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A CURRICULUM FOR A FOUR-YEAR MULTIPLE ACTIVITY
PROGRAM IN INDUSTRIAL ARTS AND A PROGRAM
FOR THE SCHOOL PLANT ORGANIZATION

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I. THE PROBLEM

A curriculum problem of the Catholic secondary school in contemporary education is to fuse, interrelate, and synchronize industry in the total educational program by providing a new special curriculum in industrial arts. In view of this action, this study was to conduct a survey of literature in two major areas; namely, "Planning a Curriculum for a Four-Year Multiple Activity Program", and "A Program for Planning a School Plant for the Special Curriculum".

In this period of education, the school has been confronted with the educational system, now it is a challenge and now it is to deal with contemporary education which is being developed. With the ever increasing complexity of the modern program, various fundamental skills are needed by students to deal with the present and future. The school is to be most effective. Therefore, the role of the educator is to provide the student with multiple opportunities for learning and experience.

In view of this action, the purpose of this study is to investigate and to determine the two major areas of the industrial arts program. The first major area of this study is the curriculum for

II. OVERVIEW

In American society, education has many tasks. The entire nation from the President on down recognizes the significant role of the school in changing the culture. Whether the problem is international relations, mental health, poverty, or civil rights, education is a part of the solution.

American schools are going through a period of transition. The changes are inevitable and are occurring at an optimal rate. Today high schools are no longer concerned just with preparing a limited number of maturing boys and girls to meet the problems of adult life; but rather the secondary school is considered as the necessary minimum educational experience for all youth.

In this period of transition in which new values have penetrated the educational system, more effective approaches and means to deal with contemporary curriculum should be explored. With the ever increasing complexities in technical progress, certain fundamental skills are needed by everyone to find the place and job in which he can be most effective. Therefore, the role of the educator is to provide the student with multiple opportunities for having self-educative experience.

In view of this action for the future, the purpose of this study is to investigate and to develop the two major areas of the industrial arts program. The first major area of this study is the curriculum for

a four-year multiple activity program. This area involved the identification of the program through a survey of literature on the comprehensive high school, the special curriculum, the organization and method of the multiple activity program, and the justification for the program. The second major area is setting up a program for the planning of a school plant for the special curriculum. This area involved the identification of the building through a survey of literature on the nature of the building and the extent of the building.

through self-discipline. The Catholic Encyclopedia defines education as that form of social activity whereby, under the direction of mature minds and by the use of appropriate means the physical, intellectual, and moral powers of the trainee must be so developed as to prepare him for the accomplishment of his life's work here and for the attainment of his eternal destiny.

The ends or objectives of Catholic education should take into consideration the nature of the student, the needs of the student, and the destiny of the student. The ultimate objective of Catholic education is Christian perfection in this life and eternal salvation in the next. This end embraces all other objectives, for Christian perfection means the performance of all duties in the fields of social living.

A characteristic of the Catholic comprehensive high school is individualized education and functional learning. To achieve this end

III. THE CATHOLIC COMPREHENSIVE HIGH SCHOOL

The Catholic comprehensive high school provides learning opportunities for all the normal adolescents with a range from the barely educable to the gifted and talented students. Its purpose is to enable each student (a) to develop to his greatest potential for his own success and happiness here and hereafter and (b) to make a maximum contribution to the American society of which he is a part.

In its barest essentials, education is a process of self-development through self-discipline. The Catholic Encyclopedia defines education "As that form of social activity whereby, under the direction of mature minds and by the use of adequate means the physical, intellectual, and moral powers of the immature human being are so developed as to prepare him for the accomplishment of his life's work here and for the attainment of his eternal destiny."

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the school should affect positively the behavior of its students as adolescents and later as adults in all areas and aspects of living--- not only as wage earners, citizens, and family members, but as unique human beings. The student should have opportunities to learn at a pace with his own abilities. Each of his experiences should be meaningful and should be related to life outside the classroom. This requires maximum intellectual development within a context of sound spiritual, physical, emotional, and social growth.

Since industry and technology play a dominant role in the structure of our society, industrial arts should be a part of the general educational program. If we can assume that a fundamental purpose of the Catholic comprehensive high school is to transmit the way of life of a group of people, then those aspects of American culture characterized by dependence upon technological and industrial achievements should be reflected in the school's program.

In developing the industrial arts curriculum the basic elements of knowledge, appreciation, and understanding that are essential to all students were identified. The basic elements were drawn from further analysis of the democratically oriented society in the area, the needs of the youth in the area, and the knowledge of the fundamental subject content required as a basis for further creative and specialized activities on the part of the students taking the industrial arts courses.

The prospective students for the new curriculum live in an urban area of sixty-five thousand people belonging to the upper middle class. The adult population work within a complex social structure. Eighty-five percent of the wage earners are engaged in industries of sheet metal, paper, rubber and garment manufacturing.

