INDUSTRIAL ARTS FOR THE ELEMENTARY SCHOOL

23rd YEARBOOK

American Council on Industrial Arts Teacher Education

1974

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American Council on Industrial Arts Teacher Education

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Foreword

Industrial Arts is perceived by many persons only as a subject in junior and senior high schools. Of course it is that and much more. This yearbook contributes to the notion that industrial arts has a significant role to play in early and middle childhood education. Through relevant activity, children can and should learn of the technology that shapes the world and their very lives.

Industrial arts experiences have been commonplace in many elementary schools for decades. However, there has been a revival of theory building and program research and development within the past few years. Some theorists contend that industrial arts activities assist the elementary teacher in doing better those things he or she is already attempting to do. Others feel that industrial arts is a subject which represents a missing discipline, a void in the elementary curriculum, and as such should be studied as a major dimension (technology) within the school program. Regardless of which position (or a combination of these) is taken, the reader should find that this yearbook will sharpen the issues in the field and, in the long run, contribute to a more meaningful education of youth.

The ACIATE is greatful to the editor, Robert G. Thrower, and to his assistant editor, Robert D. Weber, for their leadership and hard work in bringing this yearbook to fruition. The chapter authors are to be saluted for systematic treatment of their contributions. This yearbook is indeed a welcomed addition to the literature of our field.

The Council also wishes to express its appreciation to the McKnight Publishing Company which, in August of 1951, agreed to underwrite this yearbook series. This continuing relationship, between ACIATE and the publisher, is a unique one where McKnight invests all of the capital, absorbs any losses, and returns any profit to the Council. On behalf of this partnership, this twenty-third yearbook is presented to the profession.

Willis E. Ray
President, ACIATE

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Yearbook Proposals

Each year, at the AIAA national convention, the ACIATE Yearbook Committee reviews the progress of yearbooks in preparation and evaluates proposals for additional yearbooks. Any member is welcome to submit a yearbook proposal. It should be written in sufficient detail for the committee to be able to understand the proposed substance and format, and sent to the committee chairman by February 1 of the year in which the convention is held. Below are the criteria employed by the committee in making yearbook selections.

ACIATE Yearbook Committee

Guidelines for ACIATE Yearbook Topic Selection

With reference to a specific yearbook topic:

1. It should make a direct contribution to the understanding and the improvement of industrial arts teacher education.
2. It should avoid duplication of the publications activities of other professional groups.
3. It should confine its content to professional education subject matter of a kind that does not infringe upon the area of textbook publication which treats a specific body of subject matter in a structured, formal way.
4. It should not be exploited as an opportunity to promote and publicize one man's or one institution's philosophy unless the volume includes other similar efforts that have enjoyed some degree of popularity and acceptance in the profession.
5. While it may encourage and extend what is generally accepted as good in existing theory and practice, it should also actively and constantly seek to upgrade and modernize professional action in the area of industrial arts teacher education.

6. It can raise controversial questions in an effort to get a national hearing and as a prelude to achieving something approaching a national consensus.
7. It may consider as available for discussion and criticism any ideas of individuals or organizations that have gained some degree of acceptance as a result of dissemination either through formal publication, through oral presentation, or both.
8. It can consider a variety of seemingly conflicting trends and statements emanating from a variety of sources and motives, analyze them, consolidate and thus seek out and delineate key problems to enable the profession to make a more concerted effort at finding a solution.

Approved, Yearbook Planning Committee
March 15, 1967, Philadelphia, Pa.

Previously Published Yearbooks

1. *Inventory-Analysis of Industrial Arts Teacher Education Facilities, Personnel and Programs,* 1952. Walter R. Williams, Jr. and Harvey Kessler Meyer, eds.
* 2. *Who's Who in Industrial Arts Teacher Education,* 1953. Walter R. Williams, Jr. and Roy F. Bergengren, Jr., eds.
* 3. *Some Components of Current Leadership.* Roy F. Bergengren, Jr. *Techniques of Selection and Guidance of Graduate Students.* George F. Henry. *An Analysis of Textbook Emphases.* Talmage B. Young. 1954, three studies.
* 4. *Superior Practices in Industrial Arts Teacher Education,* 1955. R. Lee Hornbake and Donald Maley, eds.
* 5. *Problems and Issues in Industrial Arts Teacher Education,* 1956. C. Robert Hutchcroft, ed.
* 6. *A Sourcebook of Readings in Education for Use in Industrial Arts and Industrial Arts Teacher Education,* 1957. Carl Gerbracht and Gordon O. Wilbur, eds.
* 7. *The Accreditation of Industrial Arts Teacher Education,* 1958. Verne C. Fryklund, ed., and H. L. Helton.
* 8. *Planning Industrial Arts Facilities,* 1959. Ralph K. Nair, ed.
* 9. *Research in Industrial Arts Education,* 1960. Raymond Van Tassel, ed.
10. *Graduate Study in Industrial Arts,* 1961. Ralph P. Norman and Ralph C. Bohn, eds.
*11. *Essentials of Preservice Preparation,* 1962. Donald G. Lux, ed.
*12. *Action and Thought in Industrial Arts Education,* 1963. E. A. T. Svendsen, ed.
*13. *Classroom Research in Industrial Arts,* 1964. Charles B. Porter, ed.
14. *Approaches and Procedures in Industrial Arts,* 1965. G. S. Wall, ed.
15. *Status of Research in Industrial Arts,* 1966. John D. Rowlett, ed.
16. *Evaluation Guidelines for Contemporary Industrial Arts Programs,* 1967. Lloyd P. Nelson and William T. Sargent, eds.
17. *A Historical Perspective of Industry,* 1968. Joseph F. Leutkemeyer, Jr., ed.
18. *Industrial Technology Education,* 1969. C. Thomas Dean and N. A. Hauer, eds. *Who's Who in Industrial Arts Teacher Education,* 1969. John M. Pollock and Charles A. Bunten, eds.
19. *Industrial Arts for Disadvantaged Youth,* 1970. Ralph O. Gallington, ed.
20. *Components of Teacher Education,* 1971. W. E. Ray and Jerry Streichler, eds.
21. *Industrial Arts for the Early Adolescent,* 1971. Daniel L. Householder, Editor.
22. *Industrial Arts in Senior High Schools,* 1972. Rutherford E. Lockette, Editor.

*Out-of-print yearbooks can be obtained on microfilm and in Xerox copies. For information on price and delivery, write directly to University Microfilms Inc., 313 N. First Street, Ann Arbor, Michigan 48107.

Contents

Preface

The American Council on Industrial Arts Teacher Education (ACIATE), with the cooperation of McKnight Publishing Company, has sponsored a yearbook each year for a number of years. This issue is the twenty-third in the series. It is also the fourth and final one in a series which presented an overview of Industrial Arts at the various levels of education. The titles and editors which considered these levels are presented below:

1. *Components of Teacher Education.* Willis Ray and Jerry Streichler, Editors. (1971)
2. *Industrial Arts for the Early Adolescent.* Daniel Householder, Editor. (1972)
3. *Industrial Arts in the Senior High Schools.* Rutherford E. Lockette, Editor. (1973)
4. *Industrial Arts for the Elementary School.* Robert G. Thrower, Editor. (1974)

For a number of years the leadership of the American Council for Elementary School Industrial Arts (ACESIA) had envisioned a professional publication devoted to the topic of industrial arts for the elementary school. Much thought had been directed by the group toward what should be included in such a publication, as well as to the public it should serve. The collective thinking of the group concluded that such a publication should bring together under one cover a rather thorough treatment of the elementary school age child, the source of curriculum content, curriculum design, and the learning environment. In addition, it should include a look at what is currently happening in elementary programs, the role of various personnel in an elementary school industrial arts program, historical reflections, philosophical positions, and a review of related research.

This group felt the need for a publication that would explain elementary school industrial arts to lay persons and educators from other disciplines without confusing them. This was considered to be very important because the success of elementary school industrial arts, more so than at any other level, is largely dependent on persons outside the field of industrial arts. At the same time, the publication needed to serve the industrial arts professional, whether he be a classroom teacher; supervisor; or teacher educator.

The ACESIA members had sought various ways to bring such a publication to fruition with no avail. Thus the time was ripe when Dr.

Howard Nelson, representing the Yearbook Committee, approached this writer on the possibility of the elementary group doing a yearbook. The opportunity was accepted and many of my colleagues immediately offered their services, and they are to be commended for their professionalism. From this impetus, the yearbook was undertaken.

ACIATE in general, and the editor in particular, is grateful to T. Gardner Boyd; William A. Downs; Harold G. Gilbert; Norma Heasley; William R. Hoots, Jr.; Robert G. Hostettler; Franklin C. Ingram; Delmar L. Larsen; W.R. Miller; Vito R. Pace; Mary-Margaret Scobey; and Eberhard Thieme for their well prepared chapters. A very special debt of gratitude is owed to Dr. Grace Graham, Dr. Ardelle Llewellyn and Dr. Violet Robinson who, even though from outside the field of industrial arts, have made major contributions to this publication. The industrial arts profession is deeply indebted to them. This editor also wishes to acknowledge the valuable assistance of Robert D. Weber in editing and preparing the final copy.

It is hoped that this Yearbook will be of value to both the layman and professional who is interested in the field of elementary school industrial arts and that it will stimulate the growth of industrial arts as an integral component of elementary curriculums throughout the country.

Robert G. Thrower

CHAPTER I

Industrial Arts in the Elementary School

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A nation-wide group of industrial arts leaders wrote a statement in 1971 to clarify the contribution of industrial arts at the elementary school level. Recognizing industrial arts "as an essential part of the education of every child," the group stated the scope of the field:

> It deals with ways in which man thinks about and applies scientific theory and principles to change his physical environment to meet his aesthetic and utilitarian needs. It provides opportunities for developing concepts through concrete experiences which include the manipulation of materials, tools, processes, and other methods of discovery. It includes knowledge about technology and its processes, personal development of psychomotor skills, and attitudes and understandings of how technology influences society. (Hoots, 1971, p.3)

Why do children need such knowledge today more than ever before? The answer lies in complex changes on the current scene that have sociological, psychological, and technological dimensions.

CHANGING SOCIAL CONDITIONS AND ATTITUDES

The revolt of youth beginning in the sixties provides part of the answer. Their attitudes and actions are related to our economic system, to the world of work, and to the rewards that our technological culture offers. The affluent youth are resisting the materialism they associate with capitalistic enterprise; the indigent youth seek equality in competing for work; young "hard hats" are becoming increasingly alienated from their jobs. Latecomers on the scene are advocates of women's liberation, who, sometimes wearing buttons that read "Uppity Women Unite," are demanding equality of opportunity for jobs and equal pay.

To some extent, the process of socialization in schools has failed all of these groups. We must not, however, make teachers the scapegoats and relieve parents, political leaders, and business and industry tycoons of their share of blame. Nevertheless, we should admit that teachers, like parents, have stressed money as the primary, if not the only, reward for work. They have not succeeded in imparting basic skills to the poor. Often they have favored white collar jobs and denigrated the skills of the blue-collar worker. They have discouraged girls from seeking training and jobs except in very restricted fields. In all fairness, then, we must conclude that young people and their mentors have a point of view worthy of serious attention. A common thread that unites them in differing ways is their attitude toward materialism.

Materialism: An Issue in the Current Unrest

Is the charge that materialism has become a dominant trait in our culture justified? Though we like to think that our nation was founded on spiritual and philosophical ideals, we ignore the historic origin of materialism in the American national character.

Innate in the religious philosophy of our founding fathers were beliefs about work and wealth. The Puritan Ethic held that work glorified God; Calvinism stressed the notion that God rewarded those predestined for salvation with worldly goods. Hence those who became wealthy through honest work, they thought, were Godly men. In this century, religious faith has declined, yet money as the source of all material things which makes life pleasant, has, for some, become the idol. The most luxurious automobiles, the finest stereo, and the most stylish clothes are among the possessions that make life worthwhile for them and give them status among their friends. The poor and the unemployed are also materialistic. They increasingly demand their fair share of the goodies. Even university students, who decry materialism, assert their right to food stamps as though they were of the uneducated and unemployable poor.

Americans' acceptance of materialism as a "good" has in fact a powerful force behind the development of the technology which is the basis for America's mammoth industrial complex and our high standard of living. The demand for consumer goods has motivated industrialists to hire scientists, engineers, and other specialized workers who seek effective ways to produce products for the consumer. Sophisticated tools and processes have made it possible for greater numbers of people to own a greater variety of articles necessary for "the good life." "The more we have, the more we want" has been proven in the marketplace. Our materialistic drive has resulted in a highly efficient industrial system supplying the needs of our nation and much of the world.

Strong materialistic values are derided by many social critics. Writers such as Marcuse, Ellul, and Reich deplore the power represented in industry and technology as a negative influence on man. Influenced by such thoughts, some young people reject work in organized industry. Instead they seek to survive through creative handicrafts, or they work on temporary jobs only when it is necessary to increase their financial resources. That "work makes ants of men" is their point of view. They are afraid that independent thought, individualism, and sensitivity are crushed by technology. Man becomes merely a cog in the machine.

Others, however, feel that our highly developed technology can and will help man attain greater understanding of self and more satisfactory personal accomplishment. Maslow, Combs, Kelly, and other humanistic psychologists believe that man can use the materialistic offerings of our technology to his advantage. Material well-being can release intellectual energies for the solution of social problems, thus improving the quality of life and of human relationships. For example, automation and cybernation are steadily decreasing the work week, giving workers longer hours of leisure, more time for study, family, and creativity. Instant research, via computer, facilitates not only the work of the scholar, but also that of the physician and the engineer. We are learning to use technical know-how to improve our damaged ecology and to make our parks and playgrounds more useful and beautiful.

Writers with divergent points of view are, then, offering us food for thought. The question is, are our minds at peace within this affluent economy? Do we see our relationships with the products and processes of industry and technology as a menace or a benefit to mankind? Can we learn to appreciate material inventions and be conscious of both the positive and the negative influences they create? Can we influence economic change to give meaning to our lives rather than contributing to the alienation of the young? What role can the school assume to help in the solution of these problems? What contribution can industrial arts make?

