AN ABSTRACT OF THE THESIS OF

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Date thesis is presented August 13, 1953

Title An Integrated Industrial-Arts Program for the Grant Union District Secondary Schools of Sacramento County, California

Abstract approved Redacted for privacy

The study was made to facilitate the integration, expansion, and reorganization of the industrial arts curriculum in the Grant Union High School District. The specific purposes of this study are: (1) to determine basic industrial arts curriculum for the grades seven through twelve; (2) to establish standards of competencies for the various grade levels; (3) to develop a minimum equipment list for each industrial arts area; and (4) to augment this program by recommending an administrative organization for efficient and effective operation.

In conducting the study the following procedures were used: (1) library materials were studied; (2) requests were sent to thirteen California school districts having the 6-3-3 plan; and (3) requests for information were sent to seventy-three city school districts throughout the nation. The materials compiled for this study are to be applied primarily to the Grant Union High School District.

The results of this survey when compared to the result of surveys conducted twenty years ago indicate progress is being made toward better balanced industrial arts programs. Woodwork and drawing are no longer the two main shop courses, but graphic arts, metalwork, electricity, and crafts now rank high. In the senior high school machine shop, and auto mechanics are added to the above list with radio generally taught as an advanced course of electricity.

It was noted in the study that the Grant District industrial arts program does not offer the students the broad course coverage that the average state and national city school systems offer.

When comparing the present Grant Secondary Schools industrial arts program with state and national programs there is a need for: (1) revision and extension; (2) an increased number of areas offered at all levels; (3) integration of the courses of the various schools; (4) established standards of student competencies; (5) an industrial arts curriculum that meets the needs of the students, both boys and girls; (6) course enrichment and more intensive work instituted; (7) and a qualified industrial arts man to supervise the program.

AN INTEGRATED INDUSTRIAL-ARTS PROGRAM FOR THE GRANT UNION DISTRICT SECONDARY SCHOOLS OF SACRAMENTO COUNTY, CALIFORNIA

by

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A THESIS

submitted to

OREGON STATE COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

June 1954

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Date thesis is presented August 13, 1953

Typed by Jean Jonas

ACKNOWLEDGMENT

Grateful acknowledgment is hereby given for the cooperation, assistance and guidance of Dr. Horace O. Schorling, Visiting Professor of the Department of Industrial Education at Oregon State College, and for the assistance and advice of Professor George B. Cox, in conducting this study. Particular acknowledgement is given to my wife for her help throughout the study.

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AN INTEGRATED INDUSTRIAL-ARTS PROGRAM FOR THE GRANT UNION DISTRICT SECONDARY SCHOOLS OF SACRAMENTO COUNTY, CALIFORNIA

CHAPTER I

INTRODUCTION

Integration of the industrial arts curriculum is as important as the correlation of industrial arts with the other subjects of the school program. General education includes all subjects in the curriculum, and in order for industrial arts to make its rightful contribution an efficient and well organized program must be maintained. This is possible only if leadership manifests itself. Leadership is needed to assist the teachers in understanding the philosophy and broad objectives of industrial arts and its relationship to general education.

Integration as defined by the Encyclopaedia Britannica (13, p.457) gives meaning to the word:

> In physiology it signifies the unification of the various organic functions, the knitting together and harmonizing of the manifold activities of the entire organism. The nervous system is the most important co-ordinating system and integration acquires special significance in relation to bodily, mental and psychological processes.

How well a department or departments are integrated will depend upon how well the parts are brought together to work for common goals and objectives. These goals were drafted by the Industrial Arts Policy and Planning Committee of the American Vocational Association and

published in the bulletin "A Statement of the Place and Function of Industrial Arts in Education," Barich (1, p.3,4) as follows:

> Industrial Arts is instructional shopwork which provides for all youth sound educational experiences that contribute to the satisfaction of their purposes, needs and wants.
>
> It is an integral part of the general education program of all youth. It offers those learning experiences which assist boys and girls to understand the industrial and technical aspects of life today. It is a curriculum area that makes a realistic contribution to life adjustment education. It shares with other areas of the school, the responsibility for promoting the optimum development of the good citizen.
>
> The unique contributions of Industrial Arts are centered mainly around significant aspects of the manufacturing and construction industries and their effects on daily living. Those who participate in Industrial Arts programs receive orientation in the areas of production, consumption and recreation through actual experiences in planning, producing, servicing and repairing various types of consumer goods in common usage. Through these experiences young people learn about material goods. They learn how such goods are made. They learn how to use and maintain them intelligently. They develop general skill and resourcefulness in working with things, technical and mechanical. They learn facts, principles and procedures about tools, materials, processes, mechanics and design. They learn about electricity, motors, engines, structures and other items of importance, interest and concern to all people at home, on the farm, at work and in recreation. They learn to do critical thinking in solving problems relating to these matters.
>
> Industrial Arts is organized on a basis as representative of modern industry as is possible within practical limits. The program embraces such areas as woods, metals, graphic arts, power mechanics (electricity, engines, etc.), leather, plastics and ceramics with general drawing and planning included in all of them. These areas

should not be regarded as separate subjects but as areas of experience and segments of the total program.

At no time should we lose sight of these goals, for they are the ties which link industrial arts to general education.

Integration as it is used here does not mean bringing all parts together as one but only to the point where they can function independently for the common good. The integration for which we should strive should be a program operating at the fullest efficient capacity or optimum in attaining the goals of industrial arts.

Statement of the Problem

Industrial arts programs are operating in the Grant Union High School District, but they do need integrating so that common objectives can be attained. As in many areas, growth has caused problems, and as a result, supervision and coordination of industrial arts work in the several schools of the district is necessary. The district has changed from the 8-4 plan to the 6-3-3 plan; this became effective September 1952. At the present time the district is composed of three junior high schools and one senior high school. Within the next six years one junior high school and one senior high school will be added.

The content of the industrial arts program in the Grant District has already been established in the various

schools by the shop teachers in these schools. Some of these industrial arts areas are well organized and handled, and the reason for listing them will be for comparative purposes. On the junior high school level the following areas are included:

8th grade--general shop, required of all boys.

9th grade--woodwork and metalwork, elective for boys.

On the senior high school level these areas are included:

10th grade--woodwork, pre-aircraft, and electricity; taught as electives for boys.

11th and 12th grade--woodwork, and auto mechanics; taught as electives for boys.

Under this plan, the senior high school program will be affected by the junior high school programs. All junior high school boys should have covered about the same material in general shop and elective areas of industrial arts when they enter senior high school. Without organization and integration much repetition would be necessary in order to bring all students to a basic minimum level of learning and performance. Woodwork may be used as an example: one junior high school woodworking class may have covered hand tool operations only, while in another junior high school both hand tool operations and machine operations may have been covered.

The industrial arts programs have had little supervision to date. The problem is becoming greater, and now

is the time to develop some organization for bringing the schools and teachers together to meet the common objectives. In no way should this restrict the teacher's independence, or cause him to feel the program is "cut and dried." There are important fundamentals which should be covered; how they are covered should be left to the individual teacher.

No criticism of teachers or administrators is intended for this situation has been brought about by the rapid growth of the Grant Union High School District. Only limited expansion is possible in the City of Sacramento because of the locations of the American and Sacramento Rivers. This has caused much residential growth in the Grant District and in turn has put the burden of education on this area. Many of the residents of this district work in industries, businesses, and state offices which are located in the city of Sacramento. The two air bases and signal depot located adjacent to this area have brought about a decided school growth.

Purpose of the Study

The purposes of this study are:

To determine a basic industrial arts curriculum for the grades seven through twelve in the Grant High School District.

To establish standards of students competencies at the various grade levels.

To develop a list of minimum machines for each area in the industrial arts program.

To augment this program by recommending an administrative organization for efficient and effective operation.

Procedure

The first step in this study was to check library reference materials in the industrial arts field. This material was most helpful, but it was felt that additional information should be obtained.

The survey was made to obtain first hand information on what is being done in the field. Requests were sent to all California school districts which were known to use the 6-3-3 plan. Thirteen letters (appendix, p.57) were sent, asking for information. Replies were received from twelve districts; but usable information for this study was supplied by nine.

On the national basis, seventy-three letters were sent to city schools with a population of 50,000 or more. There was no way of knowing whether the schools of these cities were using the 6-3-3 or 8-4 plan. However, returns from them indicated at what grade levels the different industrial arts activities occurred, and to what extent they were required or elective. From thirty-one replies, usable information was received from twenty-two districts.

A total of eighty-five letters were sent to school systems, which brough forty-three replies. (Chart, p.8) Thirty-three responded with usable material for this study.

Scope and Limitations

This problem is limited to establishing an industrial arts program for the junior and senior high schools of the Grant District. The entire program of industrial arts will be considered for this district. Special attention will be directed to the integration of the shop program.

There are several limiting factors which must be considered in this study. The rapid population increase of California has brought about the necessity for many additional schools. School building programs have not been able to keep pace with this rapid growth. This in turn has caused limitations to be imposed, and the industrial arts shops have been limited in floor space.

Only boys in the Grant District junior and senior high schools have been offered work in industrial arts. This is because of the lack of facilities which in many cases are not adequate to take care of the requirements of the boys.

Terminology and Definitions

The possibility of confusion will be reduced if the meanings of terms are clarified at this time. The

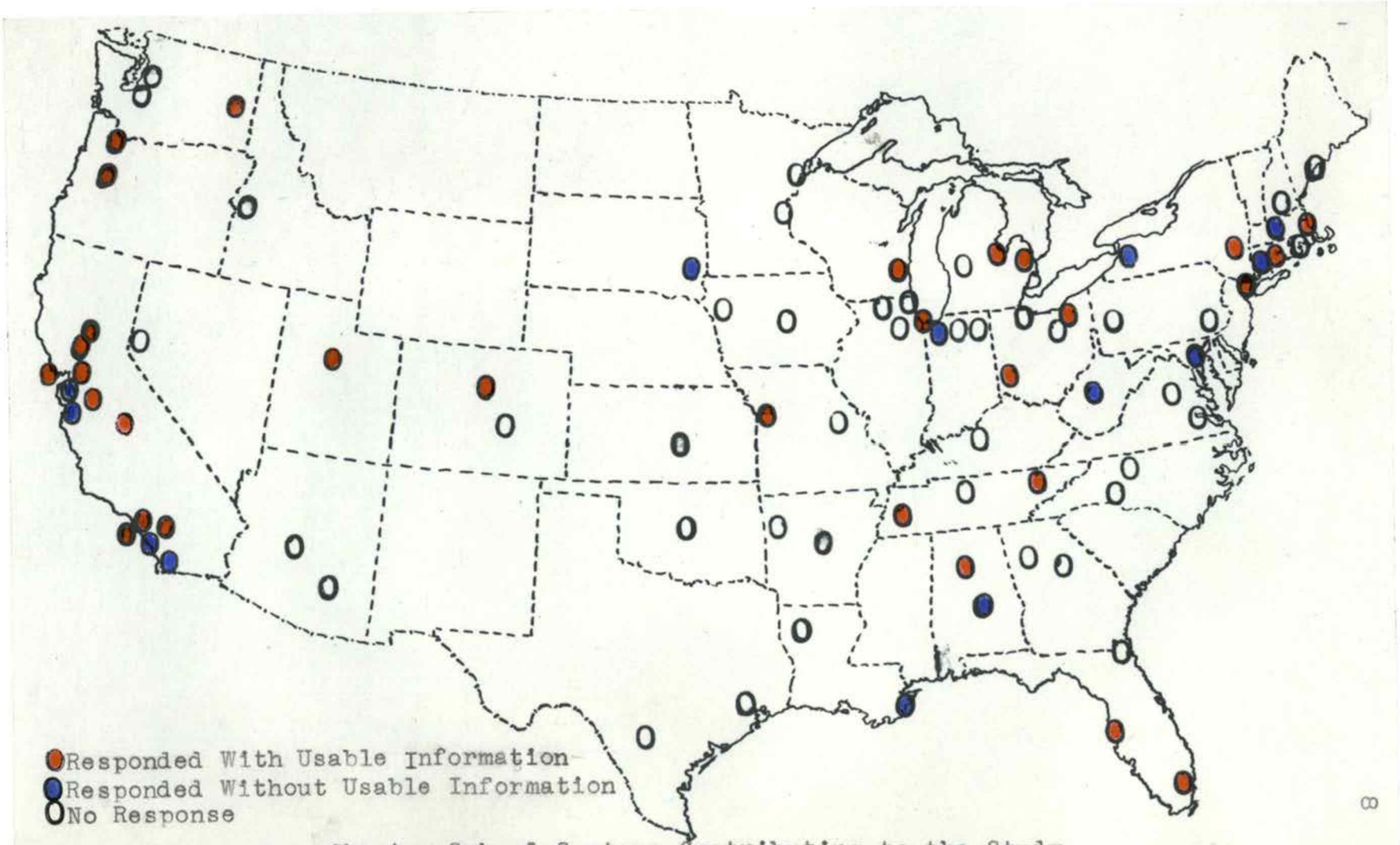


Chart - School Systems Contributing to the Study

definition of industrial arts, industrial education, practical arts, unit shop and general shop are adequately defined in the California State Department of Education Bulletin (6,p.3):