The community is well oriented to the contemporary trends in education. They not only think as workers but also as citizens, as family members, and as consumers of goods and services of all kinds. They are sensitive to changes in the job market and realize that technical jobs are becoming more technical placing increased demands on brainpower and requiring longer training periods. They also realize that service occupations are rapidly expanding in the community.

Based on the current developments within the community potentially one hundred percent of the 1280 student population of the high school could profit from the new industrial arts curriculum.

However, for convenience in discussing the new program the student body will be divided into three groups. The first group will be composed of the professionally oriented college-bound students which will include sixty-five percent of the student population or 832 students. Of this number twenty-five students will probably take industrial arts as a major. The second group are those students with lesser ability and those planning to go into technical fields. This group will include thirty-three percent of the student population

or 423 students. Of this number there will probably be seventy-five students taking industrial arts for a major and ten students taking it for a minor. The third group will be composed of underachievers or potential dropouts. This group will include two percent of the student population or twenty-five students. All twenty-five students will take industrial arts as a major. Based on these numbers there will be a total of 135 students taking industrial arts courses with varied ability, interests, and capabilities.

The courses should challenge the students to think through problems, to make relationships, to generalize, and to develop and clarify values which are essential to democratic living. Consequently, the traditional trade approach or a workshop approach to the curriculum should be greatly modified. Trade or program reflects the nature of jobs in the majority of occupations. The courses should seek to identify common elements in a family of occupations. They should more completely develop a structure of knowledge, and an understanding of principles and generalizations applicable to an organized body of content.

Industrial arts as a curriculum area is defined as that phase of general education which deals with industry--its organization, materials, occupations, processes and products, and with the problems resulting from the industrial technological nature of society. Using this definition to guide the development of the curriculum, the focus should be on the development of a body of knowledge and skills which will enable the student to understand and participate in the industrial process. The curriculum should be

designed to build in the m IV. THE CURRICULUM through the world

with required subjects and objectives that relate to the required

A prime requisite for the new industrial arts curriculum should be balance and depth. Courses should be offered at levels of difficulty to challenge all the students in the basic academic subjects. Opportunities should be provided for each student to take elective subjects consistent with his interest, needs, abilities, and plans for the future.

The courses should challenge the students to think through problems, to sense relationships, to generalize, and to develop and clarify values which are essential to democratic living. Consequently, the traditional trade analysis or job oriented approach to the curriculum should be greatly modified. Trade no longer reflects the nature of jobs in the majority of occupations. The courses should seek to identify common elements in a family of occupations. They should more completely develop a structure of knowledge, and an understanding of principles and generalizations applicable to an organized body of content.

Industrial arts as a curriculum area is defined as that phase of general education which deals with industry--its organization, materials, occupations, processes and products, and with the problems resulting from the industrial and technological nature of society. Using this basic concept the curriculum should be developed to deal with each facet in a realistic and meaningful way. The curriculum should be

designed to begin in the ninth grade and continue through the twelfth with required subjects and electives that relate to the required

industrial arts courses. I, II, or IV, and Art I or II may be taken

in any one of the four years depending upon circumstances. Chemistry

and Physical Science may be taken either in the Junior or Senior

year depending upon circumstances.

NINTH GRADE

A. Required

1. English I

2. World History

3. Business Arithmetic

4. Industrial Art I

a. Orientation - Work in a factory, business organization, and materials, finished products

b. Shop experience - Design, drafting, woodworking, metal working, plastics, crafts

c. Fragmented learning - Resource materials for exploratory work and developing special interests and interests

B. Elective related subjects

1. Social Studies I

a. Basic conception of man

b. Extension

c. Labor and management

d. Rights and responsibilities of good citizenship

e. Transportation

f. Communication

2. General Science

3. Algebra

4. Art

CURRICULUM FOR THE GENERAL-EDUCATION PROGRAM IN INDUSTRIAL ARTS

Social Studies I, II, III, or IV, and Art I or II may be taken in any one of the four years depending upon circumstances. Chemistry and Physical Science may be taken either in the Junior or Senior year depending upon circumstances.

