.

PLATE 1. Tenon, mortise, cross-lap joint. Topics: orthographic projection of a simple project involving vertical and horizontal lines, scale full size, dimensioning straight line objects.

PLATE 2. Line reel, paper weight, wedge, V-block. New topics: 30° and 45° lines.

PLATE 3. Tent stake, door stop, adjusting block. New topics: slant lines, scale half size.

PLATE 4. Guide block, lathe clamp plate, hold-down clamp, spool, bushing. New topics: circles, dimensioning of circles.

PLATE 5. Keystone block, cold chisel, wrecking bar. New topics: hexagon, scale 3" = 1'0".

PLATE 6. Pen tray, letter rack, ink bottle holder, cast iron leg base. New topics: simple full sections, crosshatching wood or cast iron.

PLATE 7. Flat crank, pawl, operating handle. New topics: tangents.

PLATE 8. Flywheel, emery wheel flange, handwheel, gear blank. New topics: half sections, crosshatching steel.

PLATE 9. Riveting hammer, soldering copper, setting down hammer, cape chisel. New topics: octagon, small circles and tangents.

PLATE 10. Hexagon and wrench, square box wrench, link, valve handle. New topics: revolved sections, breaks.

Mechanical Drawing II

Five one-hour periods per week for one semester.

Units listed for this and following semesters are the new ones to be taught for the first time, in addition to those already taught. The new work will of course involve a review of units already studied. Units marked with the asterisk (*) in the previous semester's work should be considered part of the minimum essentials for this semester.

Operation Units

1. Letter notes and specifications
2. Use two triangles to draw a line through a given point at any common angle to a given line.
3. Figure a complete bill of materials for a small woodwork project.
4. Transfer measurements with the dividers.
5. Draw a fillet (arc) tangent to a circle and line.
6. Draw a fillet (arc) tangent to two lines not perpendicular to each other.

*7. Sharpen and adjust the ruling-pen and compass-pen.

*8. Ink a line with a ruling-pen.

*9. Ink circle and arcs.

*10. Ink a drawing in the proper order.

*11. Erase an ink line or spot.

*12. Make a blueprint.

*13. Make an ink tracing.

14. Make an auxiliary view.

15. Dimension an auxiliary view.

*16. Use the irregular curve.

17. Draw a simple floor-plan, using the proper symbols and conventions.

18. Bisect an angle.

19. Draw the development of a cylinder.

*20. Draw the development of a cylinder cut by an oblique plane.

21. Draw the development of a cone and its frustrum.

22. Draw the development of a simple irregular surface with parallel elements (cup handle, etc.).

23. Make a detail drawing.

24. Make an assembly drawing.

25. Make an isometric drawing involving only straight lines.

26. Dimension an isometric drawing.

27. Design and draw a simple woodworking project.

*28. Draw a pentagon.

29. Obtain data, plan layout, determine scale, and draw a simple chart orgraph.

30. Make drawing using symbols for concrete, reinforcing steel, cinders and clay.

31. Draw an ellipse by trammel method, cutting plane method, method of major and minor axes, or four-center approximation.

*32. Use a partial auxiliary view to complete a main view.

33. Dimension a simple reinforced concrete drawing.

34. Use reference numbers to refer from a detail to a bill of materials.

35. Estimate the cost of a simple woodworking project.

36. Use single stroke Gothic lower case to letter.

37. Draw conventional screw threads.

Information Units

1. Definition and spelling of a selected list of technical words and phrases
2. Purpose and construction of each of the projects drawn
3. How to take notes on technical reading
4. Occupational information, opportunities, training, etc.
5. Use of charts and graphs
6. Reinforced concrete construction

*7. Drawing inks

8. Conventional forms for doors, windows, and walls
9. How iron castings are made and why fillets are used
10. Review of fundamentals of arithmetic: proportion, circles, triangles, rectangles, areas, volumes, decimals
11. Weights and gauges of sheet metals
12. Standard wire gauges
13. American National screw threads

Suggested Problems - Mechanical Drawing II

Ten plates, $9\frac{1}{2}$" x 12", each plate requiring approximately nine one-hour periods. Select one problem similar to those suggested for each plate.

PLATE 11. Sprocket wheel, ratchet, spoke pulley. New topics: tangents and divisions of a circle.

PLATE 12. Taboret, footseel, fernstand, bookends. New topics: simple assembly drawing, details, bills of materials.

PLATE 13. Tin cup, scoop, candlestick, stove pipe elbow. New topics: development of the cylinder.

PLATE 14. Funnel, ventilator hood, tree guard, flower holder. New topics: development of a cone.

PLATE 15. Concrete flower pot, tank garden seat. New topics: structural conventions, symbols, dimensioning, scale 1" = 1'0" and scale $\frac{1}{2}$" = 1'0".

PLATE 16. Jig angle, angle stop, connector bracket. New topics: auxiliary views.

PLATE 17. Nail box, birdhouse, anchor block. New topics: straight line isometric drawing.

PLATE 18. One or two-room cabin, garage, rural school. New topics: simple floor plans, conventions, symbols, dimensioning.