> Industrial arts is that part of general education concerned with satisfying man's inate desire to construct things with tools and materials and with the development of an intelligent understanding of our modern industrial civilization and the problems which have resulted from it. Contacts with a wide variety of manipulative experiences and industrial products are provided. Industrial arts occupies the same relationship to the school's curriculum and the areas which comprise social studies, health activities, language studies, or the fine arts. It does not attempt to develop skills needed in earning a livelihood or to train a pupil for a specific occupation. That function belongs to another field known as vocational education.
>
> Industrial education is a generic term which includes industrial arts and vocational trade and industrial education.
>
> Practical arts is functional education of a manipulative nature and includes such fields as agriculture, homemaking, and industrial arts on a nonvocational basis.
>
> Unit shop is a shop that provides facilities for experiences in a single industrial arts subject field or area such as printing, machine shop, or electrical work.
>
> General shop is a shop that provides facilities for a combination of industrial arts activities and pupil experiences in a variety of industrial arts subject fields. Activities in areas such as drafting, woodwork, metal work, and electricity may be carried on in a single room.

CHAPTER II

THE BACKGROUND FOR PLANNING AN INTEGRATED INDUSTRIAL ARTS PROGRAM

Integration of the industrial arts program is accomplished through the building of a proper foundation, and the understanding of the materials which must be used. The successful industrial arts program may not be organized without a knowledge of the purposes of general education, and of industrial arts.

Purposes of General Education

The purposes of general education upon which our present secondary schools are based, as stated broadly by authorities in the field of education, are usually readily accepted. Differences of opinion arise when specific terms are used in the application of these purposes or when attempts are made to implement general education programs.

A general statement of the issues is made by Corey (8,p.170):

> There are differences in social policy and differences in views on the nature of man. As long as men differ on these matters, they will differ on matters of educational policy and educational practice.

The reasons for the differences of opinion in general education are expressed by Gray (11,p.184) in another manner:

> The procedures are diversified, and properly so in view of the differences in the conditions that surround the institutions in which they are being developed. Certainly, at this stage rigid standardization of modes of attack on the problems involved would be a mistake. As to goals sought, a fuller understanding on the part of all interests in the field of education is much to be desired.

Many secondary educators in past years and some even today would be unable to answer the questions asked by the pupils of a class used in Chapman's illustration (7, flyleaf) as follows:

> Greeting his pupils, the master asked:
> What would you learn of me?
> And the reply came:
> How shall we care for our bodies?
> How shall we rear our children?
> How shall we work together?
> How shall we live with our fellowmen?
> How shall we play?
> For what ends shall we live?
> And the teacher pondered these words, and sorrow was in his heart, for his own learning touched not these things.

General education should answer all these questions. Morse (16,p.63) clearly states this as follows:

> The development of the capacity to form sound judgments will therefore involve three things: the refinement of logical or methodological processes in relation to subject matters to which they are appropriate; practice in dealing with particular problems; and the proper use of our heritage of discussion and knowledge. Acquaintance with the last alone may make a man an encyclopedia; familiarity with method alone may make him a skillful, intellectual chess player. The three properly coordinated may make him wise.

Wilber (24,p.3) stated the purposes of general education when he wrote:

> Careful consideration reveals, however, that when stripped of verbiage and special applications the various statements may be summed up as implying three basic purposes: (1) to transmit a way of life, (2) to improve and reconstruct that way of life, and (3) to meet the needs of individuals.

Emphasis is placed upon the individual, and continued attempts to meet the needs of the individual must always be uppermost. The National Education Association Booklet's statement is indicative of what is expected of education today:

> Every child, regardless of race, creed, social position, residence, or physical condition, should have the opportunity for the fullest development of his individual powers through education.
>
> The educational program should take into account the interests, needs and abilities of individuals. It should prepare pupils for cultural, vocational, recreational, and civic responsibilities.

A further thought on the purposes of education is presented by Bonser (5,pp.3,5):

> The aim of schooling is always educative, but the practice often is not. By the educative (aim) we mean having experiences through which we learn to act, think, or feel in ways that are better than the ways we would act, think, or feel without the experiences. No experience is educative unless we behave in someway desirably different as a result of it. The most highly educative experiences also develop tendencies to engage in further similar experiences and reveal new possibilities for larger activity.
>
> Education, of course, relates to the improvement of the desirable activities that are important in life--those that are significant in the practical life of the home and the occupations, health, community and other forms of social and civic life, and the use of leisure.
>
> Have we not very largely neglected in schools to give children experiences in the real activities

> of life and therefore failed to develop in them any connection between the things we require them to learn and the activities in which they are useful? We violate all the laws of learning and of human nature, and then wonder why children come out of the school uneducated.

Smith (20,p.50) states similar purposes of general education:

> The primary purpose of education is to develop happy, useful, and successful citizens. This purpose leads teachers to assist youth in attaining and retaining desirable attitudes, habit, and accomplishments. The instructors in the schools and to make these changes in the most effective and economical ways.

The purposes and objectives of education are many and varied, and usually stated in broad general terms. But programs are implemented in specific ways; this is true of industrial arts. Integration of an industrial arts program cannot be accomplished without both general and specific purposes.

Purposes of Industrial Arts

The purposes of industrial arts are stated many ways, but upon close examination it will be found that generally the same principles are involved. A statement of the place and purpose of industrial arts in education was used in the introduction of this thesis; but at this time a closer comparison seems appropriate. The purposes as given by the California State Department of Education (6,p.2) are:

1. Understanding industry and industrial processes through which man changes materials to increase his health, comfort, and enjoyment

2. Appreciating the influence of industrial products and industrialization upon modern social and economic life

3. Using tools, machines, and materials

4. Constructing objects to enrich personal and group living

5. Discovering personal aptitudes, interests, and abilities

6. Understanding the opportunities and requirements of industrial employment

7. Selecting, using, and caring for the products of industry

8. Developing attitudes and appreciations leading to sound safety practices in the school, in the home, and in everyday living

9. Planning and working alone and in co-operation with others toward the orderly, efficient, and complete performance of assigned and selected tasks

10. Appreciating good design and good workmanship in construction and industrial products.

11. Applying the skills of measuring and calculating, using scientific information, graphic illustration, reading and using reference materials; appreciating the values and importance of these skills.

12. Understanding the sources and conservation of the basic materials of the world that provide resources for man's comfort, health, and enjoyment

Smith (20,p.51) summarizes the industrial arts objectives:

1. Interest in Industry. To develop in each pupil an active interest in industrial life and in the methods and problems of production and exchange.

2. Appreciation and Use. To develop in each pupil the appreciation of good design and workmanship, and the ability to select, care for, and use industrial products wisely.

3. Self-discipline and Initiative. To develop in each pupil the habits of self-reliance, self-discipline, and resourcefulness in meeting practical situations.

4. Cooperative Attitudes. To develop in each pupil a readiness to assist others and to join happily in group undertakings.

5. Health and Safety. To develop in each pupil desirable attitudes and practices with respect to health and safety.

6. Interest in Achievement. To develop in each pupil a feeling of pride in his ability to do useful things and to develop worthy leisure-time interests.

7. Orderly Performance. To develop in each pupil the habit of an orderly, complete, and efficient performance of any task.

8. Drawing and Design. To develop in each pupil an understanding of drawing, and the ability to express ideas by means of drawing.

9. Shop Skills and Knowledge. To develop in each pupil a measure of skill in the use of common tools and machines, and an understanding of the problems involved in common types of construction and repair.

Some of the objectives of industrial arts as listed by Wilber (24,p.42) are as follows:

1. To explore industry and American industrial civilization in terms of its organization, raw materials, processes and operations, products, and occupations.

2. To develop recreational and avocational activities in the area of constructive work.

3. To increase an appreciation for good craftsmanship and design, both in the products of modern industry and in artifacts from the material cultures of the past.

4. To increase consumer knowledges to a point where students can select, buy, use, and maintain the products of industry intelligently.

5. To provide information about, and--in so far as possible--experiences in, the basic processes of many industries, in order that students may be more competent to choose a future vocation.

6. To encourage creative expression in terms of industrial materials.

7. To develop desirable social relationships, such as cooperation, tolerance, leadership and followership, and tact.

8. To develop a certain amount of skill in a number of basic industrial processes.

It is not the wish of the writer to create the impression that objectives or purposes written on a piece of paper will suffice as guide posts for an integrated industrial arts program. These may serve as part of the foundation upon which an industrial arts program may be built.

Philosophy of Industrial Arts

Webster defines philosophy as:

> The study and knowledge of the principles that cause, control, or explain facts and events.

What is a philosophy of industrial arts? The answer to this question is not formulated by repeating the objectives or aims of industrial arts; but rather by assembling one's own philosophy of life, philosophy of

general education, and beliefs in industrial arts. That which is set down on paper as objectives of industrial arts will not make a successful industrial arts teacher. His belief in and application of these objectives will determine his worth as a teacher. Friese (10,p.67) brings out this point:

> In the Teaching of Industrial Arts, the Teacher is more Important Than Space, Equipment, and Supplies.--The industrial arts teacher who is an educator and who sees the several educational, social, developmental, and cultural outcomes reflected in this philosophy can accomplish much more, even with limited facilities, than the run-of-the-mine teacher with all of the physical facilities he desires. Personal spirit, educational vision, and initiative can overcome shortcomings in facilities when the real objectives are constantly kept in mind.

Individuals may have somewhat different philosophies even though they are teaching in an identical situation. This is because of many influencing factors such as: home environment, religious beliefs, and physical, intellectual, and emotional growth. Lamb (15,p.7) gives his basic philosophy of industrial arts as:

> I believe that industrial arts should be made available to all children, at every level from the elementary grades up through junior college.
>
> I believe that the commonly accepted objectives for industrial arts, such as exploration, consumer-knowledge, avocational opportunities, esthetic appreciation, etc., should be critically analyzed for their teaching--learning implications.
>
> I believe that these objectives, so analyzed and selected will have desirable outcomes if put into action by a teacher of professional caliber.

I believe that the industrial-arts program should advance the program of the whole school. If it does not, it is nothing more than worthless.

I believe that each industrial-arts teacher should radiate such a sincere, wholesome philosophy of life that it would aid in shaping pupil attitudes and appreciations appropriate to the school's underlying philosophy.

I believe that an intelligent industrial arts program can provide for each pupil the opportunity to share in the common task according to interest, and capacity.

I believe that interest, initiative, and inner urge are important in shaping the quality of experiences to be had by the pupils.

I believe that opportunities can be made available in which each pupil will find many interesting and appropriate challenges.