NINTH GRADE

A. Required

1. English I
2. World History
3. Business Arithmetic
4. Industrial Art I

- a. Orientation - Work in a factory, business organization, raw materials, finished products
- b. Shop experiences - Design, drafting, woodworking, metal working, plastics, crafts
- c. Programmed learning - Resource materials for exploratory work and developing special talents and interests

B. Elective related subjects

1. Social Studies I
 - a. Basic communities of man
 - b. Economics
 - c. Labor and management
 - d. Rights and responsibilities of good citizenship
 - e. Transportation
 - f. Communication
2. General Science
3. Algebra
4. Art

TENTH GRADE

A. Required

1. English II
2. Physics
3. Industrial Arts II
 - a. Contract Counseling - Problem solving
Self-evaluation in relation to choice
and career planning
 - b. Team work with other dept. of the school
 - c. Programmed learning - Resource materials for exploratory
work and developing special interests
and talents

B. Elective related subjects

1. Social Studies II
 - a. Science and industry
 - b. Labor-management relations
 - c. Democracy
2. Analytic Geometry
3. General Business
4. Plain Geometry
5. Art
6. Biology
7. ~~Social Studies I~~

ELEVENTH GRADE

A. Required

1. English III
2. American History
3. Industrial Arts III
 - a. Corporation Structure - Managers, program engineers, designers, draftmen, accountants, production engineers, sales and publicity personnel, and production group
 - b. Projects
 - c. Efficiency studies (resource center)

B. Elective related subjects

1. Social Studies III
 - a. Age of exploration and discovery
 - b. Constitution of the United States
 - c. United States as a world power
 - d. The atomic age
2. Chemistry
3. Physical Science
4. Advanced Algebra
5. Art

TWELFTH GRADE

A. Required

1. English IV

2. Industrial Arts IV

- a. Specialty major - Concentration in a particular work area depending on interests and capabilities
- b. Exploration and development - Students interested in a major in engineering, business administration, or any other related field in college

B. Elective related subjects

1. Social studies IV

- a. Government
- b. Production
- c. International relations
- d. Exchange
- e. Distribution

2. Chemistry

3. Physical Science

4. Solid Geometry

5. Art

V. THE ORGANIZATION OF THE MULTIPLE-ACTIVITY PROGRAM

The multiple-activity program is a method of organizing and teaching multiple activities concurrently as contrasted with the unit shop where just one subject or major activity is taught. The multiple activities center around mechanization and technical development with major areas of power, transportation, communication, and manufacturing. A large number of problems, projects, and investigations are suggested. Emphasis is placed on informational content as it relates to industry in industrial technology.

The all-purpose general shop is organized for the multiple-activity program. This shop is a room equipped and organized so that students may participate in various activities and have experiences with a variety of tools, equipment, and materials. The shop literally should become an experimental laboratory of industries in which the students work together to understand the industrial and technical aspects of life today.

The industrial arts laboratory in its general frame work should be equipped with the latest available products in its environment of electronics, metals, woods, drawing, design, graphics, power, and fabrication. Working in these areas should be conceived of as methods of living and learning. They should be conceived of in their social significance as types of processes by which society keeps itself alive and as agencies for bringing home to the students some of the primal necessities of community life.

A student-directed organization operating within this laboratory of industries emphasizes the social efficiency objective of the program. In this organization the students participate in the planning and executing of the administrative and service responsibilities. They learn to direct and manage class activities for the welfare of the entire group in a cooperative setting, while each student carries on the development of his own project in a highly individualized manner. A well-directed organization provides experience in human relations and the work of each student is under constant evaluation as he assumes his just share of the responsibility.

In the approach to the establishment of a student-directed organization the instructor proposes to the class that it would be wise to have an organization of some sort to manage the affairs of the class. An organization would then be cooperatively planned by the students and the instructor. The duties and responsibilities would be assigned to the officers with the intent of fulfilling the objectives previously stated. In brief the responsibilities for the superintendent might be: (1) appoint substitutes officers (2) conduct the program (3) conduct shop inspection with each foreman (4) inspect the officers at work (5) give the signal for clean-up (6) conduct the report period (7) dismiss the class.

The names of the officers would conform with those used in industry. The student who is in charge of the organization and the other officers would be called the superintendent. The student in charge of safety

responsibilities would be called the safety engineer. The duty of repairing tools would be executed by the serviceman. The responsibility of checking tools would be placed on the toolman. An officer in charge of a group of workers would be called a foreman.

The student officers serve a term of four weeks. The elements of this type of human activity should contribute to the development of the skills and habits of mind which should be the instruments of continuous change and growth on the part of the individual.

The multiple-activity method related to the study of major industry and line production experience extends from the various levels of personal organization through procurement, planning, production, and distribution. This method should be used with discretion and teacher enthusiasm. Two or more major activities may be in operation at one time depending on the ability of the students and the administrative ability. Where creativity, initiative, originality, inventiveness, and self-direction are objectives the aim of the instructor should be to introduce as many activities as possible.