PLATE 19. Machinist's jack, vise screw, clamp. New topics: American National screw threads.

PLATE 20. Simple chart or graph. New topics: obtaining data, planning, chart, scale.

Mechanical Drawing III

Five one-hour periods per week for one semester

Operation Units

1. Divide a number into approximately equal parts with the dividers.

*2. Make a black and white print.

3. Indicate finish on a simple machine part.

4. Draw two circles tangent to each other.

5. Use a table of decimal equivalents.

6. Draw isometric circles and arcs in all three plans.

*7. Draw an isometric section.

8. Draw tangents to isometric circles and arcs.

9. Use all common scales in addition to those already used.

10. Make a cabinet drawing involving circles.

*11. Make a cabinet sectional drawing.

12. Use shaded lines to indicate curved surfaces in pictorial drawings.

13. Make a simple semi-mechanical perspective.

14. Draw a circle, given the radius and two points on the circumference.

15. Make a house wiring diagram.

16. Make a radio wiring diagram.

17. Make a detail and assembly drawing of a simple electrical project.

18. Draw U.S.S. bolts, nuts, and machine screws.

19. Draw structural rivet heads.

20. Draw standard structural steel shapes.

21. Make a simple structural steel detail drawing.

22. Use inside and outside calipers for measuring simple machine parts.

23. Use thread gauge to determine pitch of threads.

24. Use machinist's scale, combination squares, and surface gauge to measure machine parts.

25. Make a complete freehand sketch of a machine part on cross section paper.

26. Dimension to limits using decimals.

27. Make complete drawing of a machine part, following a freehand sketch.

*28. Make a pencil tracing on tracing paper.

Information Units

1. Definition and spelling of a selected list of technical words and phrases.
2. Purpose and construction of each of the projects drawn.
3. How to take notes on technical reading.
4. Occupational information
5. Review of fundamentals of algebra: substitution in formulas
6. Use of data tables
7. Structural steel shapes, methods of fabricating, riveting, and welding
8. The use of untrue projection to clarify a drawing
9. Why different holes are marked "drill", "ream", "bore", etc.
10. The meaning of finish and where it is used

11. A.S.A. house wiring symbols

12. A.S.A. radio symbols

13. Sizes and kinds of standard bolts, nuts, and screws

Suggested Problems - Mechanical Drawing III

Five plates, size 12" x 19", each plate requiring approximately eighteen periods. Ink tracings to be made of any two plates. No inking to be done on original drawings.

PLATE 21. Machine details. Details of simple machine parts involving sectioning, dimensioning to limits, screw threads, finish marking, and material notes, reference numbers.

PLATE 22. Machine assembly. Assembly drawing in three views of the parts detailed in Plate 21, overall dimensioning, reference numbers, bill of materials.

PLATE 23. Pictorial drawings. Cavalier drawing, isometric drawing one of the above to involve a section, thirty-degree cabinet drawing of a simple piece of furniture, semi-mechanical perspective.

PLATE 24. Structural steel. Details of a simple structural steel joint, simple girder detail, typical shape sections and data table.

PLATE 25. Electrical drawing. Details, assembly, wiring diagrams, and bill of materials for an electric buzzer, bell, or similar device; simple radio wiring diagram, table of A.S.A. symbols.

Mechanical Drawing IV

Five one-hour periods per week for one semester

Operation Units

1. Make drawing of aircraft part involving curves.
2. Develop sheet metal pattern involving cylinders with axes intersecting perpendicularly.
3. Develop sheet metal pattern with axes of cylinders intersecting obliquely.
4. Develop oblique conic section.
5. Draw an end elevation of a simple one- or two-room building.
6. Draw a front elevation of a simple one- or two-room building.
7. Draw a simple property plat.
8. Indicate welded joints.
9. Draw a complete assembly of a piece of cabinet work.
10. Draw sectional detail of mortise and tenon joint.
11. Draw sectional detail of drawer construction.
12. Detail turnings.
13. Make complete bill of material for a piece of cabinet work.

Information Units

1. Definition and spelling of a selected list of words and phrases
2. Purpose and construction of each of the projects drawn
3. Occupational information
4. Estimating costs of simple one- or two- room building
5. Special kinds of drawing used in aircraft design: lofting,

fairing, rolled assembly drawings, zone markings

6. Special kinds of drawing used in automotive design

7. Special applications of mechanical drawing in various types of shopwork; sheet metal, cabinet full size drawing, etc.

8. Design of simple one- or two- room building

9. Use of simple property plats, surveying, civil engineering

10. American Standard Fusion Welding symbols

Suggested Problems - Mechanical Drawing IV

Six plates, size 12" x 19", each plate requiring approximately fifteen periods. Ink tracing to be made of any one plate. Pencil tracing on tracing paper to be made of any one plate. No inking to be done on original drawings.

PLATE 26. Aviation drawing. Details and assembly of a simple flying model plane, or detail of wing section or other typical part of full size plane.

PLATE 27. Sheet metal patterns. Development of complete patterns for a practical sheet metal project.