The Struggle to Equalize Opportunity

Another social concern is for inequalities of opportunities for work and monetary rewards between social groups. For over a decade now the American people have become increasingly aware of the economic and educational disparities between the middle class and those groups represented by minorities, inner city residents, rural poor, and the unemployed.

The solution to this problem lies in changing home and community environments, providing jobs and job training for adults, fighting racism and social-class snobbery, seeking means for distributing wealth more fairly, and reforming the system of law and justice as well as providing equality of educational opportunity. Some desirable social changes have been attempted. Urban renewal plans have sought to eliminate slums. The Fair Employment Practices Act seeks to assure that discriminatory hiring and firing practices do not occur. Several churches have tried to attract people of different races and social class origin. Big businessmen and industrialists have sponsored various programs designed to give economic opportunities to the poor.

But, in typical American fashion, most people, unwilling to make fundamental social changes that would affect their life styles, have demanded that schools solve the problem by assuring equality of educational opportunity. "If children of the poor could read, write, and figure and learn to work hard," they say, "they would get jobs. The schools must teach these skills and attitudes."

Responding to such demands, teachers became the front-line fighters and schools the battlefield in the war on poverty. Real attempts were made during the Sixties to integrate races, with little success except in the Deep South. Arguments among adults about bussing projects designed to facilitate integration still continue. Compensatory education, planned to increase the educational effectiveness of schooling for underprivileged children has been heavily financed by governmental funds, but with less than hoped for success. Schools alone have not been able to counteract the social and economic handicaps of the poor. A recent study by Christopher Jencks (1972) and his Harvard team finds that in spite of our efforts to provide better schools for underprivileged children, they have had little effect on equalizing intellectual achievement or on eliminating social and economic equalities. His study casts doubt upon the assumption that basic educational skills alone will eliminate inequality in economic fields.

The struggle to equalize opportunity within schools has produced, however, an important by-product. Integration, rejection of materialistic goals and of conformity to middle class norms coupled with the decline of social groups that have social, racial or religious restrictions on memberships, have helped to develop a new social consciousness among younger people. They are interested in questions such as these: How can human and physical resources be utilized to the greatest benefit of our society? How can we help man achieve his full potential? How can our environment be made more livable? How can all people learn to develop and use their talents?

Although we cannot point with great pride to the school's achievement in equalizing economic opportunities, the social concern and acceptance of people who are different, which young people are learning largely in school and through the efforts of the mass media, are clearly steps toward the goal of future fundamental social changes. The curriculum of industrial arts to date can claim little credit for these advances, but it certainly can be improved so that it will make a significant contribution to developing humaneness and social responsibility in children.

Changing Attitudes Toward Work

At the same time that developers of industrial arts curriculum will incorporate concerns for humaneness in their plans, they will also have to take into account changing attitudes toward work. Active young people are not rejecting work because they are lazy. They are simply reflecting their own parents' experiences at work and deciding for themselves to put work in its place.

Adult attitudes have changed in part because the nature of work has changed. We have witnessed the advent of a technology that has deemphasized handicraftsmanship and man's pride in his finished product. In mass production no one man is responsible for the finished product; with cybernation the machine is the producer. Even carpenters, laboratory technicians, and researchers work in teams. Much work tends to be repetitive and dull. The new technology also changes the kinds of jobs available. The creation of new jobs and the obsolescence of old ones means that a worker may be forced to change his job and often the geographical location of his job as often as six times in his career.

These shifting conditions of work have lessened the worker's commitment to his job. He turns his attention to leisure activities for self-fulfillment. Work and a job become a means of earning money that will facilitate other activities from which satisfaction can be gained. Some workers, indeed, stay on the job long enough to accumulate unemployment pay, then find some excuse for becoming unemployed in order to enjoy the financial benefits. A job, then, is to many workers less important than the creature comforts for himself and his family that the financial rewards from working will bring.

Attitudes toward one's job status can be related to a person's craving for money and his declining interest in work itself. In professional fields, job status has not been dependent upon wages alone. The education and experience needed for the work, the hours worked, and the range of responsibilities are factors warranting social approval. For the non-professional, however, the monetary rewards have become the chief criterion of status. Today the sanitary engineer who collects refuse earns enough money to live well and his standard of living commands a kind of social respect.

Changing attitudes toward work and jobs presents educators with the very real problem of identifying the place of work in self-fulfillment. Can we educate children and youth to appreciate work for the satisfaction derived from it? Can we help the learner explore the many handicraft skills to find those that are rewarding as leisure time activities, and are of special interest as work skills? Can pride in craftmanship be reestablished and fostered? These are the kinds of questions that a well-conceived program in industrial arts can help to answer.

Attitudes Toward Women at Work

Workers' attitudes and youth's arguments that work is alienating and meaningless stand in sharp contrast to those of feminists. The latter point to their own household drudgery and dead-end jobs in business and industry, but view men's jobs as intellectually challenging and significant as well as financially rewarding.

They also attack the school for stereotyping women, low-rating their talents, and relegating girls to a few lowly occupations or poorly paid professions. Some changes are being made. Books stereotyping the roles of women at work are being criticized. Even Mother Rabbits in a child's book wear aprons! An analyst of Dick and Jane books found 148 male occupations and only 26 women's occupations, one of which was Fat Lady in a Circus. (Alroy, 1972)

The content of industrial arts programs in the elementary school offers an unusual opportunity for revising estimates of women's talents. Why shouldn't a girl learn how to fix appliances? Why shouldn't a girl be allowed to develop skills in woodworking? In a small Oregon town a high school girl was recently refused the privilege of enrolling in a shop class because the building contained no rest rooms for girls. She had offered to run to another building if she had to go! Isn't it true that industrial arts in high schools and middle schools has been flagrantly guilty of stereotyping girls' aptitudes?

SOCIAL NEEDS INFLUENCING CURRICULUM DEVELOPMENT

The schools cannot be divorced from social problems as they are being identified in various sectors of our society. Sarason (1971, p. 7) emphasizes the relationship of the school to the society when he says:

> There are few, if any, major social problems for which explanations and solutions do not in some way involve the public school—involvement that may be direct or indirect, relevant or irrelevant, small or large. After all, the argument usually runs, the school is a reflection of our society as well as the principal vehicle by which its young are socialized or prepared for life in adult society.

Parents, community leaders, educators, and students are giving increased attention to the kind and quality of education being offered today. The President of the Bank of America advised a group of top educators of what he believes to be the primary goals of education for this decade: "First, teachers must emphasize the basic skills of reasoning and communication. Second, they must balance the needs of society against the needs of the individual. And third, they must make sure their teaching reflects current and future social needs." (Clausen, 1971)

Pressures for Humaneness and Relevance

In particular, questions are currently being asked about the relevancy of school experiences as they affect the humaneness of the learner. Is education a personally integrating experience? Do we offer a truly liberal education? That is, does the curriculum in fact provide for the learner a real understanding of himself, develop humane judgmental capabilities, and influence effective human relationships? Do the young discover the personal meaning of new information and skills that have been learned?

Perhaps what people are seeking, in addition to adaptation to the social and political environment, is greater discovery of feelings, attitudes, hopes, and perceptions of self as related to the world of people and things. The emphasis is upon the kind of human beings we want to produce. If the child is father of the man, his early experiences will be crucial in his development as a human person. Developing a child's social sensitivities is very pertinent to success on the job as well as to a meaningful life. More workers are fired for lack of ability to relate amicably to their co-workers than for lack of job skills. The impersonality of bureaucratic business organizations can be lessened if persons in them are socially sensitive to the needs of others.

The designers of educational curriculum are responsible for relevance in that curriculum. From what social critics are saying come clues. As educators, our responsibility is to identify social needs, analyze them for their educational implications, and then translate the findings into curricular experiences. Industrial arts educators need to pay particular attention to the social ferment related to materialism, equal opportunity, development of human and physical resources, attitudes toward work, and the need to educate for leisure in order to improve the credibility of industrial and technological education. They need to ask themselves questions such as those above and the following:

Do we have the responsibility to develop children's work skills, *per se,* and do we also need to provide opportunities for youngsters to perceive the wide variety of work effort necessary to our way of living? Do learners need to know their own special talents and skills, working interests, and preferences? Do they need to gain an understanding of the products and processes of industry and technology that will help them to increase their own effectiveness as consumers?

Do industrial arts educators need to make a conscious effort to influence attitudes and perceptions? Do we teach children to appreciate the work of others and the dignity and need for all types of work, no matter how menial? Do children understand the complexities of industry and technology, including the interdependencies of individual jobs, working processes, and services?

Can we meet Bruner's challenge to "guarantee a future for someone?"

Pressures for Career Education

Popular definitions of education as job training and recent Federal government decisions to stimulate Career Education, whether rightly or wrongly conceived, offer an unusual opportunity for effective programs of industrial arts in the elementary school. Public support and federal money will be available.

The cry that every high school graduate who is not college bound should be prepared to take a job upon graduation from high school is not new, but now it is being reinforced in the Department of Health, Education and Welfare (HEW) by plans for Career Education. Clearly industrial arts in the elementary school cannot contribute directly to this goal.

But HEW agents, leaders in many state departments of education, and many laymen are demanding, loud and clear, that certain aspects of Career Education, much of it unique to industrial arts, begin with young children. Understanding one's self, developing one's mental and manipulative abilities and interests, acquiring skills that will lead to productive and economically successful work, understanding and appreciating the human dignity of all types of workers are directly related to industrial arts experiences.

The renewed interest in Career Education does indeed have a silver lining for those of us who are interested in the industrial arts curriculum. As John Dewey (1902) pointed out years ago, man has always expended his creative energies in solving problems connected with his work. Dewey's curriculum for small children was based on a study of the *processes* required in making products. Although his curriculum may not be relevant today, his conceptualization of an industrial arts curriculum still has vitality.

Often in pedagogy we seem to make a full circle; perhaps we are now almost back to Dewey's design. Thus we join the ranks of those critics of education who unconsciously espouse Dewey's principles and practices.

Pressures for Less Verbalization and More Participation in Schools

Contemporary critics of education, like Dewey, deplore the textbook-recitation type of schooling that is frequently found in traditional classrooms. They insist that children be free to learn by using their senses, by exploring their own interests, and becoming "involved" in what they are learning.

Support for this kind of learning is found in the writings of Marshall McLuhan (1964). He hypothesizes that television has made obsolete visual linear-type learning, the one-thing-follows-another kind of learning promoted by books. He says that the instant communication of color, perspective, and action on a television screen not only offers more information than schools do, but also, what is more important, influences the *way we think.* We use all our senses in learning. McLuhan further describes television as a "cool" medium which drives viewers to involvement.

Although we may reject McLuhan's somewhat mystical interpretations, we must admit that the competition from television may have "cracked the schoolhouse walls" by increasing children's sophistication, and making them critical of the pace and dullness of many classroom activities.

If young people today want less abstract and verbal learning, and more participation in concrete, first-hand experiences, and we believe they do, they will be stimulated by a well-designed curriculum in industrial arts. Such a curriculum will also fit in well with recent developments in elementary education and make a unique contribution to it.

EDUCATIONAL TRENDS INFLUENCING CURRICULUM DEVELOPMENT

Throughout the public school system, and even more markedly in the private free schools, change is apparent. Perhaps innovations have not pervaded the educational establishment completely, or as generally as we might wish, but enough school districts are either trying new practices or have them well enough established to generalize about the following trends and identify their implications for industrial arts programs.

Curriculum Content

Perhaps the most pervading of changes has been reform in the organization and content of the major elementary school disciplines. The new math was the first; a reorganized approach to the study of language, of science, and more recently, of social studies followed. Emphasis in these subjects is upon significant academic meanings learned through use of concrete devices, active participation, analysis of content relationships, and pupil discovery. The stress is upon the importance of understanding principles, interrelationships, and personal application of facts and ideas. Emphasis upon cognitive learning now includes affective learning, because thinking and feeling are closely related.

Change in academic emphases embracing both cognitive and affective learning, means that the industrial arts curriculum must include much more than simple handicraft activities or a watered-down high school curriculum. Careful identification of objectives, considered sequences, and coordination with other subjects within the elementary curriculum should be the basis for reorganization of elementary school industrial arts.

Instructional Materials

As structural organization and content emphases have changed in the various disciplines, scholars, educators, and publishers have cooperated to prepare materials that implement new approaches to learning. Today's teacher has many options and a rich variety of materials to help him achieve his objectives.

Instructional materials have been designed to facilitate instructional flexibility, individualized learning, small group activity, and greatly diversified interests and abilities. Perhaps the most important result of the influx of such materials is that teachers are encouraged to use a variety of them, and even to prepare their own.

The use of a wide variety of materials for industrial arts has long been a part of the program of manipulative, concrete experiences. The materials tend to be the raw materials of industry, however, and we face a continuing problem of keeping up with the technical changes in materials and machines. Use of instructional aids, such as tape recorders, picture files, and self-directive contracts, are also helpful.

The volume of materials prepared by business and industry for use in the school, such as brochures, films, booklets, and kits, also need to be carefully evaluated and modified for use with young children. Though some verbal materials are required in developing cognitive learning, overemphasis on them could weaken the great strength of industrial arts as 'doing' experience.

School Environment

The new architectural design of elementary schools has brought a new look and a new concept in education—openness. Advocates of open space claim it facilitates flexibility in movement, grouping, instructional activities, and arrangements of learning centers. It provides easy access and increases communication.

Though slower to be evidenced than modified physical arrangements, the social and emotional climates tend to be freer, more accepting, and in this sense, more open. Emphasis is upon positive reinforcement. Children are encouraged to do their own thing under indirect guidance by the instructor and in relaxed, informal control. Concentrated efforts are being made to help children understand each other, to build mutual respect, and to accept differences among themselves. Cooperation and mutual support between teacher and learner in plans, action, and evaluation is increasing. Interaction between groups and individuals is also fostered. The result is an improved personal understanding and acceptance that adjusts the social and emotional climate to the advantage of academic learning.

This trend toward an open school plant and personal openness is a boon to industrial arts educators who have always worked with flexibility of movement over large open space in the laboratory. They know how to manage individual projects and small group endeavor. The relationship between learners and between pupil and teacher has tended to be informal.