The method for developing the activities should be organized under the aspects of theory, practice, and discovery. In the theoretical aspect factual information, principles, concepts, and generalizations should be taught. The content should be divided into units of study should be organized on the basis of the knowledge and skills needed to perform the duties required in the shop situation. The mode of organization should be determined by an analysis of what workers do

VI. THE METHOD USED IN THE MULTIPLE-ACTIVITY PROGRAM

The work under each unit is divided into subject matter and projects. The projects are illustrative of processes of manufacture. The processes of construction involve not only hand production but a study of power machinery, factory production, and transportation. The social aspects of the subject includes studies of the sources of material, markets, and the condition of laborers, the relation of employers and laborers, and these to the consumer.

The multiple-activity method related to the study of major industry and line production experience extends from the various levels of personnel organization through procurement, planning, production, and distribution. This method should be used with discretion and teacher enthusiasm. Two or more major activities may be in operation at one time depending on the ability of the students and the administrative ability. Where creativity, initiative, originality, inventiveness, and self-direction are objectives the aim of the instructor should be to introduce as many activities as possible.

The method for developing the activities should be organized under the aspects of theory, practice, and discovery. In the theoretical aspect factual information, principles, concepts, and generalizations should be taught. The content should be selected and units of study should be organized on the basis of the knowledge and skills needed to perform the duties required in the shop situation. The mode of organization should be determined by an analysis of what workers do

on a job and what responsibilities they fulfill as part of the job. In the practical aspect job competency should be developed along with the acquisition of the skills. This part of the course design should provide a high degree of motivation on the basis of aspiration and goal expectancy. It should contribute to the development of interests, talents, and capabilities. It should utilize to the fullest the maxim that learning results from experience and the more meaningful and significant the experience the more is learned. In the discovery aspect the students should be provided with elements of subject matter that relates to the total unit content and provides for student involvement and active participation in two broad areas of educational experiences; namely, research and planning. In the area of research students learn to collect information, organize information, and present information to others. In the area of planning students learn to design, draw, solve problems, and work with others.

The unit method is used in the ninth grade course in industrial arts. The unit method utilizes a set of teaching techniques which are common to the study of broad and comprehensive units. These units attempt to provide for the student a better understanding and appreciation of the growth and development of civilization in general. Through lectures, films, demonstrations, and trips to business and industrial plants, the students find out what it is like to work in a factory, how a business is organized, and how raw materials are made into finished products. In addition, the students gain some ideas as to job opportunities.

The learning experiences with materials and tools are not offered in a predetermined pattern. However, during this part of the course the students work in different areas such as wood, metal, plastics, electricity, drafting, and design. For example, the students studying sheet metal development should engage in the following kinds of unit studies and job operations:

1. Introduction - course aims and unit description
2. Safety precautions
3. Principles of layout
4. Educational and occupational guidance
5. Testing procedures and grading
6. Measuring and layout of sheet metal
7. Metal forming
8. Metal finishing
9. Various operational units
10. Estimating jobs and repair work
11. Improving present method

During the operational unit the students work in their own style and at their own rate of speed. In addition to the bench work the more capable students should do related exploratory work in the resource center.

Contract counseling is used in the tenth grade course in industrial arts. This method has two major elements: (1) encouragement of student's understanding in relation to occupational choice and career

planning and (2) utilization of the problem-solving approach to work.

For the problem-solving method the class is organized into a number of small groups. The students of each group select and produce a project that is symbolic of the learning that has taken place during the process. Each member of the group chooses a topic related to the project under study and researches the information available and then presents this information to the group. Each student contributes to the total group project by selecting a part of the total project in which he engages in designing, planning, constructing, and assembling.

As an example of the problem-solving method a group of students might decide to develop an air car. This problem would require study in the resource center and library, consultations with practicing technicians, design, drafting, testing of ideas and materials, the construction of parts, the assembly of parts, and test flights to evaluate the solution. After the project would be completed the students would discuss their learning experiences with the entire class.

The problem-solving method should provide opportunities for each student to achieve some degree of success, to develop qualities of leadership and followership, and to learn shared responsibility. The entire group process should be flexible. It should meet specific needs and should challenge the ability of students.

The corporate structure is used in the eleventh grade course in industrial arts. The corporate structure simulates an industry by forming a company, selling stocks, manufacturing products, and selling the student contribution in a particular work area. The exploratory development is provided for the capable students who plan to major in

the products for profit. The products should be student selected. However, limits are set for proper selection depending upon the size, cost, availability of materials, and the desired goals and skills to be learned. The products could vary from producing some standardized object to the building of a product to order.

The corporate structure should develop ways and means of gaining greater insight into industrial and management operations. Instead of each person doing some small item on his own, the corporate structure increases the opportunities of life experiences through organization and working together.

The big problems start to evolve when the flow of materials, finishing, inspecting packaging, distributing, and selling are in progress. During this phase the students should attain new social and technical experience as they learn to work together with tools, materials, and machines. They should begin to realize the importance of each man's responsibility in order to manufacture a quality product.