PLATE 28. Furniture drawing. Three assemble views of table or cabinet of medium difficulty, details of mortise and tenon, dowel or similar joint construction, other details.

PLATE 29. Architectural drawing. Floor plan, front and end elevations of a simple structure, complete dimensions and specifications, door and window schedule.

PLATE 30. Map drawing. Property plate of a city block, or topo-

graphic map of school grounds or small field.

PLATE 31. Welding drawing.

A Standard Course of Study in Woodworking

In preparing this course of study in woodworking it was decided to offer it for three years. Since Tables VIII, IX, and X indicate that in the white high schools the course was usually offered for a shorter period and that in the Negro high schools for three to four years, the course was prepared for three years in length.

Hand Woodworking

Operation Units - Group A

1. Make a working drawing.
2. Make out a bill of material.
3. Measure with a rule.
4. Grind a plane bit.
5. Hone a plane bit.
6. Assemble and adjust a plane.
7. Use a try square.
8. Use a marking gauge.
9. How to use a face mark
10. Square stock to dimension.
11. Plane chambers and bevels.
12. Lay out curves and finish curves.
13. Bore holes in wood.
14. Sharpen an auger bit.

15. Use a brad awl for making holes for screws and nails.

16. How to use wood screws

17. How to drive nails

18. How to draw nails

19. How to set finishing nails

20. How to use a rip saw, a cross cut saw

21. How to use a coping saw

22. How to use a backsaw

23. How to use a miter box

24. How to use a wood chisel

25. How to sharpen a wood chisel

26. How to make a butt joint

27. How to lay out and make a lap joint

28. How to make a dad's joint

29. How to make a miter joint

30. How to make a mortise and tenon joint

31. How to plane end grain

32. How to make an edge to edge glue joint

33. How to make a dowel joint.

34. How to use a doweling jig

35. How to use bar clamps

36. How to use hand clamps

37. How to apply hot glue

38. How to mix and apply casein glue

39. How to sharpen and burnish a scraper

40. How to dress a screwdriver

41. How to set an expansive bit

42. How to prepare a wood surface for a finish

43. How to use sandpaper

44. How to use a sanding block

45. How to apply stains

46. How to apply shellac

47. How to apply filler

48. How to sand between finish coats

49. How to apply varnish

50. How to apply paint and enamel

51. How to rub and polish varnish

52. How to apply wax

Operation Units - Group B

53. Lay out irregular design by means of squares.

54. Form with spoke shave.

55. Make a rubbed glue joint.

56. Adjust and use a rabbet plane.

57. Cleaning finishing brushes

58. Cut a groove or a rabbet.

59. Do a simple upholstery involving webbing and rolled edges.

60. Do upholstery involving simple padding.

61. Do simple weaving in cane or rush.

62. How to use a keyhole saw

63. Cut curves with a turning saw.

64. Fit hinges.

65. Put on locks.

66. Put on drawer pulls.

67. Lay out and make a dovetail joint.

68. Make and fit a drawer.

69. Fasten on a table top.

70. Cut a spline joint.

71. Cut an edge mold.

72. Apply inlay and overlay.

73. Lay out and cut a rule joint.

74. Use a Forstner bit.

75. How to sharpen a saw

76. How to use a combination plane

Information Units

1. Addition and subtraction of fractions

2. How to read a working drawing

3. Standard lumber dimensions

4. Types of hand planes

5. Laying out tools

6. Sizes and types of wood boring bits

7. Sizes and types of wood screws

8. Proper use of flat and round head screws

9. Sizes and types of nails

10. Uses of common nails

11. Characteristics and habitats of common woods and their uses

12. Composition of glues used in woodworking

13. Composition of abrasives used in woodworking

14. Economical use of sandpaper

15. Planning the finish for the use it will receive

16. Finishing abrasives

17. Kinds of stain and their composition

18. Uses of shellac

19. Uses of solvents

20. Uses and composition of varnish

21. Care of brushes

22. Safety precautions in the finishing room

23. Cleanliness in the finishing room

24. Safety precautions in the use of tools

25. Common hardware used in woodworking

26. Removing old finishes

27. Use of stencils

Suggested Projects - Hand Woodworking

1. Bread and meat board

2. Peg game

3. Bird house

4. Chinese Checker board

5. Desk tray

6. Miter box

7. Book ends

8. Wall shelf

9. Shoe box

10. Plant stand

11. Flower box

12. Drawing board

13. Half round end table

14. Lawn chair

15. Lawn table

16. Study table

17. Setp ladder

18. Book rack end table

19. Porch swing

20. Toys

21. Tool box

22. Lap board

Machine Woodworking

Operation Units - Group C

Turning Lathe

1. Safety rules for operating a lathe

2. Range of work which may be done on a lathe

3. Adjust and care for a lathe.

4. Center stock.

5. Mount work between centers.

6. Rough down with gouge.

7. Smooth with a skew.

8. Lay off pattern on piece.

9. Mark off with a skew.

10. Use cut off tool.

11. Cut tapers with a skew.

12. Cut beads with skew.

13. Cut concave cuts with a gouge.

14. Measure with outside calipers.