I believe that a methodical, well-integrated industrial-arts program can result in effecting a reconstruction of pupil beliefs and habits in the light of their mutual relationships.

Concurrent with and underlying these beliefs is the notion that the common man is endowed with a natural dignity that should be respected to the extent of permitting and encouraging him to develop his personality to its greatest, happiest, and fullest capacity.

Industrial Arts Subject Areas

Industrial arts areas or courses vary with the location of the school and the needs of the particular community. The teacher or teachers, and administration may influence the areas selected. Existing facilities and ability to expand facilities are important factors to consider.

The basic subject areas as presented by Barich (1,pp.4,5):

1. General Technical Drawing
2. General Woodworking
3. General Metalworking
4. General Power-Mechanics
5. Graphic Arts
6. General Crafts
   Leather work, ceramics, textiles, plastics, jewelry, etc.

The Dade County Schools of Florida have endeavored to improve their industrial arts program to meet the present day needs. Hurst (12,pp.375-376) tells of one of the new schools:

> The new two million dollar Coral Gables Senior High School opened in September with four shops: general woods, general metals, graphic arts including drafting, and crafts. The four units operate a rotation orientational program for all first year pupils in which they spend nine weeks in each shop. Unlimited election for full semesters is allowed in all years after the exploratory year.
>
> The exploratory period of general woodshop includes bamboo, rattan and other native materials, plastics, and general hand and machine woodworking. The period in general metals includes sheet metal, machine shop auto, welding, and electricity. The period in graphics will include introduction to drafting, silk screen, bookbinding, printing, and photography. All shops will have adequate libraries, and planning centers. All shops are well equipped otherwise.

The California Guide for Industrial Education (6,p.17) lists these exploratory courses on the seventh, eighth and ninth grade level as a suggested pattern:

Planning and drawing
Woodwork
Graphic arts
Handcrafts

Electricity
General metal

The California Guide for Industrial Education (6,p.30) lists these courses for the senior high school grade level:

Drafting
Handcrafts
Woodworking
Graphic Arts
Electricity
General metal
Auto mechanics
Machine shop
Radio

It is interesting to note the changes which are taking place in the industrial arts courses offered. Handcrafts is a recent course addition; printing and electricity are rapidly gaining in popularity. The survey conducted in the state of Minnesota by Smith (19,p.73) in 1924 indicates rapid progress in printing and electricity:

Woodwork (little power machinery)
Woodturning (taught with woodwork)
Carpentry (woodwork elective)
Drawing (little freehand work)
Machine shop (limited offering)
Pattern-making and foundry (infrequently offered)
Electrical work (rapid progress)
Sheet metal (good student interest, and pretrade possibilities)
Printing (gains recognition rapidly)
Auto mechanics (widespread objectives)
Home mechanics (usually eighth grade)

The survey conducted in 1927-28 by Warner, (23,p.21) of two-hundred-ninety-four shops in the state of Ohio shows the frequency of the thirty-five highest industrial arts areas taught:

1.	Bench woodwork	179
2.	Mechanical drawing	170
3.	Cabinet and furniture construction	129
4.	Architectual drawing	70
5.	Joints, making of	63
6.	Wood-turning	58
7.	Wood and metal finishing	51
8.	Carpentry	48
9.	Farm shop and woodwork	48
10.	Blueprint reading	46
11.	Sheet metal	42
12.	Upholstering	42
13.	Electric wiring	41
14.	Design of projects in wood and metal	40
15.	Trip making	38
16.	Blueprinting	35
17.	Machine drawing	35
18.	Household mechanics	30
19.	Printing	25
20.	Forging	21
21.	Machine shop	21
22.	Reed and fibre work	21
23.	Wood inlaying	20
24.	Woodcarving	19
25.	Guidance, as occupational information	17
26.	Radio construction	17
27.	Patternmaking	17
28.	Study of industrial occupations	16
29.	Farm mechanics	14
30.	Bench metal work (not sheet metal)	13
31.	Boat-building	13
32.	Mill work	13
33.	Leather work, plain and decorative	12
34.	Cement work, plain and decorative	11
35.	Molding	11

This shows that twenty-five years ago woodwork and mechanical drawing completely dominated the industrial arts field.

Supervision

Industrial arts needs supervision, as do all general education subjects. The best program of industrial arts must have supervision if it is to maintain that position.

In a small high school supervision may be taken care of by the principal or some designated person. However, the principal's lack of time and frequent lack of a knowledge of industrial arts may limit the amount and quality of supervision given to this area. In larger school systems industrial arts is usually supervised by a part time or full time person who works in close cooperation with the superintendent and principals of the various schools. The school organization of today has become more complicated and the special subject fields have been neglected because of the lack of qualified personnel. The need for supervision which applies to the industrial arts field is stated by Barr (2,p.36) as follows:

> Supervision of the functional service basis is a necessary, integral part of any general educational program and of any specific school system because:
>
> 1. Supervision as expert service on the consultancy basis is an accepted principle in all difficult and complex human undertakings in any line of endeavor.
>
> 2. Education, particularly, is complex and intricate, and furthermore is carried on in minute divisions, classrooms, scattered throughout a community and over the nation. The great extension of educational opportunity particularly on the secondary level increases the demands for technical assistance. Brief teacher tenure also complicates the situation. Supervision in the sense of leadership will contribute to unity (not uniformity) of purpose and coordination of effort.

A further statement for the necessity of a supervisory program is made by Jellison (14,p.7):

The needs of industrial arts teachers can best be determined by a well-organized supervisory program. Any good supervisory program should recognize the needs of all students in the program being supervised. It should concern itself with the problems of the teacher and the relationship that should exist between the supervisor and the teachers with whom he must work.

It is not the aim of the writer to give a basis from which to build a supervisory program, but rather to justify the organization of a supervisory program. To further show the supervisory need, Stoops (21,pp.29-30) says:

Necessity for considering supervisory needs. In addition to the advisability of answering the challenges of economy-minded boards of education and critical teachers, Brueckner has indicated that teachers do not work up to capacity without supervisory services:

At the present time there is a low correlation between the estimated ability of a teacher and the results of her teaching as measured by the scores made by pupils on standardized tests.

This statement points out the necessity for considering supervisory help which teachers desire and the types of needs for supervisory services.

The Third Yearbook of the Department of Supervisors and Directors of Instruction presents the results of a study in which 154 supervisory officers reported 1682 teachers requests for assistance during one semester. The frequency and type of requests follow:

Requests concerning desirable methods	318
Requests for advice concerning individual needs and difficulties of pupils	271
Requests for provision of materials of instruction, supplies and equipment	136
Requests for help in the selection of materials of instruction, supplies, and equipment	83
Requests for diagnosis of teaching difficulties	68

The foregoing data point to the inference that teachers are aware of their instructional inadequacies and desire constructive help.

Types of needs. An almost endless list of needs for supervisory services at the secondary level could be catalogued, but most of them can be organized under the general headings of (1) need for teacher growth in service, (2) need for curriculum readaptation, (3) need for enriched instructional materials, (4) need for appropriate physical conditions, and (5) need for adequate supplies and equipment.

The following concise statement by Wiles (25,p.3) justifies a supervisory program:

> The basic function of supervision is to improve the learning situation for children. If any person in a supervisory position is not contributing to more effective learning in the classroom, his existence in that position cannot be justified. Organization, equipment, staff relationships, and teacher welfare are important only as devices for improving learning opportunities for children. Supervision is a service activity that exists to help teachers do their job better.

It would appear from the following list of duties that integration of the industrial arts in the several schools of a district should be the responsibility of a supervisor. Jellison (14,p.7) states these duties for the supervisor:

1. Assist in the development of curriculum studies.
2. Teacher improvement.
3. The development of new techniques and methods.
4. The development of new materials.
5. Conduct teacher conferences and group meetings.
6. Teacher evaluation.
7. Public relations.
8. Programs of safety.
9. Recommendations to the business office concerning supplies and equipment.

Jellison (14,p.7) further states the things that a teacher wants from the supervisor:

> Teachers want give-and-take in a supervisor. One who can admit it when he is wrong, who can let the little things pass and not bring them up six months later.
>
> Teachers want a supervisor who is easy to talk to.
>
> Teachers want to feel that the supervisor knows what he is talking about and who usually has the answers.
>
> Teachers want a supervisor who will compare them with other members of the staff.
>
> Teachers want a supervisor who will "stick up" for them if they are right. They want one who will not alibi out of a situation and who will criticize them in private.
>
> Teachers want a supervisor who can get results, who can get them supplies and materials, who can settle their many problems.
>
> Teachers want a supervisor who understands the significance of industrial arts in today's world, who helps them relate the work in the classroom and shop to meet the needs of the community and nation.

It is evident that industrial arts as well as other subjects on the secondary level need supervision. That supervision which is recognized as good has shown a definite trend away from telling the teachers what should be done to a more democratic form of planning and working together. It is generally conceded that supervision is still in an experimental state in our schools. In a comprehensive nation-wide survey Schorling (17,pp.142,143) shows in his conclusion the weaknesses and needs of present day supervision:

1. There is a definite need for improvement and expansion of state and local supervision of industrial arts.

2. Supervisory practices are lagging well behind supervisory theory on both the state and local levels.

3. The training and experience of many of the present state and local supervisory personnel are generally not of the kind most needed for the adequate supervision of industrial arts.

4. Because of divided responsibilities, most of the vocational supervisors and general supervisors are unable to provide many of the desirable and necessary services for industrial arts teachers and school administrators.

5. Desirable supervisory practices in industrial arts are performed more consistently and with greater regularity whenever the responsibility for supervisory services is placed with special industrial arts supervisors.

6. State and local industrial arts supervisors need staff assistance if more and better supervisory services are to be provided.

7. On the state level, the services most generally emphasized are those relating to the improvement of personnel.

8. There is considerably more detail connected with supervision on the local level than on the state level; in addition, there is a tendency for a better balance among the various types of services provided by the local supervisors.

9. There is need for cleaner statements and understandings of the substance and procedures of industrial arts supervision on both the state and local levels.

10. There is evidence of a need on the part of some of the state and local supervisory personnel for clearer concepts of the meaning of democratic, cooperative, and creative supervision.

CHAPTER III

THE STUDY

The rapid population increase necessitated the establishment of the 6-3-3 plan in the Grant District. The need for integrating the industrial arts programs in the junior high schools and the senior high school is the result of this change. Books and periodicals were checked for useful material relative to organizing an integrated industrial arts program. A survey was made in the state of California to secure information about industrial arts programs in school systems using the 6-3-3 plan. On the national level, information was obtained relating to the industrial arts courses taught at the various grade levels.

The purpose of this study is to obtain information and guidance so that the best possible integration of courses may be accomplished. The adoption of a definite curriculum plan which leads to a smoothly operating program will offer the students maximum opportunities for progress in this phase of general education.

To insure the proper functioning of this program, an administrative organization must be established. Revision of the program must be a continuous process, first to stabilize the program, then to keep it up to date.