After production the students discuss their learning experiences in discussion groups. This is the time when engineers give their production reports. The production manager reports on costs, sales, investments, and profits. The industrial relations man and safety engineer report on their roles, and all the students have a new experience by actively participating.

The speciality major and the exploratory development unit is used in the twelfth grade course in industrial arts. In the speciality major the student concentrates in a particular work area. The exploratory development is provided for the capable students who plan to major in

science, engineering, or business administration in college. The student selects a problem area in which he would like to perform a research study. Usually the problem is one in which the student is deeply interested and concerned. After selecting a general topic or area of study the student develops a statement of the problem. After having developed the statement of the problem, he begins to search for information concerning his problem. The exploration for knowledge, because of sincere interest in a particular problem is a lasting educational experience. The true researcher should exhaust all areas of knowledge and use numerous means of searching out that knowledge. In his search for information, the student should discover ways to plan and construct and test his problem.

During the constructing and testing phase, the entire class conducts a seminar. Two students are usually chosen during one class period seminar to report on the progress of their study and to support their problem. The students who are not presenting a problem should raise questions and offer helpful suggestions as a part of the critical analysis of the seminar report. The exploratory development unit should have flexible scheduling to facilitate the best use of time and space and to increase opportunities for independent study.

The final outcome of the courses offered should be a better understanding of contemporary industry and technology. Breaking this down into more specific understanding, realizations, and student developments the outcomes should be (1) an understanding of the sociological aspects

of group and individual interaction (2) a development of qualities of leadership and followership (3) a realization that each member of the group has a responsibility (4) an understanding of how industry organizes men, materials, and tools for production and (5) an understanding of the role of capital, labor, and natural resources in an industrial organization.

The changing manpower picture and the changing technology require that the average worker in the United States has 12.5 years of schooling and the major white collar jobs have 16 years of educational attainment. More goods are being produced for more consumers by fewer workers and more jobs require a higher level of education and technical training. As a result there is a higher age for first employment. Most recent studies predict that in the foreseeable future a young man will be twenty-four years entering his career and will have seven different jobs during his working life giving him an average of a little over five years per job.

This relationship of education, employment, and job change upon the curriculum places a greater responsibility than just emphasizing the manipulative skills in a subject field such as industrial arts. The prospective wage earner must be given an education that will prepare him for the present and the future world of industry, and he must be educated to a full appreciation of his social responsibilities.

The multiple-activity program offers a balance between the intellectual and the practical phases which deal with industry, its

VII. JUSTIFICATION FOR THE CURRICULUM

The curriculum developed for industrial arts provides an effective program which can obviously be defended as a program essential not only for today but for the foreseeable future. Education has expanded and will continue to expand because of the forces of change in the economic, social and cultural conditions of the world of work.

The changing manpower profiles and the changing technology require that the average worker in the United States has 12.5 years of schooling and the major white collar jobs have 16 years of educational attainment. More good are being produced for more consumers by fewer workers and more jobs require a higher level of education and technical training. As a result there is a higher age for first employment. Most recent studies predict that in the foreseeable future a young man will be twenty-four upon entering his career and will have seven different jobs during his working life giving him an average of a little over five years per job.

This relationship of education, employment, and jobs place upon the curriculum planners a greater responsibility than just emphasizing the manipulative skills in a subject field such as industrial arts. The prospective wage earner must be given an education that will prepare him for the present and the future world of industry, and he must be educated to a keen appreciation of his social responsibilities.

The multiple-activity program offers a balance between the intellectual and the practical phases which deal with industry, its

organization, materials, occupations, processes, and products. The program also provides an enriched and deepened performance of work by being saturated with social responsibilities.

The demands coming from society and particularly from the students are major factors for consideration in justifying the new curriculum. Society including representatives from the board of education, professional educators, parents, economists, manpower experts, and specialists demand that industrial arts and general education reinforce each other and that guidance for future planning be an integral part of the program. Society also demands a favorable cost/benefit ratio by finding ways to reduce the cost and using resources wisely. The students demand an atmosphere in which to solve problems at their own speed with sympathetic teachers and classmates. They also demand recognition of becoming an adult Somebody. Some students demand practicality by having opportunities to work with materials and processes.

Some professional educators such as Francis Keppel suggest that specific job preparation should be left to post-high school institutions and emphasis in high school should be placed upon the required skills of human relations, communications, and families of occupations. They believe that long before choices have to be made students should know how they can fit into the economic life of the country.

The Vocational Education Act of 1963 stands as a milestone of federal legislation affecting American education. It may prove to be the fore-runner of a new concept of secondary education by making

post-high school vocational and technical education a part of our educational tradition. It already provides for enlarged and improved systems of vocational training for persons of all ages in need of such training.