15. Measure with inside calipers.

16. Make and use a template.

17. Sandpaper in lathe.

18. Apply finish in lathe.

19. Make a set up for duplicate parts.

20. Off center turning

Jointer

1. Safety rules for operating the jointer

2. Range of work which may be done on the jointer

3. Care for and adjust the machine.

4. Joint an edge.

5. Cut a chamfer.

6. Make a spring joint.

7. Surface narrow stock.

8. Take the wind out of a board.

9. Cut a rabbet.

10. Cut tapers.

Circular Saw

1. Safety rules for operating saw

2. Range of work which may be done on the saw

3. Care for and adjust the saw.

4. Rip

5. Cut off

6. Cut grooves.

7. Cut dadoes.

8. Cut tenons.

9. Cut miters.

10. Cut tapers.

11. Core boxing.

12. Use of jigs

Jig Saw

1. Safety rules for operation of saw

2. Range of work which may be done on the saw

3. Care for and adjust the saw.

4. Exterior cuts

Drill Press

1. Safety rules for operating drill press

2. Range of work which may be done on the drill press

3. Adjust and control speeds.

4. Use of attachments

5. Reeding and fluting

Band Saw

1. Safety rules for operating the saw

2. Range of work which may be done on the saw

3. Care for and adjust the saw.

4. Saw curves

5. Rip

6. Cut off

7. Cut tenons.

Information Units

1. Learn common parts of machines

2. Types of machines

3. Types of blades or cutterheads available for the various machines

4. Set machines for duplication of pieces.

5. Care for and maintenance of accessories

6. Study of speeds

7. History of development of machines

Lumber

1. Learn to identify the kinds of lumber used in the community.

2. Learn the characteristics and qualities of lumber used in the shop.

3. Learn the source of lumber.

4. Study methods used in drying and seasoning.

5. Know the effect of moisture in wood.

6. Learn the nominal and actual dimensions of lumber.

7. Know how veneer and plywood are made.

8. Learn the advantages of veneered stock.

Glue

1. Kinds of glue

2. Preparation of glue

3. Conditions and preparations necessary for the use of glue

4. Manufacture and cost of glue

Nails

1. Kinds of nails

2. The use of the different kinds

3. The size of nails

4. How nails are sold

5. How nails are manufactured

6. Size of brads and how sold

7. Size and kinds of corrugated fasteners

8. Size and use of clamp nails

Screws

1. Kinds of screws

2. The use of the different kinds

3. How size and kinds of screws are indicated

4. How screws are sold

Sandpaper

1. Types of sandpaper

2. Grades of sandpaper

3. Grades and use of steel wool

Furniture

1. Is the design adapted to the use for which the piece is in-

tended? Is the construction also adapted to the intended use?

2. Are the proportions good?
3. Is it structurally sound?
4. Is it pleasing to the eye?
5. Is the finish suited to the material and the use for which it is intended?
6. From which period of furniture design does the piece belong?

Manufacture of Wood Products

1. Location of principal centers engaged in the manufacture of wood products
2. Extent of the use of automatic machinery
3. Possibilities of employment in the wood industry

Suggested Projects - Machine Woodworking

1. Drawing stool
2. Boudoir or telephone table
3. Magazine rack
4. Cedar chest
5. End table
6. Coffee table
7. Student desk
8. Sewing cabinet
9. Bed
10. Chest of drawers
11. Card table
12. Drawing table

13. Kitchen cabinet

14. Costumer

15. Picture or mirror frame

16. Desk or floor lamp

17. Model airplane

18. Shoe rack

19. Smoking stand

20. Work bench

21. Tool cabinet

22. Book shelves or cabinet

Standard Course of Study in Metal Working

Metal work is taught for two semesters in the majority of the white schools while it is taught for four semesters in the Negro high schools. The courses here suggested are in sheet metal for four semesters.

Sheet Metal

Operation Units

1. Read a working drawing.
2. Make out a bill of material.
3. Plan your procedure.
4. Measure with a rule.
5. Check material when received.
6. Make a dimensioned sketch.
7. Lay out a circle with dividers.
8. Mark pattern on sheet metal.

9. Cut out a pattern using straight and curved shears.
10. Cut out a pattern using squaring shears.
11. Bend the edge of a piece of metal at any angle with a bar folder or hand break.
12. Form metal in a cornice break.
13. Make a single and double hem by hand and on machine.
14. Form or shape a piece of metal over a stake with a wood mallet or setting down hammer.
15. Form a cylinder on the slip roll forming machine.
16. Make a lapped seam.
17. Light and operate a blow torch or furnace.
18. Solder tin plate, galvanized sheet metal, copper, and zinc.
19. Make a grooved seam with a hand groover.
20. Wire the edge of a straight piece of metal using the bar folder and wiring machines.
21. Wire a cone-shaped object on the wiring machine.
22. Make a simple parallel line development.
23. Make a simple radial line development.
24. Shring a piece of metal by crimping in a machine.
25. Reinforce and decorate by beading on machine and by hand.
26. Turn a burr on a circle using the burring machine.
27. Cut threads with tap and dies.
28. Spot weld.