When no laboratory is available in a school, however, the open spaces and organization of learning centers provides an opportunity to introduce more industrial arts experiences than ever before. A tool box and a work bench in one part of an open school are much more available than in an egg-crate school. An interest or media center set up with intriguing exhibits, manipulative materials, and instructions for technological exploration is a natural in an open school. Materials and exhibits must, of course, change frequently to stimulate continued interest, as well as to supplement ongoing studies in other curriculum areas.

Cooperative Instruction

Team teaching is not new, but the maturation of the teaming concept has brought interesting changes to the elementary school. The trend is toward cooperative instruction, the tasks of teaching one child being divided between a number of individuals. For the most part instructors are credentialed teachers, sometimes administrators, often partially trained interns, student teachers, or teacher aides, frequently parent volunteers or community workers, and in some cases, other learners. This system, for better or for worse, capitalizes upon instructional experience and talent, and differentiated responsibilities and roles. It is more likely that the variety of instructional styles will reach a greater number of learning styles. Pluralism encourages diversity in both teaching and learning.

Thus the role of the teacher is changing. He is a manager, a coordinator, a diagnostician. He shares teaching responsibility with several others.

This organization can be an advantage to the industrial arts educator. He himself can be a part of the teaching team. He can find older students, who can work with children, to supervise the handling of tools and use of materials. He knows community workers who can contribute to the instructional program by giving demonstrations or answering questions. He can help other instructors acquire tools, materials, and other supplies. He can help plan the sequence of learning experiences; he can help identify the big ideas to which the study of industry and technology can contribute. He can plan and conduct inservice workshops for all levels of school personnel. Careful judgment must be made, however, to enter into the plans of the general teaching team so that coordination of overall experiences can be made for reaching stated instructional objectives.

The concept of teaming, and of sending small groups of children to special areas to pursue their projects is, of course, helpful to those teaching in industrial arts laboratories. But it may mean that an established program will have to be modified if real help is given to random groups who seek help out of the context of the sequence usually followed in a lab. The challenge to the teacher is how to plan with the homeroom teacher, how to help children make relationships between the lab activities and the home area studies, and how to guide an ongoing, sequential program for all children.

Some industrial arts educators have already begun a teaming process with the regular teacher as well as with other specialists in the school. Art, crafts, home economics, drama, and science are curriculum areas that can be coordinated easily with industrial arts because they extend and supplement the content related to industry and technology. One can conceive of teaming with the school nurse, with the custodian, with bus drivers, as well as with numerous community workers, to further the interests of industrial arts.

Teaching Process

If a teacher must operate in a changed environment, work with several other people in cooperative instruction, and teach content which has recently changed in organization and focus, a natural result is modified methods of instruction. *Process* is the most current concern. Leaders in the field who have been analyzing the practical components of instruction recognize process as one of the most important aspects of the teaching-learning experience. Process, some say, is content, for the simple reason that *how* we learn is *what* we learn.

Probably the major emphasis is heuristic learning, or the ability to discover for oneself. In addition, the stress is upon humaneness, creativity, and personal application of skills, facts, and ideas. Increased concern for individual differences has encouraged more individualized learning.

Role playing, simulations, and games are finding new outlets and bringing more realistic meaning to learning experiences. These activities in addition to utilizing doing activities, provide opportunities for learners to use knowledge previously gained, to solve problems, to raise questions, and to find out what further information is needed.

Research activities go beyond the textbook or published materials to experiments, demonstrations, interviews, and observations. Following research, methods of organizing information require sensory manipulation in diagramming, exhibiting, designing, mapping and other forms of classification and organization that help the learner interpret his findings.

In the last few years, the term "accountability" has come to mean that teachers will be held responsible for effectiveness in teaching by measuring the achievement of his pupils. The teacher has been asked to define his instructional objectives more clearly so that assessment of learning can be more objective. In the teaching of social studies, cognitive objectives, usually in the form of big ideas or generalizations, have been identified, replacing listings of factual content. In subjects such as math and reading, sequential series of behavioral objectives have been developed.

Individualization of instruction, small group activity, and concrete manipulative experiences, so hard for the regular teacher to achieve, are only standard operating procedure for the industrial arts teacher. He has also experimented with simulations to help children develop deeper insight into technological processes. Further development of this teaching technique would be appropriate.

Behavioral objectives can be very effective for the skill development aspect of industrial arts. We have, in effect, used them for some time. But more difficult to achieve would be the objectives that would be guidelines for cognitive and affective learning. Very little has been done in this badly needed area of industrial arts education.

In reevaluating the industrial arts program for the elementary school, other aspects of teaching process deserve consideration. How can heuristic learning in part replace the rigid following of directions? Can a problem-solving approach be fostered? In what ways can that completed industrial arts product be utilized to further consumer education?

Industrial arts programs at all organizational levels need to be carefully planned. Because industrial arts originated for older, more mature students, we need to be very careful about experiences designed for very young children—including nursery school and kindergarten. Even middle school curriculum, in some cases very different from the departmentalization of junior high schools, will require a new kind of industrial arts program.

Plans at all levels must be in line with the interests, talents, and capabilities, and the unique developmental tasks of the learners. (See Chapter 2.) Sequence must be structured with a focus not only on industrial arts objectives, but with consideration of the overall objectives of the curriculum, and the established curricular sequence for achieving them.

The industrial arts curriculum needs to incorporate the teaming concept, develop a real framework for cognitive and affective learning, help children understand themselves and others, orient them to the vast complexities and interdependences of the world of work, and develop attitudes and self-awareness that will help the young become self-sufficient and economically independent adults.

WHAT INDUSTRIAL ARTS IS AND CAN BE TODAY

Like the ferment within our society and the changing trends of elementary school education, industrial arts as a field of study in the elementary curriculum is in the process of reassessment and emerging new perceptions. We must clarify its components, its concepts, and its place in the curriculum.

The Components of Industrial Arts

The term "industrial arts" first connotes that industry is the major factor. By *industry* is generally meant the production or manufacture of the material objects of our lives. In a very narrow sense, then, industrial arts is the study of systematic production and manufacturing, including tools, materials and processes. Of increasing importance to society, however, has been the wide complex of services related to technological products. These include not only electronics repair, dry cleaning, and food catering, but beauty shops, and indeed, the professional services such as dentistry and X-ray. Children should understand their role within the industrial complex. And today's industry is not limited to manufacture and services. Research teams charged with improvement and invention, design, safety, quality, by-products, conservation and pollution factors are vital parts of industries. Industrial arts, as the study of industry, must include all such related work—the sum of the ways in which people produce and maintain what they need.

Industrial arts, then, is not limited to the study of industry. Children are not only surrounded by a world of things, they are swept up in an era of change; technology is one of the major forces in that change. *Technology,* a term with greater implications for knowledge than industry, relates to man's total ability to control matter. It includes aspects of engineering, applied sciences, and agriculture, in addition to industry. Alvin Toffler (1970) states it well: ". . technology has always been more than factories and machines. . . . technology includes techniques, as well as the machines that may or may not be necessary to apply them. It includes ways to make chemical reactions occur, ways to breed fish, plant forests, light theaters, count votes, or teach history (p. 25)." It also includes the services developed to facilitate the distribution, use, and maintenance of technical products.

As Toffler's "great growling engine of change," technology influences our society both for positive and negative change. The benefits of technology, as well as the problems resulting from technology are an innate part of the study. Young children can learn to use technology to advantage rather than to disadvantage.

Since technology embraces engineering and applied sciences, industrial arts activities and understandings include many dimensions of *science.* The line between science activities and industrial arts activities for elementary school children is so fine, in fact, that it is difficult to distinguish between them. Science includes the study of electricity, yet electricity, as a source of power, is a logical part of many industrial arts experiences. Growing of yeast, a scientific phenomenon, is a basic factor in the production of breads. Many scientific principles must certainly be understood when learners pursue the study of industry and technology.

Inherent in the term, industrial arts, is reference to man's aesthetic expression, *art.* Traditionally this reference to art may have meant the manipulative skills, or arts of handicraft and production. Today's concept of industrial arts will not deny this relationship, for children and youth still need to develop some of the handicraft and machine skills needed to change raw materials. In addition, however, the term "art" must also remind us that man has always attempted to beautify his surroundings and to make the products he creates aesthetically satisfying. Form, color and texture as components of technological productions often also serve practical ends. For a reason, the school bus is yellow, and the bow of a ship is designed in simple curves. Industrial arts, then, is closely related to the fine arts in many ways, and the term cannot be limited to psychomotor skills.

Industrial arts in the elementary school has always been interpreted as a part of every child's *general education.* Its content, attitudes and psychomotor skills are regarded as appropriate learnings for all children. They are needed by children as they live as children. They will be needed by children as they grow, mature, and become socially and economically competent adults.

General education is interpreted as a comprehensive basic education that includes not only excellence in the three R's, but also many other kinds of skills and understandings that will prepare children for self-fulfillment, including their work life and their leisure. This is directly supportive of the industrial arts program.

Social demands for increased preparation and competency in occupational skill and understandings has resulted in increased focus on the *world of work.* By this we do not mean vocational education in the strict sense of the term—the special training needed for a vocation or a job. Such a task would hardly be possible when teaching four- eight- or ten-year-olds. Sidney P. Marland, then the US Commissioner of Education, urged in a series of speeches in May, 1971, that the term vocational education be dropped in favor of *"career education."* The United States Office of Education has since that time made *career education* (knowledge oriented to careers and career choices) one of its priority focuses. A succinct, clear definition of career education has not yet been universally recognized, yet many programs for elementary schools across the country are in operation and on the planning boards. They tend to be separate subjects and discrete parts of the curriculum, and they vary from sophisticated crafts programs to highly verbal studies of the occupational world. They focus on the wide variety of careers pursued in our society, and the complex of jobs that make up occupational clusters. Through career awareness and career orientation, learners are expected to find meaning in the world of work, and develop practical perceptions of himself and his relationship to the occupational world. These programs are designed to help children become aware of human hopes and aspirations, feelings and attitudes.

Industrial arts has never ignored the relationship of jobs, occupations, and work to the study of industry and technology. Wilber's (1948 definition indicates this: ". . industrial arts will be defined as those phases of general education which deal with industry—its organization, materials, occupations, processes, and products—and with the problems resulting from the industrial and technological nature of society (p. 2)." Even Bonser and Mossman's

(1923) classic definition for the elementary school included occupational considerations: "The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes (p. 5)."

Thus career education is in reality not new to the industrial arts concept, but the heavy emphasis on career education at the moment is a force for changing the way in which industrial arts content could be designed, and the scheme through which it could be presented. Industrial arts, with its general education emphasis, and its broad coverage of technology and related work efforts, is *more* than occupational orientation. For this reason, industrial arts is the natural and logical vehicle for introducing young children to the world of work and to the development of occupational literacy.

Another component of the industrial arts relates to educating for *leisure.* Though industrial arts as a special content area cannot provide children with all the knowledge and skills necessary for free time activities, it can make a major contribution to those manipulative skills and material processes which can be an enjoyable part of man's life of leisure. Just as the concrete, doing activities of industrial arts can help children understand their own talents, abilities, and interests for occupational choice, so can these same manipulative activities, properly considered, help them to select leisure activities. Industrial arts offers a wide range of materials, skills and activities from which to choose "do-it-yourself" projects which are extremely popular among adults today. In addition, industrial arts can help children understand the relation of rural campsites and recreational areas to the conservation efforts of industry.

The study of industry and technology, adequately and completely presented, includes the many aspects of product manufacture, development, and marketing that will contribute to *consumer education.* Packaging, for example, as an important aspect of industry, includes not only design, materials and production, but labelling to comply with governmental regulations and to appeal to consumers. Costs of finished products are related to the intricacies of production and manufacture, transportation and handling. Students should be learning the relationships of these cost factors, as well as building some criteria for discriminating between good, less good, and fraudulent products.

The Meaning of Industrial Arts for the Elementary School

That industrial arts is "the study of the ways in which man changes the raw materials of his environment for his use" is a basic definition that most educators will recognize. Wilber, and Bonser and Mossman, quoted earlier, presented this fundamental idea long ago. A changing concept of industrial arts is, however, implied in the 1971 definition. It emphasizes not only man's production, but also the way he thinks about and applies knowledge for the invention and production of goods and services. Further, it implies that the learner needs to develop, as a result of various methods of research, concepts which will supplement the traditional first-hand activities of industrial arts. And finally, the 1971 definition includes consideration of the influence of technology on our way of life, as well as the social problems which face us as a result of technological changes.

Drawing upon the stated demands of our society, and incorporating ideas from the character of industry and technology, certain criteria can be identified that may be inherent in a 1975 concept of industrial arts at the elementary school level.

—Industrial arts is a discrete field of study, or a subject discipline with its own unique body of knowledge, skills, attitudes and activities.

—Industrial arts is a part of the general education needed by all children and youth in our culture.

—Industrial arts seeks to interpret the broad scope of industry and technology, to recognize the interrelationships between technology and society, and to develop intellectual understanding and personal appreciation for technological processes, products, and the world of work.

—Industrial arts presents an objective overview of the processes and problems of industry and technology and of its impact on mankind. Recognition of problems is extended to analysis of the ways technology may be used for human welfare.

—The study of technology places a strong emphasis upon the human element. Man's ideas, his creative endeavor, his accomplishments in the world of productive work are an important part of the content. Technology is seen as as extension of man's capabilities, and work as a dignified contribution to our culture.

—Industrial arts stresses the first-hand, concrete experiences in which children observe, experiment, and work with materials, tools, machines, and processes through which man has attempted to control and change the raw materials of his natural environment for his aesthetic and utilitarian needs.

—Industrial arts provides opportunities for individuals to know and appreciate their own manipulative abilities and interests, to increase self-awareness and strengthen self-concept.

—The overall aim of industrial arts is to help children and youth, as individuals and as members of our society, to cope in a technological culture.