In view of these changes and demands the new industrial arts curriculum meets the experiences of life with flexibility and becomes the sequence of choice, the most responsive to what an individual needs in the changing world. It is possible to consider the multiple-activity program as moving from the group to the individual; from skills to inquiry and discovery; from spiritless climate to zest for learning; from repetition to spiral reinforcement; from teaching as telling to teaching as a creative adventure with a scientific foundation. The program offers diversified work experiences which should give a knowledge of general and transferable technical principles.

The community for which this building should be planned is located in a midwestern area in which large scale industries are abundant. The population is sixty-five thousand people belonging to the upper middle class. Eighty-five percent of the wage earners are engaged in industries of steel metal, paper, rubber, and garment manufacturing. The desires and goals of the community are well related to the advancement of education both in curriculum planning and in building a school plant.

VIII. A PROGRAM FOR THE SCHOOL PLANT ORGANIZATION

The planning of an all-purpose general shop is an individual undertaking from either a teacher or community standpoint. Within the requirements of meeting the educational specifications and the community needs there is much room for differences of opinion with no real right or wrong being involved. No two architects or educators would plan a shop laboratory in exactly the same manner even though they were given the same initial requirements. There are, however, a list of general premises to which they would all adhere and a list of common errors which none would make.

Effective planning can result only from a coordinated effort on the part of the instructor, school administrator, school board members, architect, state department consultant, and community representatives.

The community for which this building should be planned is located in a midwestern area in which large scale industries are dominant. The population is sixty-five thousand people belonging to the upper middle class. Eighty-five percent of the wage earners are engaged in industries of sheet metal, paper, rubber, and garment manufacturing. The desires and goals of the community are well oriented to the advancement of education both in curriculum planning and in building a school plant.

Students enrolling in the industrial arts classes will represent college-bound students, post-high school technical trained students, and potential drop-out students. A future

The plan of the building should be one that can readily interpret today's educational thinking. Since the educational program is broadening to bring educational experiences closer to life and to include concepts of community education, so the planning of the building should include housing of a wide variety of living experiences. These experiences should deal with industry--its organization, materials, occupations, processes, and products--and with the problems resulting from the industrial and technological nature of the society. The planning done now will either serve to facilitate or hamper educational developments in the next 20 years depending upon the wisdom with which it is planned today.

The budgetary limitations and the administrative regulations can be greatly modified when there is justification for the building. Each family of the community will be assessed according to his means for financing the building project. However, the community does demand a favorable cost/benefit ratio by finding ways to reduce the costs and using resources wisely.

Aside from the overall considerations mentioned, the following detailed information is necessary in planning the building. Sixty-five percent of the graduates pursue a college education and thirty-three percent of the graduates either enter technical fields or receive post-high school training. The students enrolling in the industrial arts classes will represent college-bound students, post-high school technical trained students, and potential drop-out students. A future

projection for a class size is twenty-six students and the total enrollment is 130 students.

The primary objectives of the industrial arts curriculum is a better understanding of contemporary industry and technology. The type of shop to achieve the ends of this phase of the school planning should be the all-purpose general shop in which different areas of industry are represented such as wood, metal, plastics, electricity, drawing, design, graphics, power, and fabrication. This type of shop should be referred to as a laboratory of industries because much emphasis is placed on industrial information and activities of an experimental nature.

The shop should be connected to the main building which is an updated two story structure built in 1930. It has a structural framing of concrete block with red brick facing. It is located outside the business district of the city, and spreads on two-thirds of a large city block leaving the north section of the block for expansion. The shop should be a one story building and located on the ground floor adjacent to the existing building.

The planning for the shop should be concerned first of all with basics such as safety, flow of materials, personnel, and a place that will encourage both the instructor and the students to extend themselves in fulfilling the purpose for which the shop is planned. All portions of the shop should be clearly visible to the instructor. Open floor space should be maintained at entrances and exits to prevent congestion.

Alternate personnel exits should be provided to afford maximum escape possibilities in case of emergency. Fire alarm boxes should be placed in the shop areas, particularly in the hot metal and electrical areas. Two types of fire extinguishers should be located in the shop: a carbon-dioxide extinguisher for fires caused by electricity and flammable liquids and a water solution extinguisher for ordinary combustible material. A first aid cabinet should be placed in a central location and readily accessible.

Proper storage of supplies and projects should be one of the most important safety factors. Combustible materials such as paints, oil, and rags should be stored in fireproof spaces. The flow of materials such as lumber, metal, clay, hand tools, and paints should be planned as near to work areas as practical to reduce travel and interference. The placement of machines with regard to sequence of operation is necessary particularly with the circular saw and jointer; the forge and anvil; the cut-off saw and the lumber rack; the power hack and the metal storage rack.