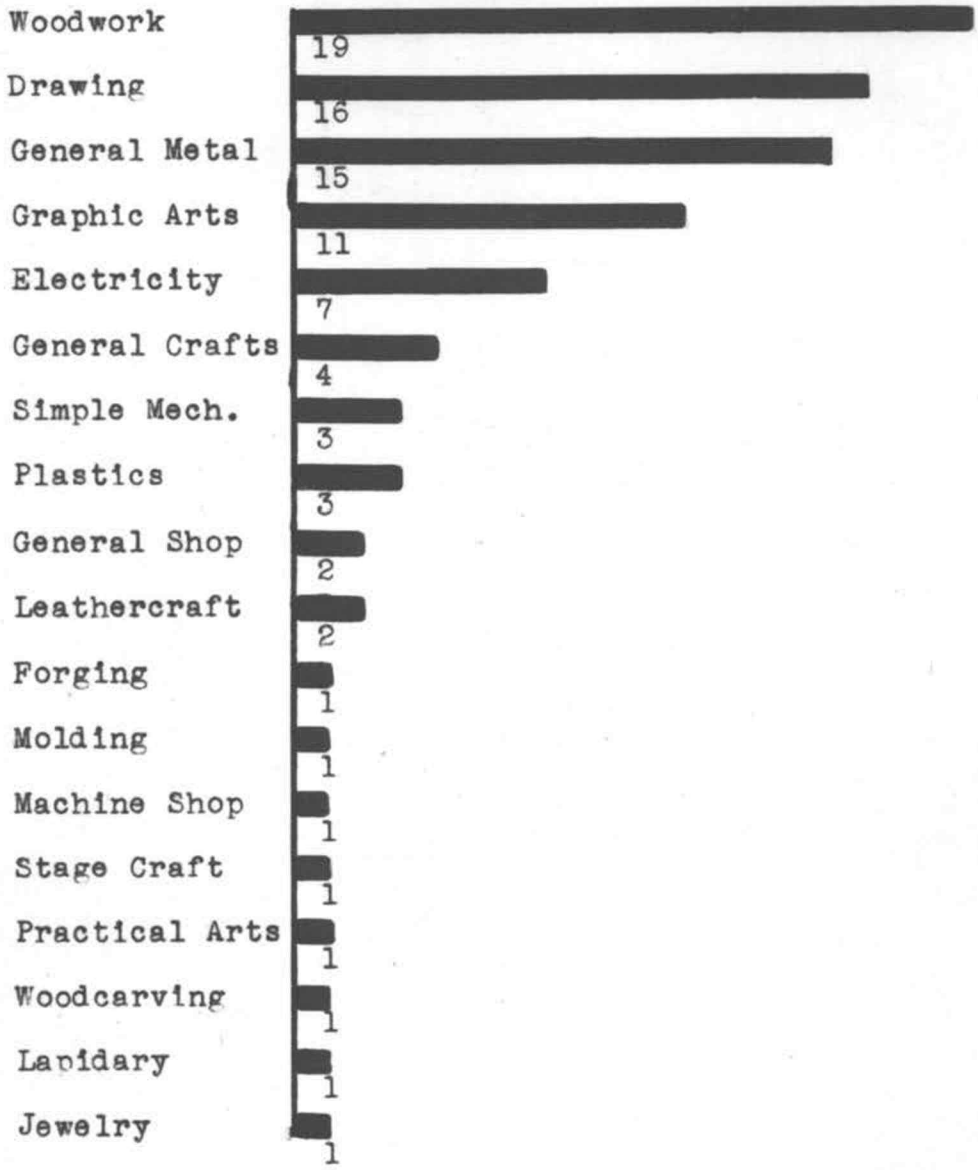
There probably was no time in history when people saw as great a change in everyday living, as they do today. This ever changing industrialized world forces problems upon education; industrial arts should be prepared to help the students face and solve some of these perplexing problems. An organized and integrated industrial arts program with the proper leadership will make a maximum contribution.

National Junior High School Course Frequency

The junior high school, with its exploratory industrial arts courses, should help to reveal to the student some of his likes and dislikes. The results of the national survey made in 1952 for this study, shown in graphs I, II, and III, pages 29, 30, and 31, when compared with the study made in 1927-28 by Warner, (page 20 of this thesis), shows much progress toward a better balanced industrial arts program on the junior high school level.