The Place of Industrial Arts in the Elementary School Curriculum

To place industrial arts as a separate subject in an already overcrowded elementary school curriculum is rather difficult. But fortunately, in most elementary schools, particularly those with self-contained classrooms where the teacher teaches all subjects, the discipline lines are not distinct. Even in team teaching situations, and where scheduling is flexible, learners and instructors are not rigidly bound to distinguish between the subjects being studied and taught.

The Interdisciplinary Character of Industrial Arts. The various components of industrial arts quite clearly emphasize the interdisciplinary scope of the field. Content is related to industry, technology, career education, and the world of work. It is closely related to art and science. It contributes to leisure education. It develops attitudes conducive to better human relationships.

People must know something of history as a basis for production and use of an item. They must know geography to locate and extract raw materials. They must know the economics of distribution and marketing of a product. They must understand and recognize the psychology behind advertising and marketing. They need adequate knowledge of language for successful marketing. They must be aware that almost all the sciences, including geology, biology, chemistry and physics, mathematics, are needed in one sector or another of technological production. Technological development is a synthesis of interdisciplinary content.

Integrating Industrial Arts into the Curriculum. Because of the interdisciplinary character of industrial arts, there are several approaches to integrating it into the curriculum.

One method of utilizing industiral arts has been to help children and teachers devise instructional aids for use in the various subject areas. For years teachers have relied on felt boards, electric question boards, or abacuses. Some teachers have helped children explore historical tools, such as quill pens and home-made inks during language study. Play houses, puppet stages, and the like are also part of language activities. Chart racks and devices to move long rolls of paper through a frame have enriched primary reading programs. Wind socks are constructed for weather study. In many cases, the industrial arts teacher has helped children make these learning tools. In other cases, industrial arts coordinators have helped teachers construct them. But the fact that these instructional aids were constructed from the tools and materials of industry related them somehow to industrial arts.

Another rather traditional method of organizing industrial arts has been to schedule special periods of time for separate experiences in laboratories. Modifications of this separate "course" approach are evident as laboratories are becoming resource centers for small groups to pursue manipulative activities under an industrial arts instructor, that are related to their basic studies.

Another method of integrating industrial arts content and activities is as a natural part of language arts, mathematics, science or art. To include industrial-arts-oriented experiences in these fields necessitates the complete cooperation of the teacher, a well-thought-through sequence structured upon existing curriculum, and a creative and energetic industrial arts coordinator. This approach could be even more effective if teachers were identifying behavioral objectives or cognitive ideas to be used as instructional goals. Ideas related to industrial arts content could be incorporated, and the necessary learning activities injected.

Another method of influencing existing curriculum in the elementary school to achieve career education goals and objectives, is *infusion strategy.*

> By using the infusion strategy, we will be able to reinforce existing program courses by adding additional objectives or substituting objectives that can be used to achieve existing curriculum goals as well as career education objectives. I am sure that, in some cases, some courses may be required to modify their existing structure or substitute materials and learning experiences which relate to career education. However, we do not visualize any massive redirection of curricula that will in effect "throw out" traditional subject areas. On the contrary, we view the infusion of career education as enriching and making more relevant existing curricula. (Miller, 1972, p. 6.)

Perhaps the most effective way to include industrial arts content and activities is integration with the social studies. The development of industry and technology, the ways in which man has utilized his natural environment, and the services and jobs necessary to technological utilization are basic to the study of any group of people, whether they be of historical past or in some other part of the world. All the social sciences are either directly or indirectly related to man's technological efforts. Man's basic human activities are generally directed to some means of changing materials, environmental control, or to use of some technological product. The interdisciplinary emphasis of a social studies unit enhances the interdisciplinary aspects of industrial arts. Industrial arts activities, furthermore, are conducive to the small group and individual projects emphasized in unit teaching.

Training and Education. The effort in the direction of relevant content and improved teaching processes has important meaning for industrial arts. Psychomotor skills have sometimes been taught without any reference to the deeper social and academic meanings of the activities. In some programs "industrial arts" has been wrongly associated with superficial manipulative or crafts activities that have had no more importance than to keep children busy. Some people think of "industrial arts" as a type of recreational activity, or a subject appropriate only for those children whose academic ability is limited. In reality, industrial arts is none of these things.

A unique advantage in the movement toward academic respectability is that the content and method of industrial arts includes components of both training and education. The alert industrial arts educator capitalizes upon these.

Training is the development of skills which are replicative and applicative. They may be achieved through imitative interaction, rote memorization, or habitual action. In essence, they are the psychomotor skills. Such skills could include the multiplication tables. Or they could be the adequate use of a saw, a hammer, or the ability to wind an electric rotor.

Education refers to the associative and interpretive skills. These may be achieved through creative and intellectual interaction. That is, concrete, first-hand experiences are extended and academic content strengthened through observation and analysis of technological production are developed; when interpretation of the materialistic aspects of our lives lead to more complete social and personal utility.

Dale (1969, pp. 25-26) discusses training and education, warning that they are not neat and exact opposites. He suggests training is "bad" only when it neglects or limits the possibility of increased growth and development. He states, "You have trained someone when you have taught him to do a small part of a whole job without helping him to see how this small part fits into the larger whole—you have taught for a fixed response only. You teach or learn uncritically and imitatively when you do not ask why certain processes are used but take them merely on someone else's say so." He examines the concepts of training and education in the following panel:

Training usually emphasizes:	**Education usually emphasizes:**
Imitative reaction	Creative, imaginative, reflective interaction
Short-range, limited goals and fixed ceilings	Long-range, broad goals with flexible ceilings
Fixed means: inflexibility	Variable means: flexibility
Memorization, repetition	Thoughtful practice and application
Unexamined conformity	Thoughtful conformity and non-conformity
Limited sharing of ideas and feelings	Unlimited sharing of ideas and feelings
Learning by prescription	Learning by thinking
The dependent learner	The independent learner who has learned how to learn

For young children, and for the purposes of relevant elementary education, it would appear that industrial arts cannot be training alone. Industrial arts as part of the elementary curriculum has its recognized place when both training and education components are emphasized.

Meeting the Challenges for Industrial Arts

In this chapter we have discussed some of the social and educational trends which are important to the educator, and we have raised some questions which pose considerable challenge to the leader in industrial arts. As he considers his industrial arts program as a real and unique contribution to elementary education, he may wish to assess it in terms of the following perceptions:

Perception of Self. Any educational program exists for the benefit of the individual learner who is to be a contributing member of our society. Therefore perception of self is a major educational objective. The industrial arts program can help children identify their own special interests and talents, whether they be creative, intellectual and verbal, manipulative, or any combination of these. The learner needs to anticipate his own preferences for work, and appreciate work for the satisfactions gained from it. When personal meaning is derived from facts, skills, and ideas gained from industrial arts experiences, his self concept is strengthened, and his ability to cope with the complexities of life is enhanced. His understandings gained about industry and technology should help him to live in peace with our affluent, technological economy.

Perception of Society and Culture. Having gained a comprehensive understanding of industry and technology, the learner increases his perception of our democratic society and the ways in which it operates in our technological culture. Utilization of human resources for the greatest benefit of mankind is included. Appreciation of the dignity of work for self and others reinforces the perception of social interactions.

Perception of Industry and Technology. Real perception of technology will lead to appreciation for material inventions. Familiarity with many handicraft skills and understanding their unique contribution to technological production will strengthen the child's appreciation for the world in which he lives and works. Though the young child learns what industry and technology are, his perceptions should include the ways in which they are a menace or a benefit to mankind. Consciousness of positive and negative influences of technology will, hopefully, provide a basis for future solutions of problems and improvement of present material conditions. The fact that technology is a vast complex of interrelated and interdependent activities to serve the needs of our present way of life helps the learner think of it positively.

Education. Industrial arts can contribute to an education that is truly liberal and that develops the full potential of every individual. Experiences that are personally integrating, that is, which are truly learned and which effect behavior as individuals and as members of society, will, perhaps, guarantee that future—a humane person who can be economically independent.

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CHAPTER II

The Child — The Learner

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THE MANY FACES OF MIDDLE CHILDHOOD: FIVE TO TWELVE

Introduction

The child's elementary school years have been given many labels and meanings. Designations such as "school age," "latency period," "gang age," and "age of quiescence" are commonly found in the literature describing this period. To certain adults, indulging a bit of nostalgia, it means the much romanticized golden rule days of schooling, and to others it summons fond memories of blissful days of fun and friends. In the pages of photograph albums it ranges from the snaggle-toothed grin of the six-year-old, through the braced and "tombstone" incisored spread of the eights and nines, to the individually defined and contoured smile of one at the threshold of early adolescence. (Stone and Church, 1968) In Erik Erikson's neo-psychoanalytic theory this is the period of industry versus inferiority. According to Jean Piaget's classification of intellectual development, the early years of middle childhood are identified as the concrete operational stage, and the later years evidence the child's entrance into the formal operations stage. For our purposes, middle childhood may be said to be a period of relative calm suited for learning what is embedded in the cultural prescription for "going to school" in America during the years from six to twelve.

Actually the realm of middle childhood extends over a wide spectrum of behavioral changes, some of which escape notice in comparisons with the neighboring periods of pre-school growth and pre-adolescent spurts. In general, this is a relatively calm period of physical development, with slight increases in height and weight. There are gradual and steady changes in neuromuscular development and coordination until the physiological stirrings of pre-adolescence begin. However, each age has its unique characteristics so that the seven-year-old is not just an older and more refined six-year-old. Additionally, major intellectual and social changes are occurring which provide the basic supports for the child's dramatic entrance into the symbol-oriented world of adults. The overall important changes in this period are mainly constituted from the consolidations, reorganizations, and refinements of previous gains in the first five years. These internal shifts and restructurings are the key processes which enable the child to develop from the concrete, action-based school beginner of six years to the reflective, problem-centered learner of twelve years. It is this patterning of the child's development, through which he gains access to the larger world of reality, to which we now turn.

To accommodate the significant trends in growth and development occurring in middle childhood, we will emphasize two areas of behavior changes that have central importance for advancing the goals of industrial arts education. One area contains the competence-independence dimensions of the individual's growth toward adulthood and autonomy. The other area involves the symbolic underpinnings of the individual's expanding access to social realities. The area of competence-independence is used here to represent a progressive flow of changes in the organism-environment transactions which occur as a person, developing from babyhood to adulthood, moves through increasing spheres of integration, refinements, and mastery of behavior. These transformations occur in response to requirements for growth, survival, and self-enhancement and gradually reach a level of optimal fuctioning in adulthood with the individual's fullest possible use of personal social resources for responsible living. The area of expanding access to social realities encompasses the changes in perspectives that occur when the developing individual engages in ways of learning which extend his reach from the simpler forms of associative encounters with information based on direct, subjective, and perception-bound contacts with his environment to the abstract, symbolic forms of knowledge contained in the ever-enlarging repertoire of man's accumulating wisdom.

The foremost concern throughout this chapter is the need to preserve the concept of continuity in childhood while gathering insights into aspects of growth and learning that offer assistance in curriculum planning. Although it may be useful at times to intensify or highlight certain details in the data, we must be mindful of the ongoingness of the child's growth and make the necessary allowances for the distortions that inevitably appear in dealing with such a complex subject. Chronological age has been a convenient basis for studying growth and development because it is easy to measure. Whether the age-grade norms and stage-linked concept of growth and learning are as universal as once thought to be is a much debated subject. Their usefulness for this chapter inheres in their ability to point out the need to meet the child at his level.

The material in this section on developmental trends is organized into two main divisions distinguished by the ages of the children. The first division, encompassing ages five through seven, is identified as the Primary Phase of School Age. The second division, embracing the ages of eight through twelve or until puberty, is designated as the Intermediate Phase of School Age. Although this classification suggests the grade level basis of organization of some elementary schools, the overlap is incidental rather than intentional. For the purposes of this chapter, it is important to bear in mind that the subdivisions provide a convenient basis for emphasizing the learner's characteristics and development during the elementary school years that have implications for designing learning opportunities in the Industrial Arts.

Turning to the growth profile of the school beginner we recall that the six-year-old is the benefactor of the integration and equilibrium achieved over his previous five years of growing. In fact, the prior year marked a high point in physical maturation. To illustrate, at five he could use a well-developed sense of balance and rhythm, and good general motor coordination to carry out certain grooming routines such as brushing teeth, combing hair, and washing himself, barring the behind-the-ears details, of course. New forms of play involved purposeful, elaborative, and sustained projects. Blocks were used for building a super highway with bridges and interchanges, for constructing a modern complex of tower and garden apartments, and for establishing an airport or harbor with heavy traffic. Impressive engineering projects were accomplished, sometimes with such purpose and reality as to warrant a tour of inspection from concerned local safety officials. Digging ditches "to empty the water into the ocean" and carrying tunnels "to the very center of the earth" are dramatic instances of these efforts. Having outgrown the sheer pleasures of daubing paint on paint, the five-year-old at the easel made the picture look like what he intended it to be or enjoyed exploring color, form and the medium itself. Other fives found their challenge with ropes for hauling, lifting and tying large and small objects not usually found so packaged or joined. Prompted by a blueprint and large muscle power, other five-year-olds worked with tools and materials to execute the construction of neighborhood landmarks or housing developments including elaborately furnished single units. Carpentry projects involving the building of trucks, airplanes, and boats of variable sizes and shapes served many uses and destinations. One ambitious youngster requested of his teacher the materials for his carefully designed model of the jumbo jet in which he had recently taken a trip. After several days of waiting for the desired wood of specified dimensions, he announced with exasperation to the teacher, "But you are interpeering wif my tinking" (misspelling intentional).

Desiring to do things in a grownup way, the five-year-old went to the store, went on errands, helped with the housekeeping, painted and made furniture, decorated useful trays and vases, and constructed boxes for storing variegated articles. His adventurous spirit gained vigorous expression in jungle gym dramas, skating, and cycling or wagon trips into the wide, wonderful world around him. The all-consuming desire for realistic orientation encouraged him to rely on his own powers to do things and the greatest source of satisfaction resided in the moment of announcing his omnipotence. Despite his dead-serious approach to the goals of conforming to grownup ways and being noticed for impressive accomplishments he actually required heavy support from adults. His independence gains are incidental in this stage of development, for uppermost in his strivings are the attention and approval of significant adults.