Wide aisles of travel with a minimum of three to four feet in width should be provided in areas in front of tool panels, storage rooms, and storage lockers. The aisles of travel should be designated by painted lines similar to those used in industry, and should lead the eye to all centers of interest such as the display area, the instructor's office, the instructional room, the resource center, and the drinking fountain. The flow of traffic should take the natural and shortest

course to doors, lockers, storage rooms, finishing room, and work areas.

THE EXTENT OF THE BUILDING

In the all-purpose general shop there are two principal areas necessary for the major activities in the various courses for study in industrial arts; namely, a woodworking area and a metalworking area. A room for group instruction and drafting should be provided so that the twenty-six students of the largest class have a place to sit, plan, and draw. A resource center should be provided for research and programmed learning. The instructor should have an office for study when he is not engaged in teaching. One large storage room should provide space for lumber, sheetmetal, and clay. A small storage room should provide sufficient space for the completed projects of the students. A finishing room is needed for the final process of painting and varnishing projects. A small toilet is essential for a well planned shop.

The shop area not including the auxiliary rooms should allow fifty square feet of space per student where light work is done such as woodworking and metal working. A rectangular shape with a width to length ratio of one to two is recommended over other shapes. All nooks, ledges, and compartments where scrap materials may accumulate must be eliminated. A woodworking area and a metalworking area are essential for the major activities in wood, metal, welding, plastics, electricity, ceramics and crafts. For example, the same equipment

and tools are used for wood and plastics therefore these activities should be planned for the same area and work stations. Metalworking and welding are closely associated with regard to sequence of operation and therefore should be planned for the same area and work stations. The work stations must be grouped so that the related activities can be carried on with a minimum of travel.

The two major areas of the shop should be separated by the work station benches. Eight four-work station benches will accommodate the twenty-six students and will allow for future expansion. These benches should have an overall length of eighty-four inches and an overall width of sixty inches. They should be equipped with hardwood tops, vises, and a metal compartment locker in the base to provide storage for the student's unfinished projects. The distance between the benches must not be less than twenty-four inches and the distance between the working sides not less than thirty-six inches.

The power equipment for the major activities should not only include the normal mechanical and electrical aspects but also must take into consideration the inexperience of student operators. The machines should be adjusted so that students are not in the line of danger. They should be placed in safety zones painted on the floor for added protection. All power equipment should be organized in the order of its operation. The necessary machines for woodworking and the related activities should consist of one belt sander followed by one disk sander, one 10" tilting arboral saw, one 12" radial arm saw, one 8"

jointer, one 14" drill press, four 12" wood lathes, one 30" planer, one shaper, one shaper, one 24" jig saw, one 20" band saw and one mortising machine. The necessary machines for metalworking and the related activities should consist of one slow speed grinder followed by one power hack saw, two metal shapers, one milling machine, one welding booth, one grinder, one metal cutting band saw, four anvils, one drill press, one arbor press, one 4" sheetmetal brake, one 4" sheetmetal shear, three 13" metal lathes, one metalworking tool cabinet, one 14" drill press and one electrical work bench.

The handtools for the woodworking area and the metalworking area will be controlled by a student assigned to the job. Tools that are missing should be easily checked. Well-designed open wall panels for hanging tools will make for ease of access, checking, and good display. Separate cabinets must be provided for non-hanging tools and small equipment. The tool panels and the cabinets for storage must be provided for each area and must be located as close to the work stations as possible.

The type of floor material used in the shop should be appropriate for the work done in each area. In the metalworking area a fire-proof floor is necessary and should be treated to avoid skidding. In the woodworking area a hard wood-block floor should be used. The initial cost is higher but in the long range cost it is more economical. Damaged sections are more easily replaced and this type of floor is easier to maintain. At the machine areas a non-skid surface such as

sand on shellac should be applied to the floor in order to minimize the danger of skidding.

The ceiling height of the woodworking and metalworking areas should be twelve feet. Acoustical materials must be used on the ceiling to prevent the transmission of sound to adjacent areas and to classrooms in the main building.

The walls throughout the shop must be constructed of material that can be easily cleaned. To serve this purpose a glazed tile could extend six feet from the floor with the remaining top area built of acoustical material. The acoustical wall material must be coarse enough so as not to lose the sound proofing quality when it is re-finished. The color of the paint to be used on the ceiling and on the upper portion of the walls must reduce glare and create a pleasant working condition.

Two entrance doors should be provided to connect the shop with the main building. Each of these doors should be thirty-six inches wide. One door will be used for the students to enter and the other door for them to leave. The locking mechanism should open when a student pushes on the opening handle to avoid traffic congestion. One outside entrance door thirty-six inches wide should be provided for entrance to the shop when other parts of the school building are not accessible.