Information Units

1. How to plan a job

2. How to care for all tools and equipment
3. How to transfer a pattern from a sheet of paper to the metal
4. The name, correct use of, and adjustments of all hand tools, stakes, and machines used
5. How to identify the various kinds of sheet metal
6. Allowances to be made for lapped seams and grooved seams
7. The kinds of soft soldering and their uses
8. The kinds of flux and dipping solutions and their uses
9. How to light and operate a blow torch or furnace
10. Resources of iron, tin, zinc, and copper
11. A brief study of the manufacture of sheet metals
12. A brief study of the standard sizes, gauge, and weight of tin plate, galvanized sheet metal, sheet iron, copper, and zinc
13. A brief study of rivets as to kind and size
14. How to clean metal surfaces for soldering or finishing
15. A brief study of taps and dies
16. Standard gauges of wire
17. Standard sizes of strap iron
18. Kinds of threads and standard sizes of taps and dies
19. Occupational information

Suggested Projects - Sheet Metal

1. Letter holder
2. Cookie Cutters
3. Doughnut cutters
4. Garden trowel

5. Measuring cup
6. Scoop
7. Ash tray
8. Desk calendar
9. Pencil tray
10. Sandwich cutter

Second Year - Sheet Metal

Operation Units

1. Copying from a template
2. Cutting sheet metal
3. Forming metal by hand and on machines
4. Breaking metal by hand and by machine
5. Riveting metal
6. Hand grooving a piece of metal
*7. Machine grooving a piece of metal
8. Double seaming by hand
*9. Double seaming with machines
10. Raised bottom seam
11. Chiseling
12. Punching a piece of metal by various methods
13. Wiring straight and cone-shaped objects by hand and with the wiring machine
14. Burring and turning metal with the burring machine and by hand
*15. Elbow edging
16. O. G. single and triple beading

17. Crimping a piece of metal to shrink edges

18. Drilling metal

19. Setting down by hand and machine

20. Sharpening a drill bit

*21. Sharpening a pair of snips

22. Grinding

*23. Gutter beading

*24. Spot welding

25. Cutting, straightening, forming, and bending a piece of wire at right angles

26. Filing

27. Scraping

*28. Hard soldering and its uses

29. Soft soldering

30. Soldering various types of metal

*31. Soldering zinc, copper, brass, and aluminum

32. Assembly and fitting

Information Units

1. The name, use, and adjustments of all hand tools

2. Care of all hand tools, stakes, and machines

3. Allowance for single hem, double hem, groove seam, wire edge, and burrowing

*4. Allowance for raised bottom, Pittsburgh seam, elbow edge, "S" slide, and drive slide

5. Reading the circumference rule

6. Recognition of materials and their general characteristics and uses
7. Thickness, specification, and commercial sizes of the following: galvanized iron, sheet copper, tin plate and tern plate, brass, stainless steel, and zinc
8. Sizes and shapes of soldering coppers
9. Relative values of electric soldering coppers
10. Types of soldering pots--gas, gasoline, and charcoal
11. How to clean solder and copper
12. How to determine when the soldering iron is hot
13. Approximate cost of materials

*14. Usual commercial sizes for various kinds of stock

Suggested Projects - Sheet Metal

1. Tool box
2. Tin cup
3. Funnel
4. Dust pan
5. Measuring cup with flange lip
6. Flower sprinkler
7. Bucket
8. Shovel
9. Chicken watering trough
10. Brooder
11. Automatic feeder
12. Wastebasket

Standard Course of Study in Auto Mechanics

Operation Units

First Semester

1. Identify the individual motor parts.
2. Identify the hand tools.
3. Use a socket set.
4. Use an open end wrench.
5. Use a box wrench.
6. Disassemble an L head motor.
7. Identify and state the function of each motor part.
8. "Time" the camshaft with the crankshaft.
9. Adjust the tappets.
10. Fit the connecting rods to the crankshaft.
11. Adjust main bearing.
12. Adjust spark plugs.
13. Remove and replace tires, drop center rims, lock rim wheel, safety wheel.
14. Patch inner tube, cold patch.
15. Patch inner tube, hot patch.
16. Inspect casings.
17. Remove and replace spring shackles.
18. Adjust shackles.
19. Rebuild springs.
20. Remove and replace "I" beam axle.