At six, the child reaches a landmark which he has eagerly awaited and proudly announces in the much-heard expression "Now I can go to school." In a sense, going to school is a cultural turning point for the six-year-old, whereas physical maturation is a developmental milestone for the five-year-old. This does not imply that the six-year-old's growth is merely an addition of finishing touches on the five-year-old's integrated behavior. Quite the contrary, there are many differences socially, emotionally, and physically to endorse the six-year-old as an individual in his own right. For example, a six-year-old spends a great deal of time making the transitions involved in finding his securities in extra-familial relationships with age-mates and other significant adults. As with most restructuring in human behavior, these changeovers may be irregular, abrupt and vacillating. To illustrate, the child's actions toward his parents may be loving and tender at one moment and in the very next second convert into a volley of hateful accusations and demonstrations. At the core, these alterations are his way of saying that he really needs the help of parents but can't admit this dependence when his main goal is to become self-propelling and self-sufficient. He must strike out in defiance of adults as a demonstration of independence.

Similiar changes in disposition and outbursts of temperament may be directed toward the teacher when, in trying to be grownup and act like older boys and girls, he is likely to overextend himself, get excessively tired, or misjudge the size of the task and fumble the performance. He is developmentally incapable of fine, delicately coordinated movements, and at this stage literally uses his whole body in all of his actions whether they are geared to the tying of a shoe, working with a complicated mechanical device, throwing a ball, or trying to handle a bat with the finesse of older children. When the outcomes don't match the aspirations, he is devastated and explodes or dissolves in discouragement and defeat. This amalgam of ragged performances, bristling and stormy defenses, hesitations and resistances sets him off from his cocky five year junior and merits major attention when selecting appropriate educational experiences.

The still-restless sevens use their improved sense of balance and finer motor skills, aided by the gradual development of small muscles and improved eye-hand coordinations, for their daring feats on the playground and in the neighborhood. Jumping from heights, doing highwire tricks on the jungle gym, stunting on swings and tree branches, roller skating, rope jumping, hopscotching, and engaging in other demonstrations of a growing sense of mastery make up the active side of their lives. But as the inroads of reality come into fuller awareness, sevens also settle into a dreamy reflective stage for time to sort out the differences between fact and fancy. Action-based learning is still required to accommodate the quest for new experiences but more sustained activities such as reading and writing are evident in this age as well. Self-assertiveness appears in instances where the seven-year-old finds it necessary to oppose adult authority and age-mates in standing up for his rights in disputes over property, rules, and sharing turns. This aggressive content serves as good practice material for the approaching rough-and-tumble gang life of the eights and older children.

Sevens need a great deal of adult assurance as they venture into more involving group interactions in games, competition over turns, and drives for mastery of performance on the playground and in the classroom. They are especially sensitive about the impression they make on other children while concurrently attempting to incorporate adult modes of thinking and acting. Feeling insecure in their strivings toward independence, and propelled by strong drives for right results, they tend to be impatient when their requests for help don't draw an immediate response from the adult. For sevens, crossing the bridge between the two worlds of childhood and adulthood requires much understanding, wisdom, and guidance from adults.

The age of eight ushers in a period of stabilization and elaboration which spans the remaining years of middle childhood. The differences between yearly growth are more noticeable in the primary years than during the intermediate phase of school age. The turbulence and strain of getting relocated in the frontier life of an age-mate society subsides in these intermediate years. Physical growth presents no startling upsets, and the general operational tone seems to be smooth and steady. The overall picture suggests a period when children may be free to be children in a potentially compatible milieu.

It must be realized, however, that this period is not without problems. The central idea is that the problems connected with growing toward greater independence and greater objectivity need not be carried to exaggerated lengths. For coping with changes of any magnitude and in any direction usually requires the making of certain adjustments and rearrangements, and may sometimes even contain elements of discomfort for a temporary period. The problem arises with undue prolongation of problems such as may be induced by overprotectiveness and lenience that may be misconstrued as abandonment and other forms of intrapersonal complications. Therefore, adults in the home, school, and community who share responsibilities for guiding children of the middle years face a major challenge. The task is to develop a blend of supportive behaviors which are keenly attuned to the growing child's needs for mastery, self-direction, and intellectual independence. At the core is the recognition that the child still needs the support, protection, and wisdom of adults to power his growth *away* from them and that the style of the adult-child relationship must be liberating so that neither is caught in a web of negative emotional currents.

Intermediate Phase of School Age

Eights are commonly envied by sevens for the supreme accomplishment of entering the "gang age." While their shouting, racing, chasing, boxing, arguing and hassling, draw much attention from grownups, eights are more often resented than envied by adults. Evidently the feeling is mutual, as least in some cases, as suggested by the sobriquet "Dark Ages" for characterizing the adult-child relationships that are definded by peer culture standards for the remaining years of life in middle childhood. Some enlightenment on the attitudes surrounding this communication gap is presented in the delightful portrayal of boyhood days in *"Where Did You Go?" "Out." "What Did You Do?" "Nothing."* where grownups were perceived as "natural enemies" whose motives were suspected of being contrary to children's ideas and pleasures. (Smith, 1957, p. 39)

Physically, the steady and gradual gains in neuromuscular development of the eights through twelves are reflected in swift, graceful, and more precise movements, so necessary for becoming a good "second base man" or "quarterback." Competence in their games and sports, such as baseball, hockey, stoopball, "advanced" roller skating, and ledge walking, is uppermost in their thoughts as qualifications for group acceptance are ardently pursued. Leadership roles are frequently defined in relation to athletic prowess and other marks of distinction such as being the champion of "soapless bubble blowing" and becoming the best imitator of sounds from the natural and mechanical world or being the dazzling stunt artist or having the greatest number of pennants or the most impressive collection of dolls or the most unusual souvenirs.

In dramatic contrast to the previous year's hypersensitivity about his ineptness, the eight-year-old can now draw public attention to his fumbles and failures as a sign of strength. These self-criticisms are significant statements regarding peer group status. Sometimes serving as mechanisms of self-denial, they confirm the youngster's willingness to fulfill peer expectations of loyalty and unconditional support. In other cases, the self-criticism eliminates any claims to uniqueness and sets the focus on conformity to shared attributes on which the group places a premium.

It is tempting to ask if this form of peer group identity is merely a case of surrendering to the authority of age-mates in lieu of parental controls. An even more serious question may be raised as to whether submission to group control jeopardizes the individual's chances of attaining healthy selfhood. An inside look at some of the dynamics of group functioning may furnish helpful leads to answers. The subject of rules illustrates the point quite well, for it features the forms of experimentation that are sometimes involved in some aspects of this youthful quest for freedom from controls. Eights and nines characteristically spend three quarters of their time arguing over the rules to be used in the remaining quarter of the game period. Committee meetings are often another staging ground for debates over rules. Other dimensions of group experiences such as leadership styles, routines, consensus, building, decision making, and role expectancies tend to be casual, loose, and open to change on short notice. Inventive minds regularly produce alternatives for experimentation and argumentation. Within this fleeting character of group life lies much latitude for averting the unwholesome outcomes of group tyranny and enslavement. But the potentiality for alarming tribal consequences as evidenced in the chilling novel, *Lord of the Flies,* underscores the need for adult guidance to be carefully timed and astutely placed. (Golding, 1962)

Bearing in mind that the thrust toward independence is a pervasive influence in most of the intermediate-age child's actions, we might examine some of the group's contributions to these goals in the latter part of this period. For this age group to satisfy their desires for minimal adult intervention, they must distinguish themselves through different modalities of speech, thought, dress and actions. Thus, nonconformity, challenge, criticism and direct resistance are often used to establish their differentness. Bold confrontations with adult authority are difficult to carry out generally, but they are more likely to succeed as products of group endeavor than as forms of individual expression. The protective coating and contagious quality of collective action are strong attractions for these young rebels. Usually there is enough give and take in such group demonstrations, however, to offset anarchistic extremes.

As peer code orientations gain ascendancy there is more structure in group endeavors whatever they might be. There is heavy emphasis on rituals and this is the time when secret codes emerge.

Adherence to group rules is paramount and mastery of group valued tasks is a dominant influence in these youngster's lives. Group activities are the focus of social relationships and it is through the group that emotional security is achieved. For the first time in his life, the child has to earn his passport to group membership on his own merits. No prearrangements can obtain this role for him; so he must prove his worth. The successes and failures, rewards and penalties, satisfactions and stresses, joys and fears that make up this passage into childhood society have far reaching influences on the individual's self-concept development and his academic attainments.

Although the group is predominant and provides an influential source of emotional support, the child still needs and wants meaningful adults for comfort and security. The role of group life is a strong force in the interpersonal relationships of the elementary-school-age period; however, it is not as powerful as it will be in adolescence.

From Mastery of Materials to Mastery of Self Through Materials

An application of Erik Erikson's (1963) theory to the developmental span of the elementary-school-age child provides a pertinent source for interpreting and understanding the major thrusts of this period. Erikson employs a concept of critical stages in characterizing growth and development. The growth stage, involving the elementary school years, is designated as one in which the *sense of industry* emerges as the major consequence of successful development in this period. Conversely, the *sense of inferiority* emerges when unfavorable conditions for growth predominate. The child's skills and tools provide rich nutrients for age growth. At this time the child discovers the realities of himself and of the milieu by interacting with others and by being in a productive situation, one in which he is producing things. This age child needs to feel productive and to experience competence and achievement. Producing things provides tangible feedback of his efforts and validates his achievements; it satisfies his needs for accomplishment and contributes to gaining recognition from the group. The development of feelings of success is crucial to healthy personality growth. A guiding theme of this period might be: from mastery of materials to mastery of self through materials.

INTELLECTUAL GROWTH IN MIDDLE CHILDHOOD

Concept Development

The previous section provided a general understanding of the continuity of childhood through a thumbnail sketch of some transitional features of development. Now we turn to selective aspects of cognitive growth.

From the standpoint of intellectual development, some theorists view school entrance in the middle years of childhood as having major implications for learning. In this period the child moves through two important cognitive shifts. One shift involves replacing an essentially subjective orientation with an objective orientation to reality. The second shift centers on the part-whole orientation that enables the child to move from simple associative thinking to higher processes of thinking in the form of problem solving and hypothesis construction.

In the earlier years, the growing child accumulates a large store of sensory data and impressions through active exploration of his environment. Multisensory forays into his surroundings through touching, listening, seeing, smelling, tasting, and hearing things and events, are his chief means of absorbing experiences and placing himself within a meaningful framework in relation to the situation. This stockpile of information, first formed as perceptions, consisting of direct sensory data, is transformed into concepts when the child acquires enough language facility to use labels such as "mommy," "daddy," "goodbye," and "baby," for naming the stimulus. At first, concepts are diffuse, disorganized, vague, and global; later representations of stimuli are more attentive to such details and commonalities as maturation and learning allow. Concepts are symbolic systems that link past and present situations and factors in relation to some common elements and the appearance of these concepts is dependent on language. Concepts then are combinations of discrete sensory data derived from past and present experiences that are drawn together by a representative label.

Concept formation moves through a progression of stages leading from concrete to abstract unities and classification systems. For help in understanding this process of conceptual development, we draw on Stone and Church's (1968) threefold classification of stages of concept formation. The stages are (1) Globs Stage; (2) Simple Concepts Stage; and (3) True Concepts Stage. A brief description of each stage follows.

Globs Stage. The label for this stage was coined by the authors, Stone and Church, as an analogue to perceptual "blobs." Globs occur in late infancy and early toddlerhood when the first signs of speech appear. At this time, the child makes gross generalizations based on perceived similarities in his direct experience with objects. For example, after he has learned the label Teddy Bear for a stuffed toy he uses the same label to identify all stuffed toys that are brought to him.

Simple Concepts Stage. In this stage, occurring in late toddlerhood and early pre-school years, the child recognizes and separates the identity of items so that concepts are used for mutually exclusive labels. Each label contains a recognition of basic differences in the perceptual attributes of the object. Although the child does not verbalize these differences, he operationally reflects an awareness of them. For example, he knows the difference between doggy and kitty by using these labels on a mutually exclusive basis although he does not articulate his understanding of the differences. It is important to note that a child may use a different set of attributes as common denominators for labeling a given object than those used by adults for the same object. Because the child is not yet ready to isolate the basis of these observed differences the term concrete concept is used.

True Concepts Stage. In this stage, appearing in the later preschool and school years, the child is no longer limited to concrete dimensions but can think with attributes in various symbolic forms. The child identifies and verbalizes the attributes and the bases for his abstract dealings with the concepts. In conclusion, Stone and Church point out that later in this stage the child can recombine concepts into higher order categories in which he deals with relationships of increasing complexity and abstractness.

Additionally, dimensions of perceptual growth evidenced in older children include capacities for dealing with multiple stimuli alternately and simultaneously, as well as grasping part-whole relationships. In fact, it is the ability to perceive stimuli simultaneously that enables him to grasp part-whole relationships. What we observe, then, is that the school child's gains in perceptual capacity provide him with the tools and resources for ordering, organizing, and integrating new and complex information. No longer perception bound, he can incorporate information of varying levels of abstractness and intricacies of pattern, and thus achieve the freedom for wide ranging explorations through the kaleidoscopic world of symbolic meanings.

Theoretical accounts of relationships between language and thought point to the process of verbal mediation as an influential factor in cognitive development. Research on problem solving with children from differing age groups provides clear evidence that verbal mediation greatly aids the processes leading to concepts and generalizations and serves as an effective tool in problem solving. Language and experiences are at the core of the concept formation process. The child needs words to form labels. He also needs experiences that require sorting and interpreting through labels. Thus experiences are windows to the world and concepts are the pathways to understanding the world.

The Development of Thinking

Unquestionably the foremost authority today on children's thinking is Jean Piaget. His work is influencing every field concerned with the cognitive development of children. Education has been vitally stimulated by Piaget's theory, as witnessed by the countless programs based upon his constructs. His work has particular relevance for Industrial Arts Education because the central part of his theory concerns the child's discoveries of the physical world through direct action in relation to it. Following is a summary of Piaget's theory which was developed by Robinson. (1970)

Overview of Piaget's Theory. According to Piaget, cognitive structures develop through the interaction of the individual and the environment as a result of the functioning of two basic, invariant tendencies, that of adaptation and organization. Adaptation consists of two complementary processes, assimilation and accommodation. Assimilation is a process of responding to and incorporating the objects and events encountered in the environment in terms of existing structures. Accommodation is a process whereby existing structures are modified as a result of making adjustments to the environment. Organization is the tendency to integrate structures into coherent systems.