The shop must be provided with light that is equal to daylight in almost every respect. Indirect lighting with light of one hundred foot candles should be used. The light must eliminate glares and must

be evenly diffused. Windows that are necessary for the architectural design should face the north or east in order to avoid glares and shadows on work surfaces. The windows should begin at bench height and should extend to the ceiling if they are needed.

The power and light controls for the shop should be centralized on a locked master control panel in the instructor's office. Master emergency throw-out push button switches must be located at strategic points throughout the shop. The power circuit system should be 220 volt three wire, three phase current. There must be one branch power circuit provided for each machine and a circuit breaker for overload protection on the power circuits. There must be one spare light circuit for every five active light circuits and circuit breakers for overload protection on the light circuits. Grounded plugs of 115 volts must be installed at six foot intervals in the walls throughout the two major work areas. The same type of plug must be installed at each work station to eliminate the use of extension cords.

The heating system for the entire shop should be recessed in the wall and regulated automatically to maintain a comfortable and healthful working condition for the students. Possibilities for the heating system could be wall unit ventilators with fan, or split system of forced air and convectors. The minimum quantity of air per student supplied by the ventilating system must be 15 cu. ft. / min. The woodworking and the metalworking areas should be served by a separate overhead exhaust system to diminish the odors, fumes, and dust. A

by the course. The resource center must be equipped with four large

vacuum exhaust system should be installed in the woodworking area to remove shavings.

A room for group instruction and drafting should be provided so that twenty-six students of the largest class will have a place to sit, plan, and draw. The size of this room could be 20 ft. by 24 ft. The instructional room must be equipped with a teacher's desk, a demonstration table, 13 large tables with twenty-six straight-back chairs, 20 feet of chalkboard, 20 feet of pinning board, one large cabinet for storing twenty-six regular size drafting boards and drawing sets, and one open cupboard for displaying samples of ore, wood, clay, and other materials of industry. A pull down screen should be placed in front of the instructional seats and a sound amplifier installed in the wall near the screen. The windows should be equipped with opaque curtains so the room may be darkened. The ceiling height and the floor material should be appropriate for a classroom. Tile block would be economical and would be easy to maintain. The wall partitions should be a sound proof material with the upper portion transparent. The instructional room must be quickly accessible to the shop areas therefore it should be adjacent to them.

A resource center should be provided for research and programmed learning. This room should accommodate eight students at one time working in a variety of activities such as developing plans, reading references, and doing exploratory work in areas of interest suggested by the course. The resource center must be equipped with four large

tables, eight straight back chairs, built-in shelves and protected from the dust by sliding doors to shelve 1000 books, cabinet space for one movie projector, one slide projector, one over head projector, one tape recorder, slide films, and a large supply of instructional programmed materials. The ceiling height, floor material, and the partition walls should be the same as that which is provided for the instructional area. The resource center must be easily accessible to the instructional room and the shop area.

The instructor should have an office which provides for privacy and study. This could be a small room 9 ft. by 12 ft. and equipped with a desk, table, two chairs, filing cabinet for teaching plans, shelves, for the professional library, and a closet for clothes. The office should be adjacent the resource center and the instructional room.

A large storage room 12 ft. by 16 ft. should provide space for large bulky items such as lumber, plywood, metal sheets, and ceramic clay. One side of the storage room should be equipped with horizontal storage space for holding long pieces of lumber and for preserving the shape of the lumber. A second side of the storage room should be equipped with vertical open compartments for metal sheets. A large over-head door ninth-six inches in width should lead into the storage room for receiving the materials and supplies. A small storage room should be provided for the completed projects of the students. This room should be 9 ft. by 12 ft. and should be adjacent the large storage room.

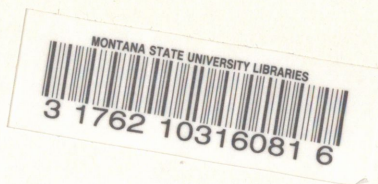
A finishing room should be provided for the final processes of painting, varnishing, or waxing the constructed projects. This room must be provided with fireproof space for storing combustible materials such as paints, varnishes, and metal finishes. A fireproof floor is required. Beyond the general requirements of ventilation a large overhead exhaust system is needed to diminish the special noxious odors. This room could be 12 ft. by 16 ft. and should be adjacent the project storage room.

Facilities should be provided to help avoid unnecessary leaving of the shop. These facilities should include a small toilet 5 ft. by 7 ft. and a drinking fountain. The toilet and drinking fountain should be accessible to the instructional room, the resource center, and the shop areas. One semi-circular wash-up sink should be provided in each work area. A deep sink piped for hot and cold water is needed in the woodworking area, in the metalworking area, and in the finishing room. The sinks must have large drains and large easy traps, since they will be used for wet and clogging materials such as clay, grease, paint, glue, and wax.

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