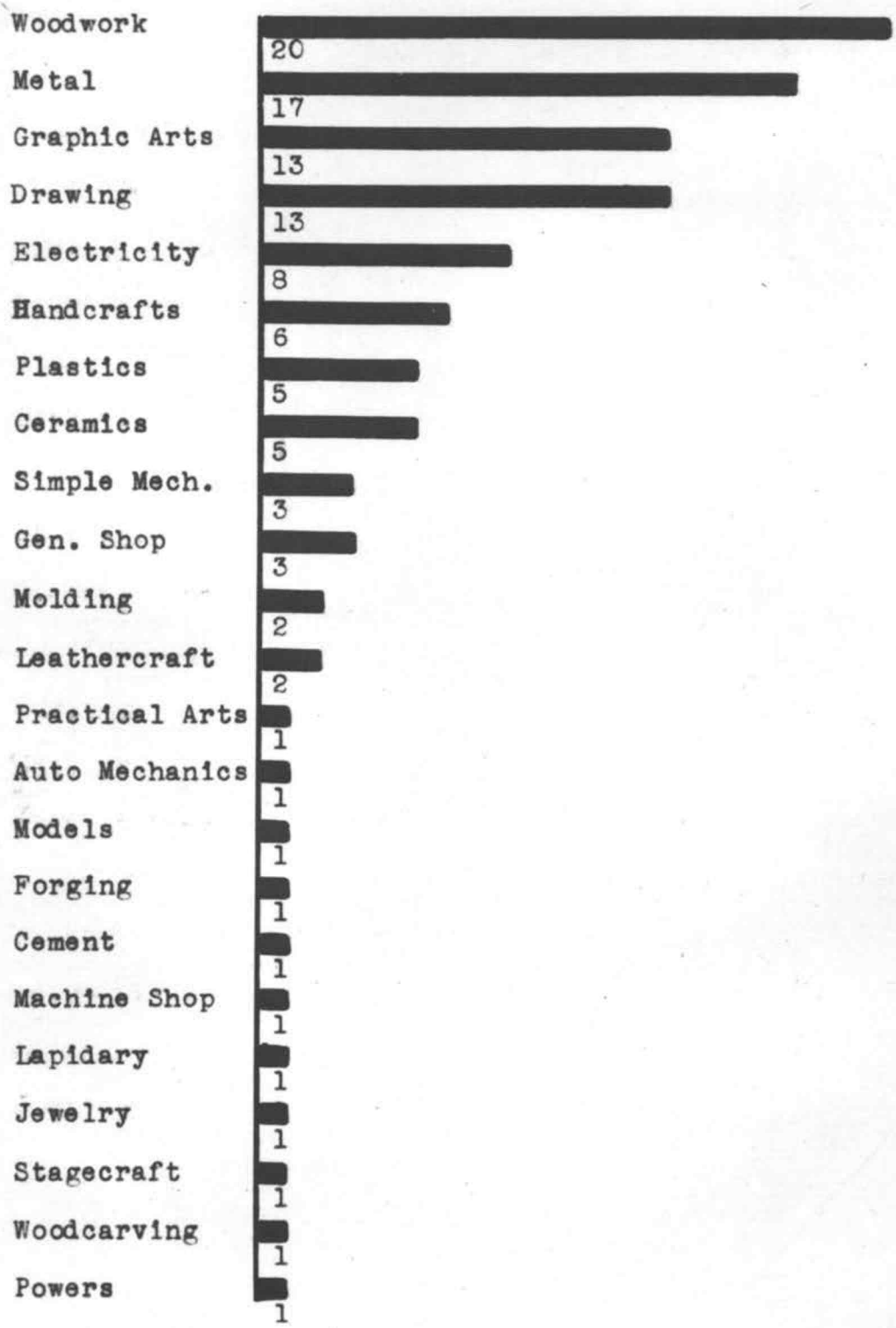
Graph I

Frequency With Which Industrial Arts Courses
Occur Nationally
Grade 7



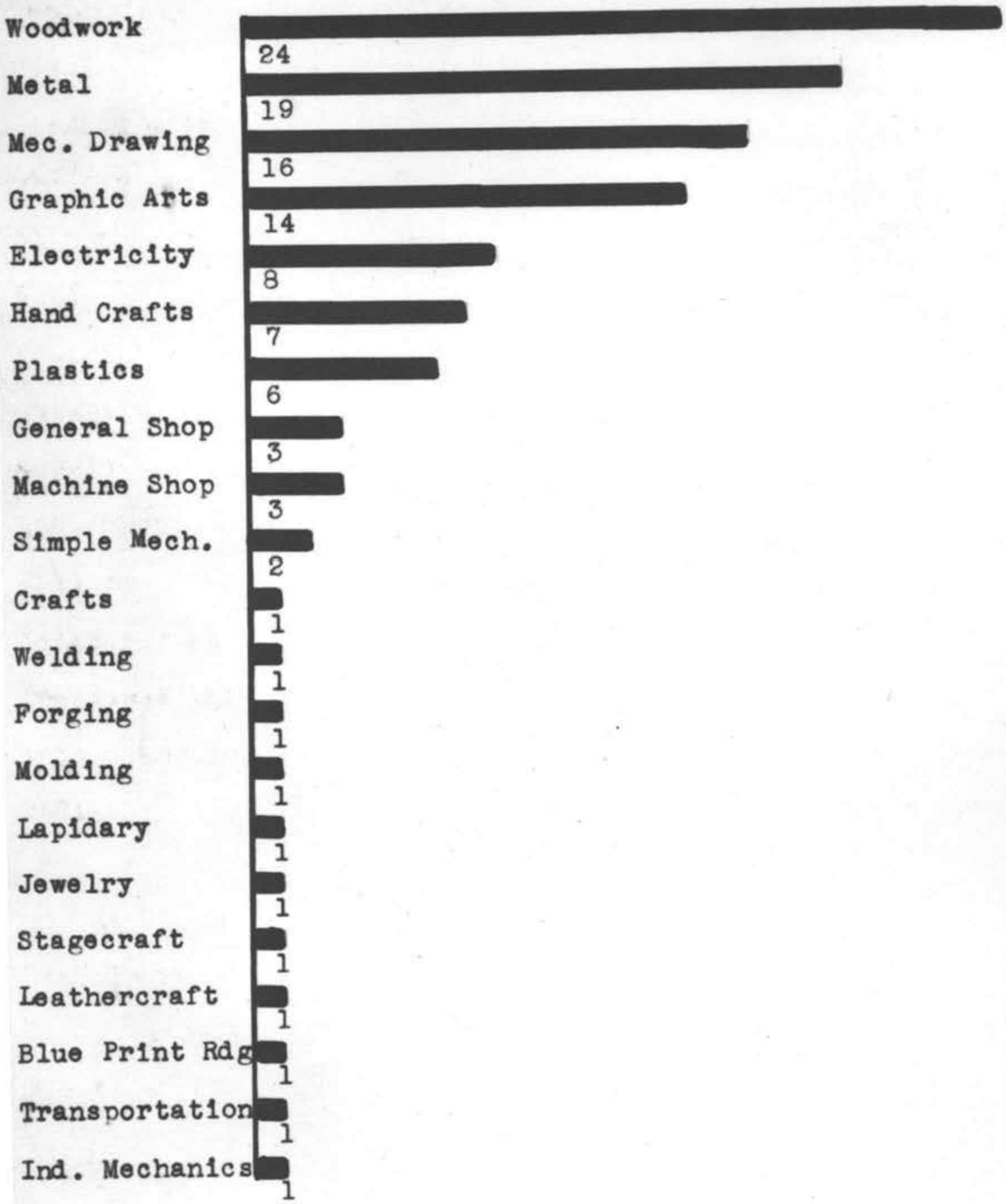
Graph II

Frequency With Which Industrial Arts Courses
Occur Nationally
Grade 8



Graph III

Frequency With Which Industrial Arts Courses Occur Nationally
Grade 9



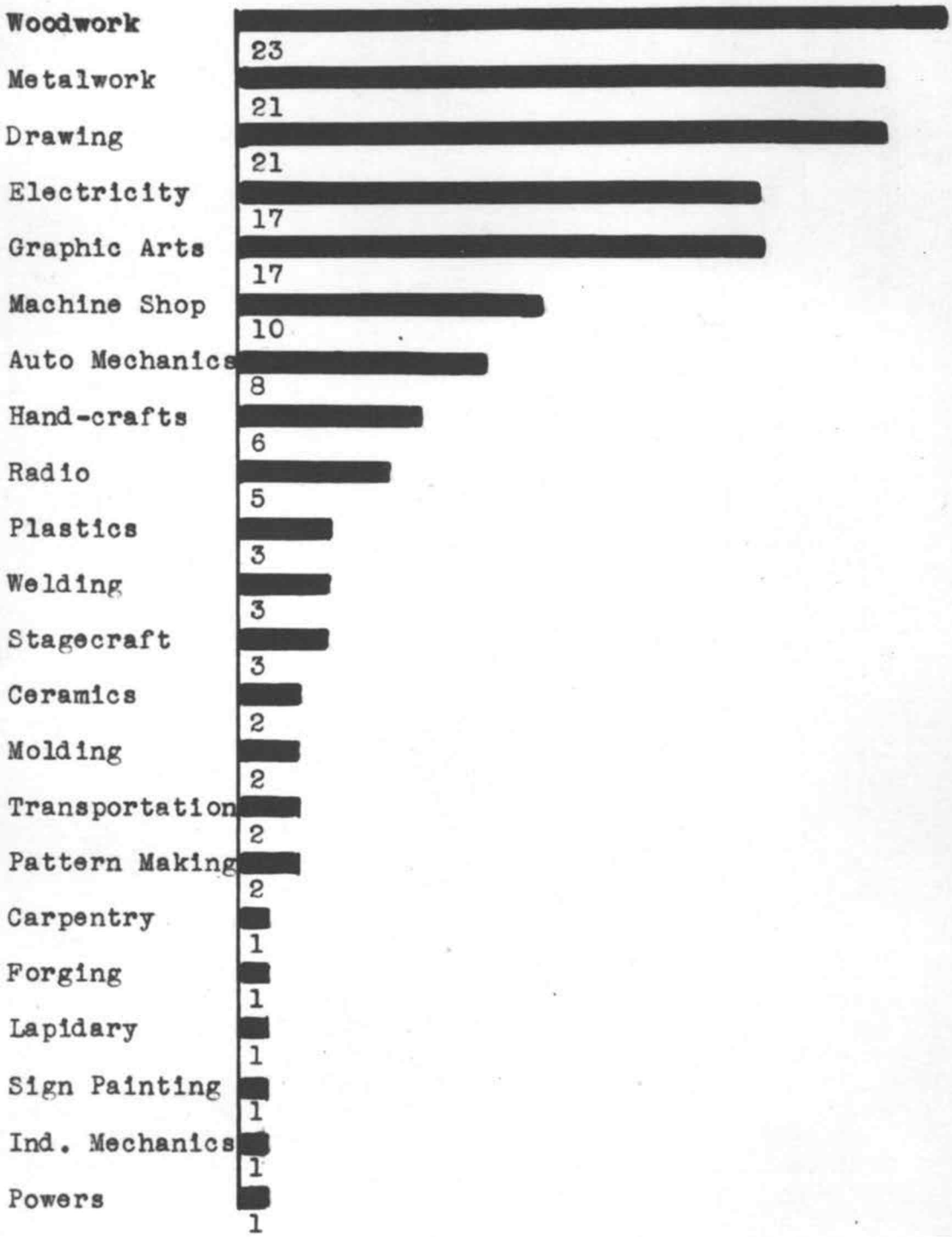
Since the beginning of instruction in shop work in the elementary and secondary schools of our nation, woodwork has been the predominate course taught. The most notable advances are seen in general metals, graphic arts, electricity, and general crafts areas. The frequency with which these courses are taught on the junior high school level throughout the nation is approaching that of woodwork.

National Senior High School Course Frequency

The senior high school student of today in contrast to the junior high school student frequently has a selection of unit shops from which to choose. This selection should be stimulated and brought about, for more intensive study, planning, and work in the shops, by the previous experience on the junior high school level. The national senior high school industrial arts course frequency is shown in graphs IV, V, and VI, pages 33, 34, and 35.

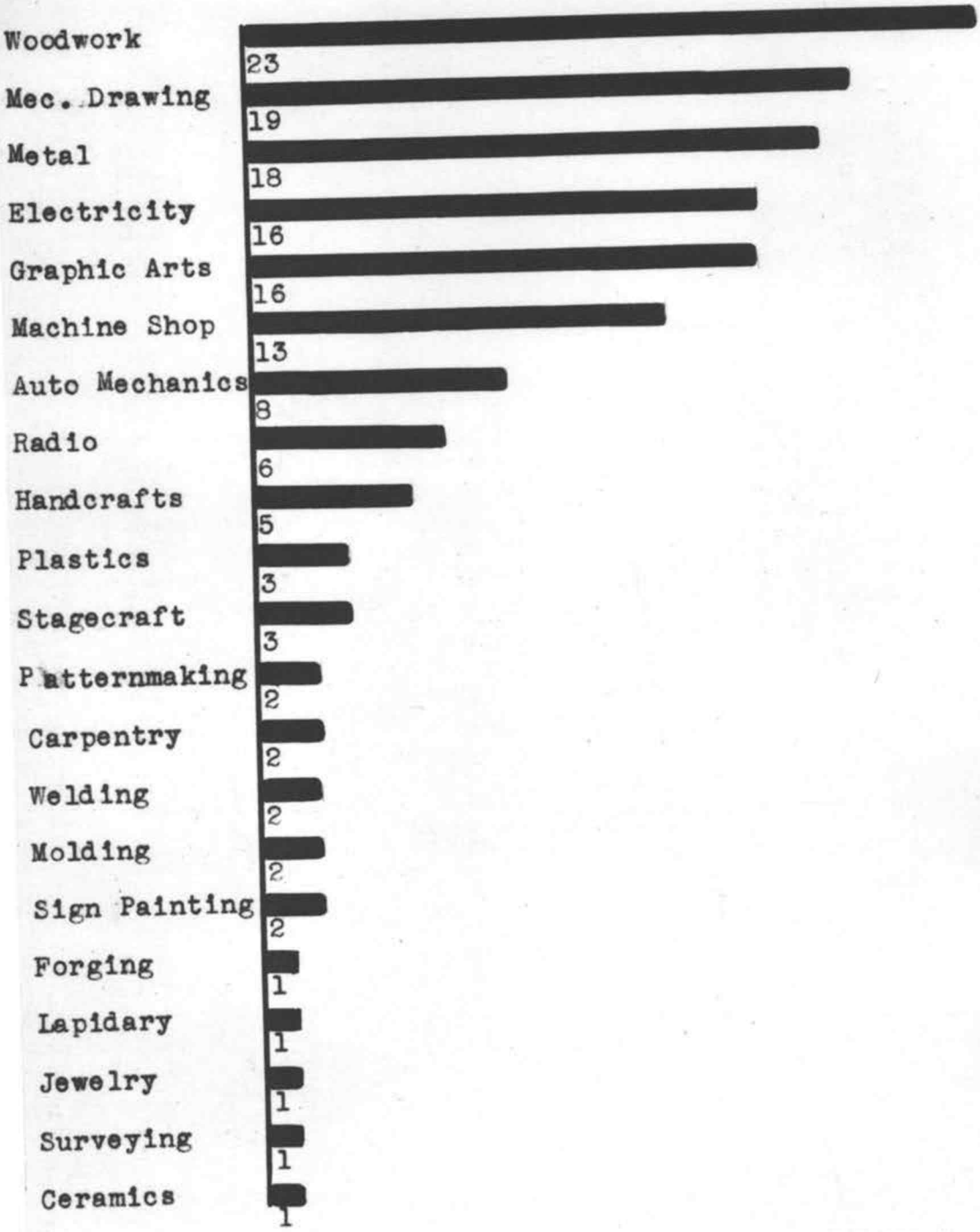
Graph IV

Frequency With Which Industrial Arts Courses
Occur Nationally
Grade 10



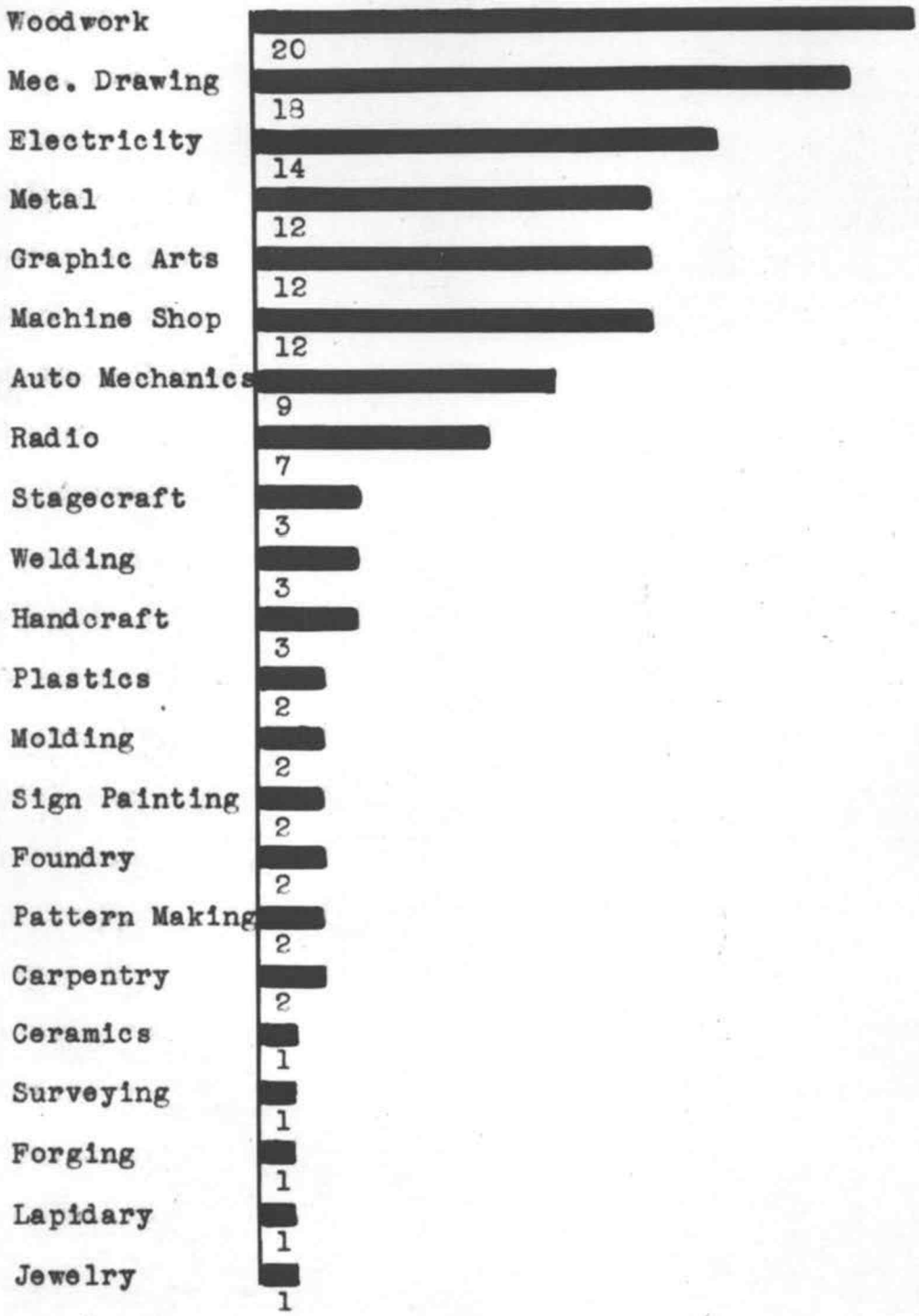
Graph V

Frequency With Which Industrial Arts Courses
Occur Nationally
Grade 11



Graph VI

Frequency With Which Industrial Arts Courses Occur Nationally
Grade 12



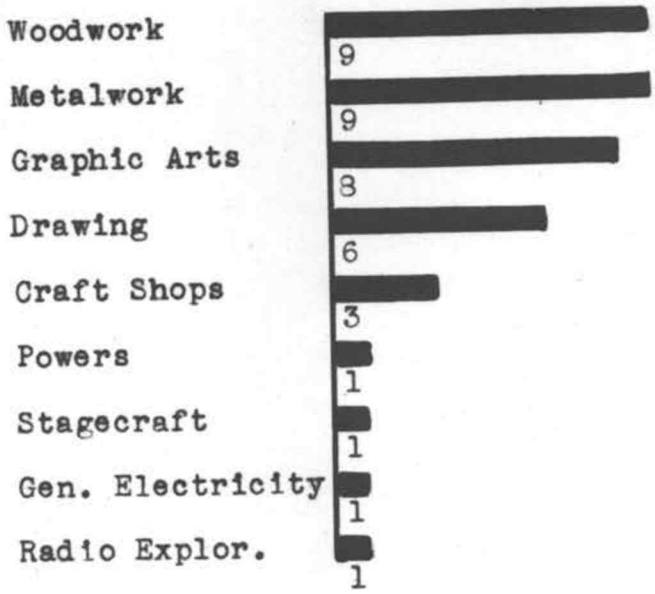
Graphs IV, V and VI show the present tendency to broaden and enrich the industrial arts program on the senior high school level. The philosophy shifts from broad exploration on the junior high school level to specialization on the senior high school level. The need for further course areas has been met by the addition of machine shop, auto mechanics, handcrafts, and radio in the senior high schools.