Piaget identified four sequential periods in the development of thinking, summaries of which follow:

1. *The sensory-motor period* consists of six stages occurring from birth to about two years of age. During this time the coordination of senses is accomplished, the recognition of the permanence of objects is achieved, and the precursors of classificatory behavior may be observed.

2. *The period of preoperational thought,* which occurs from about 2 to 7 years of age, consists of two stages. During this period the symbolic functions, language, symbolic play, and mental imagery, develop. The young child's thought is said to be

intuitive and characterized by transductive reasoning, which is reasoning from particular to particular; objects of thought are juxtaposed rather than connected. Thinking, during this period, is governed by what Piaget calls "centration," the tendency to focus on one aspect of a situation or object to the exclusion of other relevant features. The child attends to states, ignoring transformations between states, and, thus, his thinking is static rather than mobile. His thought is irreversible, i.e., he cannot negate a mental action and return to the starting point, nor can he recognize reciprocal relation; preoperational thought is uni-directional. In classification, the preoperational child forms collections of objects rather than genuine classes based on criteria concerned with similarities and differences. At Stage I of classificatory behavior, the child forms "graphic collections" which are arrangements dominated by spatial configuration, i.e., the spatial configuration enters into the collection as a property of it. For example, a triangle is placed on top of a square forming the "roof" of a house. Things are grouped together because they belong together. (Inhelder & Piaget, 1969, ch. 1) At Stage II, the child forms "non-graphic collections" based on similarity; however, these are not considered classes by Piaget because they lack hierarchical structure. Elements are juxtaposed rather than grouped in any hierarchical arrangement. (Ch. 2)

3. The period of concrete operations, from about 7 to 11 or 12 years of age, is one in which the child evidences the use of operations in his thinking concerned with concrete situations. Operations are internalized actions (cognitive actions) which are organized into systems. An operation does not exist in isolation; the presence of one operation presupposes the existence of others which may or may not be brought into action, depending upon the cognitive task. Concrete operational thought is reversible. Two forms of reversibility occur—inversion, which is concerned with classes, and reciprocity, which is concerned with relations. The child, no longer bound by centration, can focus simultaneously on more than one dimension of a situation. The principle of conservation gradually becomes manifested in the areas of continuous quantity, substance, number, and weight; conserving the whole then becomes a logical necessity. In the area of classification, the child can construct class inclusion and, therefore, the categories he forms represent, according to Piaget, genuine classes; this achievement characterizes Stage III of classificatory behavior. Although the child's thinking becomes more flexible and mobile during this period, several limitations remain in concrete operational thought; these become resolved in the next period of development.

4. *The period of formal operations,* from about 11 or 12 years onward, is one in which thought becomes freed from concrete situations and the individual can reason about the possible as well as the actual. At this level the two structures of reversibility—inversion and reciprocity—become coordinated, and thought then may proceed from a combination of these two structures. With the development of the "hypothetico-deductive operations," which enable one "to reason about a proposition considered as a hypothesis independently of the truth of its content" (Beth & Piaget, 1966, p. 180), a higher complex level of reasoning is achieved.

Educational Implications

The elementary-school-age child is in the period of life in which his efforts are directed toward independence, achievement, production and mastery of tasks as ways of gaining orientation to and control of his world. Erikson has termed this period as developing a sense of industry versus inferiority. The child wants to do things, make things, and gain competence while interacting with his peers. The school can formally organize or set up opportunities for his development along these lines, thereby accommodating his achievement of the developmental task of gaining industry. The child's successful accomplishments may result not only in his being a producer but also may enable him to bridge the gap between the adult world and his own, a factor often left out of school experiences. Here we are emphasizing the importance of the child's production—producing things, doing things—as an instrument of growth. The study of technology has an obvious role or place in a curriculum that is geared to this developmental task.

During the elementary school years, two important transitions occur in the child's development. Cognitively, there is a change from pre-operational to concrete operational thought. The other important transition is that which occurs in social and personal development. These transitions are taking place during the same period of development. Teachers in the elementary school need to be aware of the changes children are undergoing and to incorporate this knowledge in curriculum planning. The program of Industrial Arts Education, as will be shown below, has a unique opportunity to foster positive growth in all three areas of development—social, personal, and cognitive. These three areas are interrelated within the individual, not isolated.

Elementary school children require emphasis on concrete and direct experiences with objects and events in the environment as vehicles to learning. Piaget's work has pointed to the importance of concrete activities in relation to developing what he terms "operational" thought, thought in which the individual formulates hypotheses and employs logical operations.

Industrial arts activities are themselves integrative and thus uniquely capable of serving the major thrusts of the child in elementary school. The pivotal task for Industrial Arts Education inheres in the recognition of the depth to which investigations may be carried, the organization of teaching strategies for fostering durable learning, and the procedures for translating content and activities in such a way that the developing child gains mastery over himself and his world. The next section presents an illustration of how the study of technology may serve multiple objectives by intrinsically and naturally connecting the child's need to be a producer and his quest for understanding social reality.

An Example of Contributions of Industrial Arts Education to Child Development

The intuitive thinking of the young elementary school child reveals vague concepts regarding the world about him—concepts that especially today are influenced by mass media. The following statements, made by a group of second grade children, illustrate this conceptual vagueness and associative thinking gained from mass media.

HOW THE THINGS WE NEED ARE MADE

How We Think Bread Is Made

1. They put the wheat into a machine and chop it up and get the dough out of it. (The children thought that wheat was similar to straw and that the shaft was filled with dough. One cut the shaft, compressed the end of it, and the dough shot out the other end.)
2. The leftovers of the wheat go down a little slot and are used for something else. The dough comes down a bigger slot and goes into another machine.
3. This machine flattens the dough and shapes it.
4. Then the dough goes into an oven and cooks.
5. After it cooks they let it rise.
6. Then they cut it up.
7. Then it goes to the wrapping machine.

How We Think Jeans Are Made

1. They measure the sizes and cut the material.
2. They sew the jeans.
3. They put the material into a machine. The material comes down a line. There are gates and each size goes into a certain gate.
4. They put on the zipper last because it would get stuck in the machine.

How We Think Upholstered Chairs Are Made

1. They make the legs out of wood.
2. They make a frame and put the spring on it.
3. Then they put feathers or cotton in the material so it will be soft.
4. They nail the material on.

These statements opened a unit on the production of manufactured goods with second grade children from predominantly middle-class homes in an urban setting. The chances they had of knowing the world of work were mainly through the influences of mass media. Relatively few of them revealed any knowledge of their parents' occupations or had visited the locations where their parents worked. The teacher, interested in helping children achieve their developmental tasks, chose a unit on production because of its relationship to the stage of industry in the children's development and because of the inherent opportunities for developing children's awareness of the larger world. The unit also provided opportunities for helping children bridge the gap between their world and the adult world.

In this unit the children's initial vague concepts were used as hypotheses, thereby beginning the process of scientific inquiry and the development of problem-solving skills. Their initial ideas were not right or wrong—they were ideas to be investigated. The process of investigation entailed data gathering from a variety of sources: visits to factories, making items in the classroom, reading, viewing films, visiting people and interviewing people. As the data were gathered there was constant checking back to their hypotheses, as illustrated in the following example.

We Found Out How Bread Is Made By Making It Ourselves

We found out how bread is made by making it. We found out that a little bit of how we said bread was made was right. Dough is shaped. The rising was right but it rises two times before you bake it. You don't chop the wheat to get the dough out. You make the dough.

One series of activities yielded a comparison with modern production methods compared to earlier handicraft forms of production. The children ground wheat to make flour by using a mortar and pestle; after only a short time they recognized the strenuous effort and time involved in this means of production. They soon sought a more efficient and quicker means of grinding the wheat. A similar type of comparison occurred in making clothing for puppets and dolls by hand and by machine. The rug they made was woven on hand looms in contrast with the automated weaving observed in films on the production of rugs. These comparisons yielded an appreciation of modern technology in its effect on reducing arduous labor, but it also developed an appreciation for handicrafts. Grinding the wheat by hand became tiresome, but weaving individual segments of the rug seemed more of a creative product to these children. Thus the appreciation of handicraft.

The concept of mass production was vividly enhanced by visits to the factories in which the children observed great quantities of raw materials and preliminary materials utilized in the production of final products. Films did not portray this sense of vast quantity. The troughs of dough observed in a film on the factory production of bread, for example, did not appear as huge as they actually were. When the children visited the factory after seeing the film, they were astonished to see such great masses of dough. Herein is exemplified the difference between a concrete, direct experience and a two-dimensional vicarious experience. This difference was an important one in the development of the concept of *mass* in *mass production.*

The visits to the factories as well as films and reading materials delineated the concept of specialization in modern technology. The children learned about the specialization of work tasks and how an assembly line operates. The concepts developed are revealed in the following conclusion stated by the children.

> Each person does one and only one job. One person has a job, and when he is finished he passes it on to the next worker. This is called an assembly line. When they are finished, the assembly line stops. They make a lot of things each day and they stop, and then they make more the next day. It just goes over and over and over.

Understanding the role of machines in modern technology and their specialized functions also was developed in the unit. In their concluding summary, the children stated:

> All the machines have certain jobs. There are more machines than one of the same kind. Machines save time. It takes people longer than machines because machines go much faster than hands. Machines work faster but it takes men to watch them. Some machines go by themselves and some don't. Machines break down like people get sick, and then people are there to fix them.

Various forms of group work were employed in this unit. Children worked in groups to produce bread, an upholstered chair, a rug, and clothing for puppets and dolls. Some groups such as the wheat grinding group changed daily; others were of a more permanent nature. This process of working enabled children to gain skills and concepts of social interaction, including factors of leadership, scholarship, rights of individuals, cooperation, group roles, and communication. This process provided different foci of interaction in relation to interest, ability and social development. The tasks involved producing material things in the company of peers and, in so doing, growth in the development task of learning to get along with age-mates was facilitated.

We have acknowledged a readiness of children for the study of technology as a way of fulfilling developmental tasks. That such a curriculum component has social and educational significance is increasingly evidenced in the minds of people. Whether one reads the legislative provisions, employment statistics, or futuristic writing of the "Future Shock" variety, the message is the same. A focusing question to pose to the educator is: "Can we continue to bring children up in a school environment in which '60 per cent of the high school students graduate with experiences too often lacking application to the world of work'?" The challenge to the curriculum planner is clear: How can the school help the child learn to live better by using the resources of technology and machine culture to achieve the fullest kind of human growth? One answer to this question is to help children gain an understanding of their technological society *through means that enable them to meet successfully their developmental tasks at the time the tasks are arising.* Successful achievement of the tasks of middle childhood fosters success with later developmental tasks. Through a study of industry and its industrial technology, as exemplified in the unit described earlier, elementary school children may gain a sense of personal industry, achievement, and competence, as well as the concepts that will help them understand the technological society in which they live.

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CHAPTER III

Technology: The Source

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Education has a responsibility to serve the needs of people. In particular, industrial arts as an activity program in the elementary grades, can relate to the technology and its emphasis on human resources as indicated in the first chapter. The need for curriculum change to reflect the current technology causes us to look at man and the things that influence his life, as he applies scientific theory and principles to change his physical environment to meet his aesthetic and utilitarian needs.

Children need direct experiences to fully comprehend these appreciations as indicated in the second chapter. It would be ideal to have them become directly involved in technological practices by helping people in gainful occupations. To pursue this to any extent is obviously impractical. The closest possibility seems to be to create this type of industrial atmosphere in classroom experiences. The purpose of this chapter is to attempt to determine the principal technological activities that might be studied by children.

To place these in a frame of reference which children can understand and relate to, the category of employment was selected. It is obvious to children that one or both of their parents work to earn money for the family. They also hear their neighbors and relatives identified by their jobs: he works in the piano factory, he is a carpenter, he is the manager of a supermarket. So children can relate to people who work to earn a living. These jobs are determined by the technological developments in business and industry. Therefore, children can study these developments by finding out how people use them to earn a living.

All this needs to be placed in the routine of the elementary classroom. Again it is impractical to push out some classroom work to force in new work. It would be much easier to change the present work, somewhat, in order to make it more useful and meaningful to the children. So it is necessary to find a framework that adapts to the typical classroom.

FRAMEWORK FOR ANALYSIS

During the 1940's a group of graduate students working with Dr. William E. Warner (1965) attempted to analyze the technology and categorize it in a fashion that fit the school program of industrial arts. They specified five areas of technology: manufacturing, construction, communications, transportation, and power.

The study of manufacturing involved the processing of raw materials and fabricating them into useful goods. Construction activities centered about two items: the development of public buildings and homes, and the facilities for transportation. The communications area dealt with the transfer or recording of thoughts and ideas. Transportation attempted to reflect the movement of goods and people by land, sea, air and space. Power dealt with harnessing natural resources to provide useful energy.

The organization of industrial arts work into the five areas of technology named above adapts very well to the activities in elementary classrooms. The author has taught in three states and found these five units used in relation to children's work in social studies, mathmatics, science and language arts. Browsing through curriculum guides from other states indicates this is generally true in other parts of the country. Dr. William R. Hoots (1969, p. 22) conducted a formal survey of the textbooks used by children in the classrooms of North Carolina. He listed enough text references to the five areas of industrial arts to construct a curriculum guide using these areas. Therefore, organizing industrial arts activities that reflect technology in areas of manufacturing, construction, communications, transportation, and power would seem to be an appropriate framework for the elementary grades.

STATISTICAL DESCRIPTION OF TECHNOLOGY

For many years children have studied some occupations in the community. Usually the unit is called something like Community Helpers and involves the mailman, the fireman, the policeman, the gas station attendant, the truck driver and the store clerk. Occasionally teachers include the plumber, the electrician, appliance repairman or the carpenter. The activities usually include such things as trips, visual aids, reading and conversation. This is a very good beginning but these occupations are but a very small segment of the technology and the children hardly ever get involved with any activities that provide first hand experiences with tools, materials and processes.