21. Remove and replace tubular axle.

22. Remove and replace knee action, "Chevrolet type".

23. Remove, replace, and adjust front wheel.

24. Remove, replace, and refill shucks.

25. Remove and replace rear wheels.

26. Remove and replace rear axle bearing.

27. Remove and replace transmission, several types.

28. Overhaul transmission.

29. Remove and replace clutch.

30. Adjust clutch.

31. Put battery on charge.

32. Test battery.

33. Remove dents from fenders and body.

34. Wash and wax car.

35. Change oil and lubricate chassis.

Information Units

1. Elementary knowledge of the operating principles of internal combustion engines
2. Names and functions of engine parts
3. Procedure for dissembling motor
4. Basic principles of engine design
5. The four-stroke cycle motor
6. The need of lubrication
7. Procedure for rebuilding a motor
8. Main classification of cooling systems

9. Operation of manual and hydraulic jacks

10. Manipulation of hand tools, gauges, and air hose

11. Characteristics of each type of patch

12. Procedure for rebuilding springs

13. Function of spring shackles

14. Types of bearing used

15. Necessity for different types of axles

16. Principles underlying different types of transmission

17. Knowledge of free wheeling mechanism

18. Working principles of different types of clutch

19. Chemistry of storage battery

20. Polarity and charging rate

21. Shedding and sulfating

22. How to clean and wax a car

23. Care of interior of car

24. Things that damage car finishes

25. Types of transmission

26. State and national laws concerning the operation of autos

27. Local ordinances affecting drivers

28. Safe methods of operation

29. How to read a road map

Operation Units

Second Semester

1. Use cylinder micrometer

2. Determine the size of wrist pins, crankshaft, camshaft, with

micrometer calipers.

3. Disassemble the piston from the connecting rod.
4. Determine type of bearing.
5. Determine type of lubricating system.
6. Dissemble oil pump.
7. Test oil pump.
8. Trace flow of oil from pump to all parts of car.
9. Trace path of cooling system.
10. Disassemble carburetor.
11. Test induction coil.
12. Trace ignition circuit.
13. Adjust breaker points.
14. Test condenser.
15. Disassemble starter motor.
16. Trace current in starting motor.
17. Test starting motor.
18. Assemble generator and check output.
19. Disassemble generator.
20. Remove and replace coil spring front and rear.
21. Check caster and camber.
22. Toe in and toe out.
23. King pin inclination
24. Install shimmy wedges.
25. Rebush front end (steering)
26. Remove and replace L. S. arm knee action

27. Remove and replace axle, rear, semi-floating type.

28. Remove and replace rear axle, three-fourths floating.

29. Remove and replace rear axle, full floating type.

30. Overhaul differential, ring gear-pinion, gear-spider gears, and bearings-pinion bearing.

31. Adjust differential.

32. Reline several types of brakes.

33. Adjust mechanical and hydraulic brakes.

Information Units

1. The physics of a motor gas pressure, torque, displacement, compression ratio, etc.
2. The two-stroke-cycle motor
3. Valve grinding procedure
4. Types of lubricating systems
5. Purpose and use of oil pumps
6. The need for a cooling system
7. The maintenance of an efficient cooling system
8. Types of fuel systems
9. Octave rating of gasoline
10. Different types of axles
11. Operation of full pumps
12. Principles of carburetion
13. Methods of checking fuel systems
14. Purpose and operation of ignition systems
15. Induction coils

16. Methods of timing ignition

17. Purpose and types of spark plugs

18. Repair and operation of starting motor

19. Steering geometry

20. Types of steering gears

21. Steering adjustments

22. Theory and physics of steering

23. Theory and principles of knee action

24. Types of knee action

25. Servicing of knee action

26. The meaning of gear ratio and the effect on power and speed

27. Mechanics of differential

28. Proper lubrication for differentials

29. Adjustments of differential

30. Proper lubrication of transmission

31. Types and principles of different models of brakes

32. Methods of adjusting all types of brakes

33. Fundamental principles of hydraulics

Operation Units

Second Year

1. Compute the displacement of motor.

2. Determine accuracy of crank pin and main journal,

3. Check accuracy of thermostat.

4. Trace path of air and gasoline.

5. Clean air filter.

6. Calculate S.A.E. horsepower of motor
7. Calculate horsepower of motor at a given R.P.M.
8. Assemble starting motor and check operation.
9. Trace electric current from generator to battery.
10. Trace current in voltage and current regulator.
11. Overhaul several types of universal joints.
12. Complete check of wiring system of several types of car.
13. Replace seal beam light bulb.
14. Adjust head lights.
15. Overhaul generator.
16. Adjust charging rate of generator.
17. Adjust starter; install new brushes.
18. Overhaul bendix drive.
19. Overhaul positive shift start.
20. Check starter bushings.
21. Check and repair radiator.
22. Remove and replace water pump.
23. Repack water pump.
24. Make acetylene weld of fender or body.

Information Units

1. Valve timing diagrams
2. Classification of liquid-cooled motors
3. Duties and importance of motor oil
4. Various tests of motor oil
5. Methods of filtering and cooling oils in motors

6. Methods of lubricating main and connecting rod bearings

7. Construction of types of bearings to suit specific lubricating systems

8. Types of oil control piston rings

9. Kinds of anti-freeze

10. Petroleum products

11. Calculation of brake horsepower

12. Function of generators

13. Operation of current and voltage regulators

14. Principles and needs of the universal joint

15. Adjustment of certain types of transmission

16. Location of fuses

17. Understanding the headlight adjustment chart

18. Understanding the starting system

19. Principles of electricity and magnetism

20. Principles of water pumps

21. How to operate an air gun

22. How to prevent corrosion of battery connections

23. Results of "riding the clutch"

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

From the rise of the idea of training the hand in the school to the present time, two influences, the psychological and sociological, or the disciplinary and economical, have been contending factors in its direction. All the educational writers since the Renaissance recognize its place in education with greater or less clearness, some for disciplinary reasons chiefly, others on more practical or economical grounds.