California Junior High School Course Frequency

Enriching the curriculum through a broader coverage of industrial arts courses has been one of the aims of industrial arts during the past thirty years. The trend of industrial arts in the junior high schools of California using the 6-3-3 plan is shown in graph VII, page 37.

Graph VII

Frequency With Which Industrial Arts Courses Occur In California Junior High Schools



Woodwork is generally expected to hold first place as the most taught area of industrial arts; but it is rather surprising and gratifying to see other areas taking an important place. Metalwork has moved into the same position with woodwork, as shown in this survey. Graphic arts has moved very close to wood and metalwork. Craft shops have been added to the program to provide activities of an exploratory and avocational nature. Radio and electricity on the junior high school level is moving into its rightful place.

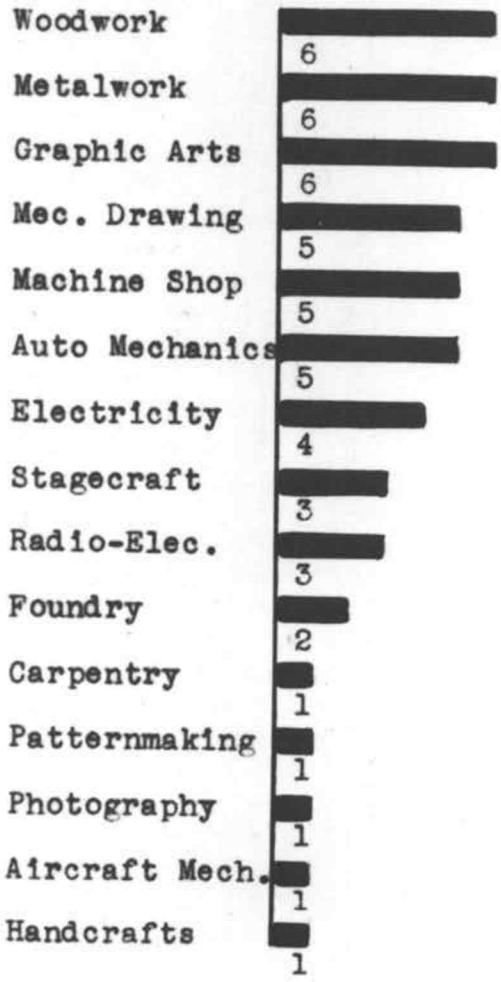
This tends to show that the needs of the students are gradually being met more fully than they were when manual training was the only shop work offered students.

California Senior High School Course Frequency

The coverage of basic industrial areas in the senior high schools of California is an attempt to give young people, enrolled in industrial arts classes, the experiences needed to live in this industrial area. Graph VIII, page 39, shows a better grouping of courses as to frequency than is noted on the national basis.

Graph VIII

Frequency With Which Industrial Arts Courses Occur In California Senior High Schools



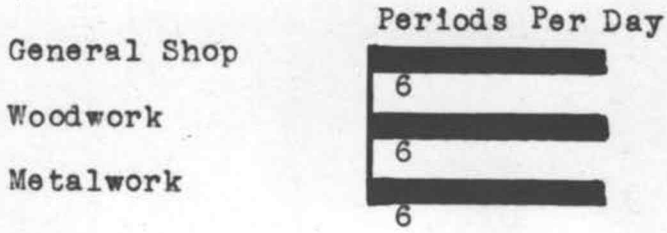
The state and national progress of industrial arts is encouraging. California is rapidly becoming an industrialized state and this development may have influenced the educational trend. A comparison of this state to the national industrial arts progress indicates California has made more progress than is generally noted nationally.

Industrial Arts Program of the Grant Secondary Schools

One of the objectives of this study is to obtain basic information for improving and broadening the industrial arts program of the Grant Union High School District. Comparing graphs IX and X, page 41, with the foregoing material will indicate the needs for revision and extention of the program.

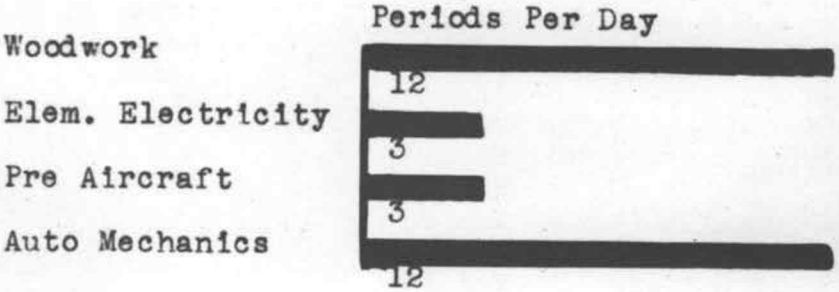
Graph IX

Junior High School Industrial Arts Courses
Taught in the Grant District



Graph X

Senior High School Industrial Arts Courses
Taught in the Grant District



A comparison of Graph IX with Graph VII and Graph X with Graph VIII reveals the following deficiencies in the Grant Secondary Schools' industrial arts program:

Junior High School

1. Industrials arts is not taught in grade 7
2. Graphic arts is omitted
3. General electricity and radio is omitted
4. Handcrafts are omitted

Senior High School

1. Graphic arts is omitted
2. Metalwork is omitted
3. Advanced electricity and radio are omitted
4. Woodwork and auto mechanics are in need of revision

Note: Drawing, which appears to be omitted, is taught as a unit of each shop area as it relates to each.

Metalwork, graphic arts, radio and electricity are an integral part of everyday living. Exploratory and prevocational experiences should be offered at these grade levels.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In general the purposes of this study are to integrat e, expand, and reorganize the industrial arts curriculum in the Grant Union High School District. These needs became evident when this district adopted the 6-3-3 plan; three junior high schools and one senior high school replaced the one four year high school. The lack of integration of the industrial arts programs of these four schools was apparent. The plan to add a junior high school and a senior high school within the next six years creates further need for better supervision, organization, and integration of the total industrial arts program.

The specific purposes of this study are:

To determine basic industrial arts curriculum for the grades seven through twelve in the Grant High School District.

To establish standards of compentencies for the various grade levels.

To develop a list of minimum equipment for each area in the industrial arts program.

To augment this program by recommending an administrative organization for efficient and effective operation.

The introductory chapter of this study defines integration, and the goals of industrial arts are enumerated. The chapter also points out the close relationship of the junior and senior high school programs and why the well integrated program is necessary. The need for supervision for this proposed integrated program is established.

The following steps were used in making this study:

1. Library materials were checked.

2. Requests were sent to the thirteen California school districts having the 6-3-3 plan.

3. Requests for information were sent to seventy-three city school districts throughout the nation.

The materials compiled for this study are to be applied primarily to the industrial arts program of the Grant District. The present industrial arts program, due to inadequate facilities, is limited to boys.

A section on terminology and definitions related to industrial arts is included at the close of chapter one.

Chapter II formulates a foundation of a balanced industrial arts program that meets the needs of the students.

This chapter is composed of five sections which are summarized on the following pages.

Purposes of General Education

When authorities in the field of education state the purposes of general education broadly they are readily accepted; it is when specific terms are used in the application of these purposes that differences of opinion arise. Quotations from the writing in the field of education are included. A knowledge of both general and specific purposes of education are necessary for the successful integration of an industrial arts program.

Purposes of Industrial Arts

The purposes of industrial arts are stated many ways, but upon close examination it is found that generally the same principles are involved. The purposes listed by several authors are included to illustrate this similarity. The understanding of these purposes is fundamental to integrating an industrial arts program.

Philosophy of Industrial Arts

A philosophy of industrial arts is not formulated by repeating the objectives or aims of industrial arts; but by assembling one's own philosophy of life, philosophy of general education, and beliefs in industrial arts. One's philosophy is influenced by many factors such as: home environment, religious beliefs, and physical, intellectual, and emotional development.

Industrial Arts Subject Areas

Industrial arts courses or areas may vary with the location of the school and the needs of the particular community. Existing facilities and ability to expand these facilities are important factors to consider. Industrial arts courses as listed by the state and national industrial arts education organizations show little variation in the courses taught. In most cases the six courses found heading the list are: woodwork, metalwork, drawing, graphic arts, electricity, and handcrafts. Compared with earlier surveys, in which woodwork and mechanical drawing completely dominated the industrial arts field, this shows progress.

Supervision

The material included in the section on supervision indicates a definite need for supervision of the industrial arts program by a qualified industrial arts person.

Chapter III was divided into five sections so that comparisons could be made between national and state industrial arts programs, and between state and local industrial arts programs on both junior high school and senior high school levels. This everchanging industrialized world is one of the main factors influencing a

change in the industrial arts programs. The summary of these findings is presented on the following pages.

National Junior High School Course Frequency

The results of this survey when compared to the result of surveys conducted twenty years ago indicate progress is being made toward better balanced industrial arts programs. Woodwork is no longer the only industrial arts course taught in many schools; metalwork, graphic arts, and electricity have become more popular. The addition of these courses offer a more extensive exploratory program.

National Senior High School Course Frequency

On the senior high school level the philosophy shifts from the broad exploratory program of the junior high school to specialization. The study shows the present tendency to broaden and enrich the senior high industrial arts program.

California Junior High School Course Frequency

The survey of California junior high schools shows a better grouping than is noted on the national level. The frequencies of the top six courses taught are very close. These courses are woodwork, metalwork, graphic

arts, drawing, crafts, and electricity. This indicates improvement in meeting the needs of the students by providing a broader base for exploration.

California Senior High School Course Frequency

The survey of California senior high schools shows a grouping that is better than the national grouping for the same level. The top ranking industrial arts courses on this level indicate more unit shops are offered than on the national level.

Industrial Arts Program of the Grant Secondary Schools

In comparing the present Grant Secondary Schools industrial arts program with programs on the national level and in California, the following conclusions. All conclusions are in reference to the Grant High School District.

Conclusions

1. There is a need for revision and extension of the junior high school and senior high school industrial arts programs.

2. The number of areas offered at all levels should be increased.

3. There is a need for integration of the industrial arts areas of the various schools in the district.

4. There is evidence of a need for established standards of student competencies.

5. There is a need for an industrial arts curriculum that meets the fundamental needs of the students.

6. Course enrichment and more intensive work should be instituted.

7. There is a need to expand the industrial arts curriculum to meet the needs of the girls in this district.

8. There is a definite need for a qualified industrial arts man to supervise the program.

Recommendations

On the basis of the material that has been presented the following recommendations concerning the Grant High School District are offered.

1. It is recommended that the industrial arts programs of the various schools be revised to meet the needs of the students on each grade level, seven through twelve. This program should have sufficient flexability to provide for the interests and need of individual students.