One reason this has not developed further may be attributed to the very limited industrial arts teacher education experiences offered to classroom teachers in their baccalaureate education. Even when they study the technology under an industrial arts teacher educator, their work is usually limited to a unit shop experience in wood, graphic arts or crafts. These are often on an adult level and not directly applicable to children's activities in the elementary grades. Classroom teachers need direct experience with activities that reflect technology in the same fashion that children would use them in the classroom.

It is hoped that the current emphasis on technology will encourage industrial arts, elementary and other teacher educators to work together to develop both pre-service and in-service experiences that will portray a broad spectrum of the technology. The remainder of this chapter will attempt to outline a comprehensive plan for studying the technology and then show how industrial arts teachers can develop teaching materials to help children have direct experiences to develop their comprehension of it.

The United States Department of Commerce presents a report called *Statistical Abstract of the United States.* (1970, p. 1018) Published since 1878 it is "the standard summary of statistics on the social, political and economic organization of the United States. It is designed to serve as a convenient volume for statistical reference and as a guide to other statistical publications and sources." Several chapters in this reference have a direct relation to a study of technology: *Labor Force, Employment and Earnings,* which lists employment by industry; *Communications,* which refers to postal service, telephone, radio, television, newspapers and books; *Power,* analyzing mineral and electrical energy, electric utilities and gas utilities; *Transportation - Land; Transportation - Air and Water; Forests and Forest Products; Mining and Mineral Products; Construction and Housing; Manufacturers;* and *Distribution and Services.* Teachers who are building resource units may start with this reference to give a scope and direction to the area of technology. Tables might be copied for use by the children in the classroom. It should be used like a dictionary: to find a definition of a technological area.

When the author first started planning this chapter he considered using the Statistical Abstract as a basic reference. However, the use of all the data would provide enough material for a whole book and not just a chapter. Another United States Department of Commerce reference, *Industry Profiles* (1970), was not so voluminous in data, but would serve to describe the technology in a comprehensive fashion. The book is designed "to provide users of industrial data with a convenient single source of comparable basic industry statistics based on published Bureau of Census data." The tables cover 527 industries with data relating to employment, payrolls, value of shipments and other information.

The emphasis on this description of technology as studied in the elementary grades was defined above as employment, therefore the most helpful chapter of *Industry Profiles* seemed to be the one describing One Hundred Largest Manufacturing Industries Based on 1968 Employment. These are listed in Table 1 of this chapter. Some of these industries like Internal Combustion Engines have been classified in this report as belonging to the Transportation Area rather than to the Manufacturing Area. For children in the elementary grades it seems to be more important to know how an internal combustion engine operates and where it is used rather than to study how it is produced. Therefore, the emphasis is placed on Transportation rather than on Manufacturing. Some schools might differ in this placement, but it does not matter as long as the children have an opportunity to study about the major technological developments. In Table 1 the number in the column headed *Rank* is the one indicating its position in the original table.

Table 1

ONE HUNDRED LARGEST MANUFACTURING INDUSTRIES BASED ON 1968 EMPLOYMENT ARRANGED BY THE FIVE AREAS REFLECTING TECHNOLOGY

Rank	Industry	1968 Employment
	MANUFACTURING AREA	
2.	Blast Furnaces and Steel Mills	531,000
6.	Miscellaneous Plastic Products	275,000
8.	Metal Stampings	232,000
9.	Bread, Cake and Related Products	220,000
11.	Women's and Misses' Dresses	211,000
12.	Shoes, Except Rubber	204,000

14.	Miscellaneous Machinery, Except Electrical	200,000
16.	Weaving Mills, Cotton	178,000
17.	Sawmills and Planing Mills, General	175,000
19.	Meat Packing Plants	169,000
20.	Wood Household Furniture	161,000
21.	Fluid Milk	159,000
23.	Computing and Related Machines	144,000
24.	Fabricated Rubber Products	144,000
25.	Gray Iron Foundries	139,000
26.	Men's and Boys' Suits and Coats	139,000
29.	Weaving Mills, Synthetics	134,000
30.	Ammunition, Except for Small Arms	131,000
31.	Farm Machinery	125,000
32.	Bottled and Canned Soft Drinks	125,000
34.	Men's and Boys' Shirts and Nightwear	114,000
36.	Special Dies, Tools, Jigs and Fixtures	110,000
37.	Fabricated Structural Steel	110,000
40.	Canned Fruits and Vegetables	105,000
41.	Pharmaceutical Preparations	104,000
43.	Hardware	102,000
44.	Corrugated and Solid Fiber Boxes	101,000
47.	Industrial Organic Chemicals	95,000
49.	Men's and Boys' Separate Trousers	92,000
52.	Poultry Dressing Plants	86,000
53.	Machine Tools, Metal-Cutting Types	84,000
54.	Women's and Misses' Suits and Coats	84,000
56.	Industrial Inorganic Chemicals	80,000
57.	Upholstered Household Furniture	80,000
58.	Knit Outerwear Mills	80,000
59.	Women's and Children's Underwear	79,000
60.	Yarn Mills, Except Wool	77,000
62.	Men's and Boys' Work Clothing	76,000
64.	Wood Products	72,000
67.	Special Industrial Machinery	71,000
68.	Plastics Materials and Resins	71,000
70.	Millwork	69,000
73.	Bolts, Nuts, Rivets and Washers	68,000
74.	Confectionery Products	68,000
77.	Frozen Fruits and Vegetables	67,000
78.	Steel Foundries	66,000
81.	Nonferrous Wiredrawing and Insulating	65,000
82.	Aluminum Rolling and Drawing	65,000

83.	Women's Hosiery Excluding Socks	65,000
85.	Glass Containers	64,000
86.	Food Preparation	64,000
87.	Metal Cans	63,000
88.	Organic Fibers, Noncellulosic	63,000
90.	Miscellaneous Fabricated Wire Products	62,000
91.	Malt Liquors	60,000
92.	Games and Toys	59,000
93.	Ball and Roller Bearings	59,000
95.	Machine Tool Accessories	58,000
96.	Women's and Misses' Outerwear	58,000
97.	Manufactures	57,000
99.	Women's and Misses' Blouses and Waists	56,000

CONSTRUCTION AREA

27.	Construction Machinery	138,000
63.	Ready-Mixed Concrete	75,000
65.	Veneer and Plywood	72,000
66.	Logging Camps and Logging Contractors	72,000
69.	Sheetmetalwork	70,000
72.	Lighting Fixtures	68,000
75.	Metal Doors, Sash and Trim	67,000
79.	Paints and Allied Products	66,000
98.	Concrete Products	57,000

COMMUNICATIONS AREA

3.	Radio and TV Communication Equipment	428,000
5.	Newspapers	331,000
7.	Electronic Components	244,000
18.	Commercial Printing, Except Lithographic	169,000
22.	Commercial Printing, Lithographic	152,000
28.	Papermills, Except Building Papers	137,000
33.	Telephone and Telegraph Apparatus	119,000
35.	Radio and TV Receiving Sets	113,000
50.	Photographic Equipment and Supplies	90,000
51.	Semiconductors	89,000
55.	Periodicals	83,000
76.	Paperboard Mills	67,000

TRANSPORTATION AREA

1.	Motor Vehicles and Parts	723,000
4.	Aircraft	414,000

10.	Complete Guided Missiles	214,000
13.	Aircraft Equipment	201,000
15.	Aircraft Engines and Parts	191,000
45.	Tires and Inner Tubes	99,000
84.	Internal Combustion Engines	64,000
100.	Engine Electrical Equipment	53,000
	POWER AREA	
38.	Motors and Generators	107,000
39.	Petroleum and Refining	107,000
42.	Refrigeration Machinery	103,000
46.	Fabricated Platework (Boilershops)	96,000
48.	Valves and Pipe Fittings	94,000
61.	Pumps and Compressors	76,000
71.	Mechanical Measuring Devices	68,000
80.	Switchgear and Switchboard Apparatus	65,000
89.	Electric Measuring Instruments	62,000
94.	Plating and Polishing	59,000
	Total for all areas:	12,428,000

(Industry Profiles, 1970, pp. 267-268)

If teachers are to plan children's activities that relate to these key industries they need to know more about them. *Industry Profiles* (1970, p. 286) gives a complete description of each industry listed. For example, the second largest industry, Blast Furnaces and Steel Mills, is described as follows:

Blast Furnaces (including Coke Ovens), Steel Works and Rolling Mills. Establishments primarily engaged in manufacturing hot metal, pig iron, silvery pig iron and ferroalloys from iron ore and iron and steel scrap; converting pig iron, scrap iron and scrap steel into steel; and in hot rolling iron and steel into basic shapes such as plates, sheets, strips, rods, bars, and tubing. Merchant blast furnaces and by-products or beehive coke ovens are also included in this industry.

Included in this industry are all establishments engaged in the manufacture of blast furnace ferroalloys. However, establishments which manufacture ferro or nonferrous additive alloys by electrometallurgical processes are classified in industry 3313. Also, establishments which draw wire from purchased rod and bar; establishments which perform only cold rolling, drawing or finishing operations; and establishments which produce welded seamless and heavy riveted pipe from purchased materials are not included in industry 3312, but are included in industries 3315, 3316 and 3317 respectively.

Some of the descriptions are even more detailed and lengthy. For example, the one describing the largest industry, Motor Vehicles and Parts, is twice as long. For detailed curriculum planning the complete reference might be helpful to clarify some details; however, for the purpose of this general overview the author has excerpted the essential parts and listed them in Table 2. The one hundred industries are grouped by the five areas of the technology in which children might study them. Also, similar industries that might be studied at the same time have been placed together. For example, the heading, Clothing, in the Manufacturing Area has subtopics of Dresses, Suits and Coats, Trousers, Shirts and Nightwear, Work Clothing and others. If the children study how clothing is sewn in a factory all of these subtopics use a common process with similar materials and machines. In the Manufacturing Area this grouping reduces the number of major industries to be studied from sixty to thirteen, which is a more practical amount for curriculum planning.

The one hundred industries in Table 2 employ a total of 12,428,000 workers. This covers about two-thirds of the workers in manufacturing. It would seem that this would be a good starting point for an industrial arts program to use these industries as a core for planning curriculum activities.

Table 2
DESCRIPTIONS OF THE 100 LARGEST MANUFACTURING INDUSTRIES GROUPED BY AREAS OF THE TECHNOLOGY

MANUFACTURING AREA

Fabricated Metal Products ....1,431,000 employees

Metal Stampings 232,000

Manufacturing metal stampings by the use of tools, dies, jigs and fixtures to punch, draw, form or otherwise modify materials under pressure in a machine. These are mainly parts sold to manufacturers for incorporation into products such as refrigerators, agricultural machinery, radio and television sets. Finished end products include cooking, kitchen and hospital utensils, pails, ash cans, garbage cans, perforated metal products, metal commercial and home canning closures, and miscellaneous items.

Machinery, except Electrical 200,000

Manufacturing parts such as pistons and piston rings, carburetors, metallic packing and amusement park equipment. It also includes establishments producing or repairing machine or equipment parts, on a job or order basis for others. They usually operate on a job or order basis and are equipped with machine tools and other power-driven metalworking machinery capable of manufacturing a wide range of machine and equipment parts.

Computing and Related Machines 144,000

Manufacturing computing machines including electronic, accounting machines and cash registers.

Farm Machinery 125,000

Manufacturing farm machinery including equipment and wheel tractors for use in preparation of the soil; planting and harvesting the crop; preparing crops for market on the farm; or for use in performing other farm operations and processes.

Special Dies, Tools, Jigs and Fixtures 110,000

Manufacturing on a job or order basis, special tools or fixtures for use with machine tools, hammers, die cutting machines and presses. The products include a wide variety of special toolings such as dies; punches; die sets and components, and subpresses; jigs and fixtures; and special checking devices. Manufacturing metal molds for casting metals, for rubber working, glass working and similar machinery.

Fabricated Structural Steel 107,000

Manufacturing fabricated iron and steel or other metal for structural purposes, for bridges, buildings and sections for ships, boats and barges.

Machine Tools, Metal-Cutting Types 84,000

Manufacturing power-driven machines, not supported in the hands of an operator when in use, that shape metal by cutting or use of electrical equipment; the rebuilding of such machine tools, and the manufacture of replacement parts for them. Metalworking machine tools designed primarily for the home workshops are included.

Special Industry Machinery 71,000

Manufacturing machinery such as smelting and refining equipment, cement making, clay working, glass making, hat making, incandescent lamp making, leather working, paint making, rubber working, tobacco working, cigar and cigarette making, shoe making, and stone working machinery.

Metal Cans 63,000

Manufacturing metal cans from purchased tinplate, terneplate, blackplate, or enameled sheetmetal.

Miscellaneous Fabricated Wire Products 62,000

Games and Toys 59,000

Manufacturing indoor games and game sets for adults and children, and mechnical and nonmechanical toys. Products include games such as chess, checkers, dominoes, puzzles and other indoor games; and toys such as toy furniture, doll carriages and carts, construction sets, mechanical trains, toy guns and air rifles and other mechanical games and toys.

Ball and Roller Bearings 59,000

Machine Tool Accessories 58,000

Manufacturing cutting tools, machinists' precision measuring tools, and attachments and accessories for machine tools and for other metalworking machinery.

Manufacture of Miscellaneous Items 57,000

Manufacturing products including beauty shop and barber shop equipment; hair work; tobacco pipes and cigarette holders; coin-operated amusement machines; matches; candles; lamp shades; dressed and dyed furs; umbrellas; parasols and canes; and other articles.