Today, according to authorities, the tendency appears to be in the direction of building up a richer content for each subject taught in the industrial arts group. Head-training, as well as hand-training, seems to be the new slogan. We have come to realize that there must necessarily be a distinction as to the degree of skill developed in the manual arts and the vocational courses. To train for skill is only a limited part of our job, the greater part being the task of directing pupils to acquire a knowledge of shop processes, and their application in the industrial world.

It is obvious that no school or group of schools can approach in the number of courses it offers the variety of processes actually carried on in industry. The best it can do is to select certain key industries, or certain processes which are common to many industries and give instruction in them.

Industrial arts teachers ought to state specifically what they expect the boy to know and be able to do at the end of a period of instruction. This list of things ought to be in the hands of the student in order that he may measure his progress. They ought to state, also, why they think a boy ought to know these things.

One great difficulty in carrying on the work of industrial arts is to secure men who can teach in harmony with the objectives of the course.

In spite of the excellent results and promising outlook which have been reviewed, this study makes it evident that traditional practice still largely determines the content and method of the industrial subjects in the high schools. The above is evident when one knows that over 20 per cent of the schools investigated reported that their shopwork is confined to work in wood only.

While the schools must continue to impart certain so-called fundamental skills and information to every pupil, their obligation does not end there. They must anticipate the time when the pupil shall have completed his schooling and taken his place in the workaday world. They must strive to see that this place is such that the pupil may contribute his best to the work and, by so doing, secure for himself the greatest happiness. This desired result cannot be left to chance. It can come about only by causing the pupil to consider his own capabilities or capacities and his various opportunities for developing them. The school, therefore, must consciously and definitely make provision in its curriculum for accomplishing this result. Hence, an adequate program of educational and vocational guidance is at the present one of the great needs of the high school.

If our boys are to be aided in making intelligent judgments and decisions as a result of knowledge and vision in matters of relative occupational possibilities and demands, it behooves the public school authorities to make reasonable provisions for each of the following closely related activities:

1. Reliable surveys should be made of the various local occupations to determine the importance of each division of work, the constancy of and demand for employment, the opportunities for advancement, the working conditions, the remuneration and other awards, the qualifications and training needed, and other like advantages and disadvantages.
2. Continuous opportunities should be provided for the interpretation of this survey material by all pupils.

While it is encouraging to note these marked improvements in methods and procedure, it would be unwise at this time to consider any promising program as more than tentative and experimental.

Recommendations

"Efficient instruction presupposes something to teach." To help supply this "something" the following recommendations are made:

1. That Prairie View University through its Industrial Arts Department undertake the job of organizing the Negro industrial arts shops in the many high schools for the purpose of correlating their courses along standard lines.
2. That Prairie View University through its Industrial Arts Department design textbooks for each course included in this thesis so that they will meet the needs of the Negro boy.
3. That Prairie View University devote one of its educational conferences to the problems faced by industrial arts teachers.

4. That Prairie View University through its Industrial Arts Department require some of its undergraduate and graduate students writing theses to make studies of the occupations in Texas open to Negroes.
5. That the State of Texas provide a Director of Industrial Arts for the Negro high schools.
6. That the course outlines and other suggestions appearing in this thesis be adopted for use by the high schools in the state.

APPENDIX

APPENDIX A

INDUSTRIAL ARTS QUESTIONNAIRE

1. Print full name of school ____________________
2. Does your school teach:
   (Check only one)
   (a) Industrial Arts? __________
   (b) Manual Training? __________
3. How many students are enrolled? ____
4. Is the course
   (a) Compulsory? ______
   (b) Elective? ______
5. If course is compulsory what grades take it? __________
6. If course is elective what are the age limits of students? ______
7. Is a separate building used for courses? Yes ______ No ______
8. How long has this course been taught? ______ years.

Note: In the table below the word course herein used is defined as a list of recommended Industrial Arts experiences.

9.

Name of course offered	Class is taught how many Hours per Day	Days per Week	Semesters	Text Books Used
Architectural Drawing				
Mechanical Drawing				
Auto Mechanics				
Electricity				
Woodwork				
Metal Work				
Others				

10. Teacher Qualification

Name of Teacher	I. E. Subjects Taught	Number of Years	Degree Held
Example:			
1. John Doe	Woodwork	6	B.S. in Ind. Ed.
2.			
3.			
4.			
5.			