2. On the junior high school level broad general shop areas are recommended to meet the exploratory needs of students.

3. Industrial arts should be extended to provide shop work for the seventh grade pupils.

4. It is recommended that an increase be made in the number of areas offered on all levels, seven through twelve. This is illustrated in the proposed course plan which can be found in Appendix B. This plan provides for the addition of graphic arts, electricity, and metalwork.

5. It is recommended that the industrial arts program of the Grant District be integrated so that it may function smoothly and with advantage to all. Such an integrated program would eliminate undesirable or unplanned duplication of instruction. Unnecessary duplication of expensive equipment could also be eliminated.

6. It is recommended that basic standards of student competencies be established through teacher and supervisor cooperation in order to facilitate the integration of the industrial arts program and promote learning. Equalization of opportunities and standards of attainment could be achieved through cooperative planning.

7. It is recommended that the industrial arts courses be enriched to provide maximum opportunities for the development of the student on various intellectual levels. Such a program would have something to offer the fast as well as the slow learners.

8. It is recommended that, when facilities can be made available, the curriculum be expanded to provide industrial arts for the girls in this district.

9. It is further recommended that a man prepared and qualified in the field of industrial arts be appointed to supervise the program. The basic function of the supervisor is to aid in improving the teacher-learning situation. This may be accomplished in many ways but must be planned for by providing the administrative organization which will give industrial arts the leadership it needs.

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APPENDICES

APPENDIX A

LETTERS REQUESTING INFORMATION FOR THE STUDY

214 Doolittle Street
Del Paso Heights 4, Calif.
March 26, 1952

Mr. G. Millage Montgomery
Division of Secondary Education
451 N. Hill Street
Los Angeles 12, California

Dear Mr. Montgomery:

Please send me any information you may have related to your junior and senior high school industrial arts program. We are making plans for three junior high schools in our district, and would appreciate any information you can furnish at this time.

This may be in relation to the program from the seventh through the twelfth grade, also shop facilities which are considered necessary to carry out your industrial arts program.

Thank you for your consideration in helping with this problem.

Sincerely yours,

Leroy Nedom

214 Doolittle Street
Del Paso Heights 4, Calif.
April 16, 1952

Gentlemen:

Within the next two years, we are opening three junior high schools in our district, and would appreciate any help we can obtain from cities having well established junior and senior high school industrial arts programs.

We realize that general plans are available from state departments of education; but we would like to have first hand information on programs which are in use in your school system. This information in conjunction with material supplied by other schools would give us an opportunity to develop a program most satisfactory to our needs.

Any information related to your industrial arts program, grades seven to twelve inclusive, would be very helpful. We are particularly interested in course content and grade level, tools and machinery, which are necessary to conduct the program.

Any consideration you can give us in assisting with this problem will be appreciated.

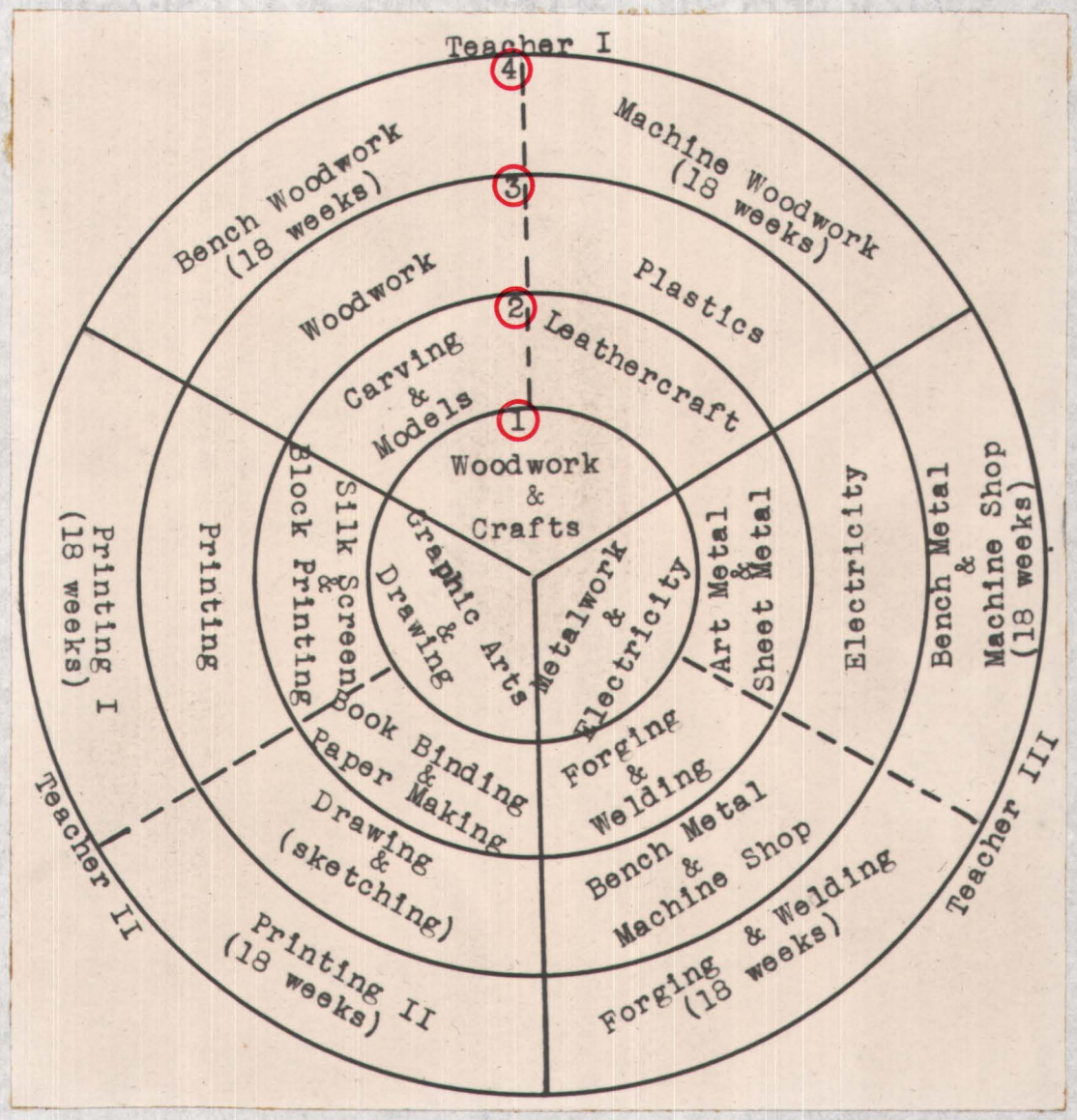
Sincerely yours,

Leroy Nedom

APPENDIX B

PROPOSED COURSE PLAN

Recommended Junior High School Industrial Arts Program



The illustration above indicates the areas which could be taught on the junior high school level when three industrial arts teachers are employed. Each general area, as indicated in the inner circle (1), is taught by one teacher. The units to be covered on the various grade

levels are shown on the following pages. Circle (2) indicates the areas required of all seventh grade boys. The student will rotate through all low seventh grade areas with six weeks in each. During the second semester all boys will rotate through all high seventh grade areas with six weeks in each. Circle (3) indicates the areas required of all eighth grade boys. These areas should be covered in the order indicated in the following course plans, all low eighth areas first, then all high eighth. Circle (4), the ninth grade, offers the students two semesters work in elective areas.

This method of handling the industrial arts courses makes available to the students a much broader and richer program without the addition of staff members. The additional equipment needed may be kept to a minimum and greater use of existing facilities realized.

Woodwork and Crafts--Teacher I

Carving and Models--Low 7

1. Design and project selection
2. Plans and procedure
3. Layout design
4. Use of tools
5. Care of tools
6. Finishing
7. Safety*

---

*Safety information is disseminated throughout each area.

Leathercraft--High 7

1. History of leather
2. Use of tools
3. Leather manufacturing and purchase
4. Kinds of leather
5. Simple processing of leather
6. Simple construction
7. Safety

Plastics--Low 8

1. History of plastics and development
2. Plastic industry
3. Plastic materials
4. Sawing and filing
5. Shaping, carving, and cementing
6. Sanding and finishing
7. Safety
8. Occupational*

Woodwork--High 8

1. Lumber identification
2. Shop safety and student behavior
3. Sketching and planning
4. Layout tools
5. Saws
6. Planes
7. Edge smoothing tools
8. Boring tools
9. Glue and gluing
10. Fasteners
11. Finishing

Bench Woodwork--Low 9

1. Lumber
2. Sketching and planning
3. Shop safety
4. Layout tools
5. Cutting tools, saws
6. Planes
7. Chisels and knives

---

*Occupational information is disseminated throughout each area.

8. Wood files
9. Holding
10. Boring
11. Driving
12. Scraping
13. Joinery
14. Fastenings
15. Glue and gluing
16. Hardware
17. Finishing

Machine Woodwork--High 9

1. Circular saw
2. Jointer
3. Band saw
4. Jig saw
5. Drill
6. Sanders, belt and disk
7. Lathe
8. Grinder
9. Finishing
10. Safety
11. Occupational information

Graphic Arts and Drawing--Teacher II

Bookbinding and Paper Making--7

Bookbinding

1. General bookbinding
2. Construction
3. Sewing
4. Casing in

Paper Making

1. Materials
2. Beat stock
3. Color stock
4. Make a mold or deckle
5. Watermarking
6. Form a sheet
7. Drying
8. Sizing
9. Finishing

Block Printing and Silk Screen--High 7

Block Printing

1. Introduction
2. Securing the design
3. Transfering the design
4. Cutting, proofing and correcting
5. Printing the blocks
6. Special printing problems

Silk Screen

1. Introduction
2. Choosing a design
3. Stencil cutting
4. Preparation of screen
5. Application of the film
6. Make-ready
7. Making and handling prints
8. Cleaning the screen

Drawing (sketching)--Low 8

1. Occupational information
2. Fields of drawing
3. Simple drawing and sketches
4. Use of equipment
5. Lettering
6. Line meanings
7. Measurement
8. Projections

Printing--High 8

1. Background for printing
2. Type setting equipment and material
3. Display composition
4. Imposition
5. Presswork
6. Paper cutting

Printing I--Low 9

1. The lay of the printer's job case
2. Type, parts
3. Printer's system of measurement
4. The composing stick
5. Quads and spaces
6. Spacing composition
7. Cutting and justifying a line
8. Tying type

9. Proofing
10. Proofreading
11. Correcting
12. Lockup
13. Presswork
14. Distribution
15. Paper, estimating and cutting
16. Safety
17. Occupational information

Printing II--High 9

1. Continuation of units in printing I
2. Platen Presswork
3. Care and operation
4. Press feeding
5. Preparing the packing
6. Handling the form
7. Make ready
8. Inking and running the job

Metalwork and Electricity--Teacher III

Art Metal and Sheet Metal--Low 7

Art Metal

1. Safety
2. Metals used
3. Planning and design
4. Transfering design
5. Holding devices
6. Cutting metals
7. Shaping and forming
8. Fastening and joining
9. Finishing
10. Occupational information

Sheet Metal

1. Safety
2. Materials used in industry
3. Measuring
4. Lay-out
5. Cutting
6. Shaping and forming
7. Fastening and joining
8. Soldering
9. Finishing
10. Occupational opportunities

Forging and Welding--High-7

Forging

1. Safety
2. Materials used
3. Forging
4. Tools
5. Heating
6. Manipulation, drawing, cutting, and upsetting
7. Heat treating
8. Cleaning and finishing
9. Occupational opportunities

Welding--(demonstration and limited use)

1. Safety
2. Oxy-actelene
   a. Welding, brazing, and hard soldering
3. Arc welding
4. Advantages and disadvantages
5. Occupational information

Electricity--Low 8

Light

1. The story of electricity
2. The source of electricity
3. Switches and fuses
4. Measurement and cost
5. Lighting circuits
6. The underwriter's code and safety
7. Home lighting
8. Occupational information

Heat

1. Electrical energy
2. Uses of electrical heat
3. Requirements
4. Controlling heat circuits
5. Heating safely with electricity

Power

1. The sources of electricity
2. The transmission of electricity
3. Controlling electricity
4. The electric motor
5. Care of the electric motor
6. Safety

Communications

1. Electrical communication
2. The magnet and the electro-magnet
3. Conductors
4. Insulators and protectors
5. Methods of communication
6. Safety in electrical communication

Radio

1. Crystal set
2. One tube tuned radio frequency
3. Connecting additional tube to a radio
4. Connect microphone to a radio
5. A. C. - D. C. radio set
6. Safety

Bench Metal and Machine Shop--High 8

1. Occupational information
2. Materials
3. Tools
4. Layout and cutting
5. Shaping and forming
6. Drilling
7. Tapping and threading
8. Care and use of lathe
9. Care and use of grinder
10. Safety

Forging and Welding--Low 9

Forging

1. History of forging and heat treating
2. Manufacture and use of steel
3. Gas furnace (forge)
4. Cutting stock
5. Heating metal
6. Drawing out hot metal
7. Cutting and upsetting hot metal
8. Use of the anvil in forging hot metal
9. Use of special tools in forming hot metal
10. Grinding metal
11. Filing metal
12. Fastening metals
13. Heat treating metals
14. Cleaning and finishing
15. Occupational information
16. Safety

Welding

1. Safety
2. Care of equipment
3. Welding and cutting
4. Regulators, pressure
5. Tip sizes
6. Welding and brazing rod
7. Flame

Arc Welding

1. Arc welders
2. Accessories
3. Use
4. Rod
5. Joints
6. Safety
7. Occupational information

Machine Shop and Bench Metal

1. The machine tool industry
2. Basic machine tools
3. Kinds of layout and testing tools
4. Care and use of hand tools
5. The combination square
6. Reading the micrometer
7. Using the micrometer
8. The surface plate and parallels
9. The drill press
10. Drills, straight and tapered
11. Care of drills
12. Engine lathe
13. Lathe tools
14. Sprindle turning
15. Straight turning
16. Face and shoulder turning
17. Taper turning
18. Filing and polishing in the lathe
19. Chuck turning
20. Knurling in the lathe
21. The power grinder
22. Occupational opportunities
23. Safety

Minimum List of Heavy Equipment

Woodwork

1	Circular Saw
1	Jointer
1	Band Saw
1	Jig Saw
1	Drill
1 ea.	Sanders, belt and disk
2	Lathes
1	Grinder

Graphic Arts

3	6" x 9" Hand Lever press
2	8" x 12" Hand Lever press
1	10" x 15" Power Platen press
2	Proof press and brayer
1 -	Paper Cutter
24	California Job Cases
	Chases for presses
	Imposing stone
	Type, school book century

Metalwork

2	Gas Forges
2	Arc Welders
8	Oxy-acetylene Torches and Gauges
1	Buffer, wire
1	Brake
1	Squaring Shears
1	Bar Folder
1	Bench Shears
1	Slip Rolls
1	Stake Plate
1	Drill, bench model
1	Grinder
10	Lathes
2	Solder Furnace

Recommended Senior High School Industrial Arts Areas for the Grant District

The program is divided into five general areas, woodwork, metalwork, graphic arts, electricity and radio, and auto mechanics. Drawing is not taught as an industrial arts course in the senior high school; it is an independent department. This has made it necessary to include a unit of related drawing in each shop area.

Woodwork

The general area of woodwork is divided into seven subordinate units, to make it possible for the students to select areas of interest. Junior high school bench woodwork and machine woodwork should precede cabinetmaking I and II; cabinetmaking I and II are prerequisites for all other courses in the woodwork area.

Cabinet Making I and II--36 weeks*

1. Planning, drawing and design
2. Cut-off Saw
3. Circular Saw
4. Jointer
5. Belt Sander, floor model
6. Lathe
7. Planer or Surfacer
8. Mortise Machine
9. Band Saw
10. Scroll Saw
11. Shaper
12. Grinder

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*36 weeks equals two semesters

13. Drill Press
14. Disk Sander
15. Spindle Sander
16. Finishing
17. Lumbering and processing
18. Hardware
19. Safety*
20. Occupational information*

Millwork--18 or 36 weeks

1. Safety
2. Group planning
3. Mill production methods
4. Use of jigs and templets
5. Assembly line methods
6. Finishing
7. Occupational information

Carpentry, Elementary--18 weeks

1. Safety
2. Draw plans
3. Fundamentals of house construction
4. Frame scaled down house
5. Sheathing and roofing
6. Finish and paint
7. Occupation information
   Suggested projects: play house or doghouse

Patternmaking--18 weeks

1. Drawing
2. Types of pattern
3. Materials used
4. Draft
5. Shrinkage of metals
6. Tools
7. Check patterns by preparing a mold
8. Occupational information

Furniture Making and Design--18 or 36 weeks

1. Understand good design
2. Contemporary
3. Period
4. Functional use of furniture

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*Safety and occupational information are disseminated throughout each area.

5. Construct a well designed project
6. Occupational information

Boat Building--36 weeks

1. Safety
2. Small plywood boats
3. Planning and drawing
4. Framing
5. Application of sides and bottom
6. Application of trim
7. Finishing
8. Occupational information

Shop Maintenance--18 weeks

1. Cleaning motors and machines
2. Oiling and greasing
3. Sharpening jointer, planer, and saw blades
4. Sharpening cutting tools
5. Safety
6. Replace worn and broken parts
7. Keep machinery clean and painted
8. Occupational information

Marquetry and inlaying, and upholstery are other areas related to woodwork which may be introduced to broaden and enrich this program.

Metalwork

The general area of metalwork is divided into five subordinate units to provide a variety of metalwork experiences for the students. Junior high school forging and welding, and bench metal and machine shop are prerequisites for art metal and sheet metal; art metal and sheet metalare prerequisites for all other courses in the metalwork area.

Art Metal--18 weeks

1. Metals used
2. Design and planning
3. Holding devices
4. Cutting

5. Shaping and forming
6. Fastening and joining
7. Surface enrichment
8. Spinning
9. Enameling
10. Finishing
11. Jewelry
12. Occupational information
13. Safety

Sheet Metal--18 weeks

1. Materials used
2. Pattern drafting
3. Measuring and layout
4. Cutting
5. Shaping and forming
6. Fastening and joining
7. Finishing
8. Occupational information
9. Safety

Metal Casting--18 weeks

1. Patterns
2. Molding sand and equipment
3. Molding metals
4. Melting furnace
5. Melting metals
6. Pouring the mold
7. Treatment of the casting
8. Finishing the casting
9. Safety
10. Occupational information

Forging and Welding--18 weeks

Forging

1. Drawing
2. Manufacture of steel
3. Gas furnace
4. Laying out stock
5. Cutting stock
6. Heating metal
7. Drawing out hot metal
8. Cutting and upsetting hot metal
9. Use of the anvil
10. Use of special tools
11. Heat treating metals

12. Cleaning and finishing
13. Occupational information
14. Safety

Welding

1. Blue Print reading
2. Oxy-acetylene welding and cutting
3. Welding torch and cutting attachment
4. Regulators and tanks
5. Working pressures
6. Shutting off
7. Tip sizes
8. Welding and brazing rod
9. Flame adjustment
10. Types of joints
11. Symbols
12. Occupational information
13. Safety

Electric Arc Welding

1. Blue Print reading
2. Arc welders
3. Arc welding accessories
4. Start and stop welder
5. Adjust welder
6. Strike arc
7. Run a bead
8. Types of joints
9. Cleaning weld
10. Safety
11. Occupational information

Machine Shop and Bench Metal--18 or 36 weeks

1. Safety
2. Blue print reading
3. Care and use of hand tools
4. The drill press and accessories
5. The engine lathe and accessories
6. The power saw
7. The shaper
8. The power grinder
9. Occupational information

Graphic Arts

The graphic arts areas are printing III and IV, and V and VI. Junior high school printing I and II should precede these courses.

Printing III and IV--36 weeks

1. Safety
2. Elementary composition
3. Display composition
4. Imposition and lockup
5. Platen presswork
6. Paper estimating and cutting
7. Silk screen operation
8. Block printing
9. Occupational information

Printing V and VI--36 weeks

1. Cylinder presswork
2. Practice keyboard, Intertype
3. Intertype operation
4. Newspaper makeup
5. Book composition and makeup
6. Book printing
7. Book binding
8. Safety
9. Occupational information

Electricity and Radio

The electricity and radio areas are electricity I and II, and Radio I and II; electricity I and II are prerequisites for Radio I and II.

Electricity I--18 weeks

1. Magnetism
2. Electrostatics
3. Primary cells
4. Storage batteries

5. Voltage, current and resistance
6. Electromagnetism
7. Meters
8. Heating effects of electric current
9. Work, energy and power
10. Induced electromotive force
11. Motors
12. Mutual and self-induction
13. Rectification of current
14. Safety
15. Occupational information

Electricity II--18 weeks

1. Safety
2. Automotive electricity
3. House wiring
4. Safety
5. Occupational information

Radio I and II--36 weeks

1. History of communications
2. Wave motion
3. Simple radio receiving sets
4. Wave form
5. The antenna coupler
6. Electron flow in aerial and ground system
7. Electron flow in tuning circuits
8. Electron flow in detector circuits
9. The vacuum tubes
10. Regenerative detector
11. Audio frequency amplifier
12. Power supplies
13. Speaker
14. Radio frequency amplifier
15. Volume control
16. Tone control
17. The superheterodyne receiver
18. Radio direction finders
19. Short-wave sets
20. Oscillators and transmitters
21. Radiotelephone transmitters
22. Aerials
23. Ultra short-wave sets
24. Safety
25. Occupational information

Auto Mechanics

Auto mechanics is divided into I and II. Junior high school forging and welding, and bench metal and machine shop should precede auto mechanics I; auto mechanics I is a prerequisite for auto mechanics II.

Auto Mechanics I--18 weeks

1. Types of power for transportation
2. The vehicle code
3. Factors to be considered in the purchase of an automobile
4. Units of the automobile (cut-aways)
   Engine, brakes, transmission, carburetor, electrical system, and cooling system
5. Problems of financing and insurance
6. Assembling and disassembling automotive units
7. Washing, polishing, and greasing a car

Auto Mechanics II--18 weeks

1. Scientific principles involved in the automobile
   Engine, carburetor, ignition, battery, transmission, differential, cooling system, brakes, and lubrication systems
2. Repair, adjust, and replace automotive parts and units
3. Safety
4. Use of shop equipment
   Battery charger, valve facer, drill press, grinder, polisher
5. Occupational opportunities

Minimum List of Heavy Equipment

Woodwork

1	Cut-off Saw
1	Circular Saw
1	Jointer
1	Belt Sander, floor model
4	Lathe
1	Planer

1	Mortise Machine
1	Band Saw
1	Scroll Saw
1	Shaper
1	Grinder
1	Drill Press
1	Disk Sander
1	Spindle Sander

Metalwork

4	Gas Forge
4	Arc Welder
10	Oxy-acetylene Welding Outfit
1	Gas furnace, melting aluminum or brass
1	Buffer
1	Squaring Shear
1	Bar Folder
1	Bench Shear
1	Slip Roll
1	Stake Plate
1	Drill, bench model
1	Drill, floor model
2	Shaper
1	Grinder
1	Power Saw
8	Lathes
2	Solder furnace
	Bench Machines

Graphic Arts

1	Offset Duplicator
1	6" x 9" Hand Lever Press
2	8" x 12" Hand Lever Press
1	10" x 15" Power Platen Press
1	Cylinder Press
1	Intertype
2	Proof Press
1	Paper Cutter
1	Imposing Stone
	California Job Cases

Electricity and Radio

1	Drill Press, bench model
1	Grinder

Auto Mechanics

1	Drill Press, bench model
1	Grinder
1	Battery Charger
1	Valve Facer
1	Test Stand