11. Shop Equipment

Drawing & Planning Division

Drawing Boards__________________
T Squares__________________
45^{o} Triangles__________________
30^{o}-60^{o} Triangles_______________
Architect's Scales_______________
Drawing Sets__________________
Drawing Desks__________________
Stools______________________

Wall Charts______________
Wood Models______________

How many students can your supplies handle?____

Woodworking Industries Power Equipment

Band Saw____________________
Jig or Scroll Saw______________
Jointer______________________
Electric Glue Pot_________

Circular Saw______________
Wood Lathe________________
Woodwork Benches__________

How many students will your available supplies such as hand saws, hammers, etc. take care of?_______________

Automobile Shop Equipment

Air Compressor_______	Socket Wrenches________	Screw Driver________
Crane______________	Valve Grinder_________	Hammers____________
Car Jack____________	Vulcanizer_____________	Pliers_____________
Crescent Wrenches____	Pressure Grease Gun____	Battery Charger_____
Monkey Wrenches_____	Drill Press___________	Wheel Aligner______
End Wrenches_______	Electric Drill________	Welding Outfit_____

Other Power Equipment

1.	5.	9.
2.	6.	10.
3.	7.	
4.	8.	

12. From what source do you get your usable supplies such as wood, paper, etc.?

1. Students____________ 2. State_________ 3. Local School Board___________

APPENDIX B

HIGH SCHOOLS STUDIED

Name of School	Location
Arlington Heights	Fort Worth
Diamond Hill	Fort Worth
Handley	Fort Worth
North Side	Fort Worth
Polytechnic	Fort Worth
Riverside	Fort Worth
R L Paschal	Fort Worth
Hillsboro High	Hillsboro
Navasota High	Navasota
Brenham High	Brenham
Kilgore High	Kilgore
Lubbock High	Lubbock
San Marcos High	San Marcos
Waco High	Waco
Wichita Falls High	Wichita Falls
Amarillo High	Amarillo
Bellville High	Bellville
Victoria Heights	Brownsville
Brownsville High	Brownsville
George Evans Jr High	Corpus Christi
Margaret Minger Jr High	Corpus Christi
Charles Crossley Jr High	Corpus Christi
Cypress-Fairbanks	Cypress
Central Junior High	Del Rio
Garfield Junior High	Del Rio
Norter Heights Junior High	Del Rio
West End Junior High	Del Rio
Ennis High	Ennis
Lanier	Houston
George Washington Junior High	Houston
Lamar High	Houston
Johnson Junior High	Houston
Austin	Houston
Regan High	Houston
Davis	Houston
Milby	Houston
Pershing Junior High	Houston
Rusk and DeZar Junior High	Houston
Garden Villas Junior High	Houston
Smithville High	Smithville
John J Pershing	Houston
Technical High	Fort Worth
John Marshall	Houston
Stephen F Austin	Houston

James S Hogg	Houston
Almeda Junior High	Houston
San Jacinto	Houston
Alexander Hamilton	Houston
Edison	Houston
Luther Burbank	Houston
Stonewall Jackson	Houston
James Deady	Houston
Oates Prairie	Houston
Beaumont High	Beaumont
Austin High	Austin
Douglass High	El Paso
Ball High	Galveston
Brackenridge High	San Antonio
Jefferson High	San Antonio
Emerson Junior High	San Antonio
Harris Junior High	San Antonio
Hawthorne Junior High	San Antonio
Irving Junior High	San Antonio
Mann Junior High	San Antonio
Page Junior High	San Antonio
Poe Junior High	San Antonio
Twain Junior High	San Antonio
Central High	Galveston
Oak Lawn High	Waxahachie
Gibbons High	Paris
Moore High	Waco
Solomon Melvin Coles	Corpus Christi
Blackshear High	San Angelo
Booker T Washington	Wichita Falls
Kilgore High	Kilgore
Lincoln	Port Arthur
Cleburne High	Cleburne
Phillis Wheatley	San Antonio
Booker T Washington	Dallas
Lincoln High	Dallas
I M Terrell	Fort Worth
Douglass	San Antonio
Yates High	Houston
Phillis Wheatley	Houston
Booker T Washington	Houston
Terrell High	Dennison
Charlton Pollard	Beaumont
F W Gross	Victoria
Anderson	Austin
Temple High	Temple
Technical High	San Antonio

APPENDIX C

TABLE XII

SHOP EQUIPMENT

DRAWING AND PLANNING DIVISION

Equipment	Number of Shops
Drawing Boards	83
T-Squares	83
45° Triangles	64
$30^{\circ}-60^{\circ}$ Triangles	64
Architect's Scales	70
Drawing Sets	60
Drawing Desks	80
Stools	80
Wall Charts	61
Wood Models	40

WOODWORKING INDUSTRIES (POWER EQUIPMENT)

Band Saw	75
Jig or Scroll Saw	80
Jointer	74
Circular Saw	80
Wood Lathe	73
Woodwork Benches	120
Glue Pot	73

AUTOMOBILE SHOP EQUIPMENT

Air Compressor	20
Crane	28
Car Jack	28
Crescent Wrenches	28
Monkey Wrenches	28
End Wrenches	28
Socket Wrenches	28
Valve Grinder	20
Vulcanizer	28
Pressure Grease Gun	28
Drill Press	20
Electric Drill	28
Screwdriver	28
Hammers	28
Pliers	28
Battery Charger	28
Wheel Aligner	16
Welding Outfit	22

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