Clothing . . . . 1,265,000 employees

Women's and Misses' Dresses	211,000
Mens' and Boys' Suits and Coats	139,000
Mens' and Boys' Shirts and Nightwear	114,000
Mens' and Boys' Separate Trousers	92,000
Womens' and Misses' Suits and Coats	84,000
Knit Outerwear Mills	80,000
Womens' and Childrens' Underwear	79,000
Mens' and Boys' Work Clothing	76,000
Womens' Hosiery Excluding Socks	65,000
Womens' and Misses' Outerwear	58,000
Womens' and Misses' Blouses and Waists	56,000

Food Preparation . . . . 1,187,000 employees

Bread, Cake and Related Products 220,000

Meat Packing Plants 169,000

The slaughtering for their own account or on a contract basis for the trade of cattle, hogs, sheep, lambs, calves, horses and other small animals except small game, for meat to be sold or to be used on the same premises in canning or curing and in making sausages, lard, and other products.

Fluid Milk 159,000

Processing (pasteurizing, homogenizing, vitaminizing, bottling) and distributing fluid milk and cream and related products.

Bottled and Canned Soft Drinks 125,000

Canned Fruits and Vegetables 105,000

Poultry Dressing Plants 86,000

Establishments engaged in killing, dressing, packing and canning poultry, rabbits and other small game for their own account or on a contract basis for the trade.

Confectionery Products 68,000

Frozen Fruits and Vegetables 67,000

Glass Containers 64,000

Manufacturing glass containers for commercial packing and bottling, and for home canning. Products of this industry may be machine made or hand made and include ampules, carboys, cosmetic jars, fruit jars, medicine bottles, milk bottles, vials, and beverage and beer bottles.

Food Preparations 64,000

Manufacturing prepared foods and miscellaneous specialities such as baking powder, yeast and other leavening compounds; desserts (ready to mix); sweetening syrups and molasses; vinegar and cider; chocolate and cocoa products, except confectionery, made from purchased chocolate; potato and corn chips; and other food preparations.

Malt Liquors 60,000

Primary Metal Industries . . . . 866,000 employees

Blast Furnaces and Steel Mills 531,000

Manufacturing hot metal, pig iron, and ferroalloys from iron ore and steel scrap; converting pig iron, scrap iron and scrap steel into steel; and in hot rolling iron and steel into basic shapes such as plates, sheets, strips, rods, bars and tubing.

Gray Iron Foundries 139,000

Manufacturing gray iron castings, including cast iron pressure and soil pipe and fittings.

Steel Foundries 66,000

Nonferrous Wiredrawing and Insulating 65,000

Aluminum Rolling and Drawing 65,000

Woodworking . . . . 557,000 employees

Sawmills and Planning Mills - General 175,000

Sawing rough lumber and timber from logs and bolts, or resawing cants and flitches into lumber, including box lumber and softwood cut stock; planing mills combined with sawmills; and separately operated planing mills which are engaged primarily in producing surfaced lumber and standard workings and patterns of lumber. This industry includes establishments engaged in sawing lath and railroad ties, and in producing tobacco hogshead stock and snow fence lath.

Wood Household Furniture 161,000

Upholstered Household Furniture 80,000

Wood Products 72,000

Turning and shaping wood and manufacturing miscellaneous wood products, such as lasts and related products, cork products, mirror and picture frames, particle board, hard pressed wood fiberboard and fabricated hardboard products.

Millwork 69,000

Textile Mills . . . . 452,000 employees

Weaving Mills, Cotton 178,000

Weaving Mills, Synthetics 134,000

Yarn Mills, Except Wool 77,000

Organic Fibers, Noncellulosic 63,000

Plastics . . . . 346,000 employees

Miscellaneous Plastic Products 275,000

Establishments engaged in molding plastics for the trade, in manufacturing film, sheets, sheeting, rods, tubes, and other stock shapes from purchased resins and in fabricating finished plastics products.

Plastic Materials and Resins 71,000

Important products include: cellulose plastic materials; phenolic and other tar acid resins; urea and melamine resins; vinyl resins; styrene resins; alkyd resins; acrylic resins; polyethylene resins; rosin modified resins; and others.

Chemicals . . . . 255,000 employees

Pharmaceutical Preparations 104,000

Products finished in the form intended for final consumption such as tablets, capsules, ointments, solutions, and suspensions. Products consist of two lines (1) pharmaceutical preparations advertised or otherwise promoted to or prescribed by the health professions: medical, dental, pharmaceutical, nursing, etc.; and (2) pharmaceutical preparations advertised or otherwise promoted to the general public.

Industrial Organic Chemicals 95,000

Products include: (1) noncyclic organic chemicals such as acetic, adipic, chloroacetic, formic, oxalic and tartaric acids and their metallic salts; chloral formaldehyde and nethlylamine; (2) solvents such as amyl, butyl, and ethyl alcohols; methanol; amyl, butyl and ethyl acetates; thylether, ethylene glycol ether and dyethylene glycol ether; (3) polyhydric alcohols; (4) synthetic perfume and flavoring materials (5) rubber processing chemicals (6) plasticizers both cyclic and acyclic (7) synthetic tanning agents (8) chemical warfare gasses and (9) esters, amines, etc. of polyhydric alcohols and fatty and other acids.

Industrial Inorganic Chemicals 80,000

Products include inorganic salts of sodium, potassium, aluminum, calcium, chromium, magnesium, mercury, nickel, silver, tin; inorganic compounds such as alums, calcium carbide, hydrogen peroxide, phosphates, sodium silicate, ammonia, compounds and anhydrous ammonia; fertilizer materials such as muriate and sulfate of potash; rare earth metal salts and elemental bromine, fluorine, iodine, phosphorus and alkali metals.

Shoes, except Rubber . . . . 214,000 employees

Establishments engaged in the production of boots and shoes primarily designed for street, work, play or sport wear.

Hardware . . . . 170,000 employees

Hardware 102,000

Bolts, Nuts, Rivets and Washers 68,000

Fabricated Rubber Products . . . . 144,000 employees

Ammunition, except for Small Arms . . . . 131,000 employees

Manufacturing ammunition or in loading or assembling ammunition over 30 mm for naval, aircraft, tank, coast and field artillery; including component parts. It also includes establishments engaged in manufacturing bombs, mines, torpedoes, grenades, depth charges, chemical warfare projectiles and their component parts.

Corrugated and Solid Fiber Boxes . . . . 101,000 employees

Products include corrugated and solid fiberboard boxes, pads, partitions, display items, pallets, single face products and corrugated sheets.

CONSTRUCTION AREA

Construction Machinery . . . . 138,000 employees

Establishments engaged in making heavy machinery and equipment used by construction industries such as bulldozers; concrete mixers; cranes, except industrial plant; dredging machinery; pavers; and power shovels.

Concrete 132,000

Ready-Mixed Concrete 75,000

Making Portland cement concrete, manufactured and delivered to a purchaser in a plastic and unhardened state. It includes production and sale of central mixed concrete and transit mixed concrete.

Concrete Products 57,000

Making concrete products except block and brick from a combination of cement and aggregate.

Veneer and Plywood . . . . 72,000 employees

Producing commercial veneer, either face or technical, and those engaged in making commercial plywood, including nonwood backed or face veneer and nonwood faced plywood, from veneer produced in the same establishment or from purchased veneer. Establishments manufacturing prefinished plywood from purchased plywood are also classified in this industry.

Logging Camps and Logging Contractors . . . . 72,000 employees

Cutting timber and in producing rough, round, hewn or riven primary forest or wood raw materials. Independent contractors engaged in estimating or trucking timber but who perform no cutting operations are classified in nonmanufacturing industries.

Sheetmetal Work . . . . 70,000 employees

Sheetmetal work for buildings and manufacturing sheetmetal stove pipes, light tanks, etc. Establishments in the sheetmetal field are frequently engaged in activities which overlap the economic divisions of manufacturing, wholesale, service and construction, and some difficulty is experienced in distinguishing a sheetmetal manufacturing establishment from other sheetmetal wholesalers.

Lighting Fixtures. . . . . 68,000 employees

Making lighting fixtures and equipment of any type, including electric and gas lighting fixtures; carbide, kerosene and gasoline lamps; and metal reflectors and fittings.

Metal Doors, Sash and Trim . . . . 67,000 employees

Paint and Allied Products . . . . 66,000 employees

Making paints (in paste and ready mix form), varnishes, lacquers, enamels and shellac; putties and caulking compounds; wood fillers and sealers; paint and varnish removers; paint brush cleaners and allied paint products.

COMMUNICATIONS AREA

Graphic 1,029,000

Newspapers 331,000

These establishments carry on the various operations necessary for issuing newspapers, including the gathering of news, and the preparation of editorials and advertisements, but may or may not perform their own printing. Commercial printing is frequently carried on by establishments engaged in publishing and printing newspapers, but even though the commercial printing may be of major importance such establishments are included in this industry.

Commercial Printing except Lithographic 169,000

This industry includes general printing shops, as well as shops specializing in printing newspapers and periodicals for others, and those which specialize in gravure, rotagravure and screen process printing.

Commercial Printing, Lithographic 152,000

The work in this industry is performed on a job or custom basis; but in some cases lithographed calendars, maps, posters, decalcomanias, etc., are made for sale. Offset printing, photo-offset and photo-lithographing are also included in this industry.

Papermills, except Building Papers 137,000

Making paper from wood pulp and other fibers, and which may also manufacture converted paper products (confined almost exclusively to off-machine paper coating). Pulp mills combined with paper mills and not separately reported are also included in this industry.

Photographic Equipment and Supplies 90,000

Making (1) photographic apparatus, motion picture cameras and projection apparatus; photocopy and microfilm equipment; blueprinting and diazotype (white printing) apparatus and equipment; and other photographic equipment; and (2) sensitized film, paper, cloth and plates, and prepared photographic chemicals for use therewith.

Periodicals 83,000

Publishing periodicals or in preparing, publishing and printing periodicals. They carry on the various operations necessary for issuing periodicals, but may or may not perform their own printing.

Paperboard Mills 67,000

Making paperboard, including paperboard coated on the paperboard machine, from wood pulp and other fibers; and which may also manufacture converted paperboard products.

Electronic . . . . 993,000 employees

Radio and TV Communication Equipment 428,000

Establishments engaged in making radio and television broadcasting equipment; electric communication equipment and parts;

electronic field detection apparatus, light and heat emission operation apparatus, object detection apparatus and navigational electronic equipment, and aircraft and missile control systems; and other electric and electronic communication and signaling products.

Electronic Components 244,000

Establishments engaged in making specialty resistors for electronic end products; electronic transformers and capacitors; and other components.

Telephone and Telegraph Apparatus 119,000

Making wire telephone and telegraph equipment and parts especially designed for telephone and telegraph use.

Radio and TV Receiving Sets 113,000

Making equipment for home entertainment. This industry also includes establishments primarily engaged in making public address systems and music distribution apparatus, except records.

Semiconductors 89,000

Making semiconductor (solid state) and related devices such as semiconductor diodes and stacks, including rectifiers; transistors; solar cells; and light sensitive semiconductor (solid state) devices.

TRANSPORTATION AREA

Air ....1,020,000 employees

Aircraft 414,000

Complete Guided Missiles 214,000

Making complete guided missiles and space vehicles and in doing research and development on complete guided missiles and space vehicles.

Aircraft Equipment 201,000

Aircraft Engines and Parts 191,000

Establishments engaged in making aircraft engines, complete missile or space vehicle engines and/or propulsion units and their parts.

Land ....939,000 employees

Motor Vehicles and Parts 723,000

Making or assembly of passenger automobiles, car bodies, trucks, commercial cars and busses, special purpose motor vehicles such as ambulances, fire engines, taxicabs, scout cars, personnel carriers, amphibian motor vehicles and selected parts and accessories for motor vehicles.

Included are such parts as passenger car bodies, motor vehicle engines, brakes, clutches, axles, radiators, differentials, transmissions, wheels and frames, windshield wipers, automotive bumpers, camshafts, connecting rods, crankshaft assemblies, cylinder heads, drive shafts, exhaust systems, fuel systems, heaters, hoods, horns, instrument board assemblies, lubrication systems, mufflers, power transmission equipment, rear-axle housings, shock absorbers, steering assemblies, universal joints, wheel rims, windshield frames and automobile accessories.

Tires and Inner Tubes 99,000

Making pneumatic casings, inner tubes and solid or cushion tires for all types of vehicles, airplanes, farm equipment and children's vehicles, as well as tire repair and tire retreading (camelback) materials.

Internal Combustion Engines 64,000

Making diesel, semi-diesel or other internal combustion engines for stationary, marine, traction and other uses.

Engine Electrical Equipment 53,000

Products for internal combustion engines include starting motors and generators for automobiles and aircraft; and ignition apparatus for internal combustion engines, including spark plugs, magnetos, coils and distributors.

POWER AREA

Transmission Equipment .... 170,000 employees

Valves and Pipe Fittings 94,000

Establishments making valves for controlling the flow of liquids or gasses in pipes or mains and for machinery.

Pumps and Compressors 76,000

Measurement .... 130,000 employees

Mechanical Measuring Devices 68,000

Making industrial process instruments for indicating, recording, measuring and controlling temperature, pressure and vacuum, fluid flow and liquid level, mechanical motion, rotation, humidity, density, acidity, alkalinity, and combustion; dial pressure gauges; physical property testing apparatus such as hardness, tension, compression, torsion, ductility, elasticity testing apparatus.

Electric Measuring Instruments 62,000

Making pocket, portable, panelboard and graphic recording instruments for measuring electricity such as voltmeters, ammeters, wattmeters, watthour meters, demand meters and other meters and indicating instruments.

Motors and Generators .... 107,000 employees

Making electric motors (except starting motors) and power generators; motor generator sets; railway motors and control equipment for gasoline electric and oil electric busses and trucks.

Petroleum Refining .... 107,000 employees

Producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants and other products from crude petroleum, and its fractionation products through straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking or other processes.

Refrigeration Machinery .... 103,000 employees

Making equipment and systems using the basic refrigeration cycle, including mechanical and absorption refrigerators for commercial and industrial use; refrigeration machinery and complete air conditioning units for domestic, commercial and industrial use. Establishments manufacturing soda fountain and beer dispensing equipment are classified in this industry.

Fabricated Platework ....96,000 employees
Making power and marine boilers, pressure and non pressure tanks, processing and storage vessels, heat exchangers, weldments and similar products by the process of cutting, forming and joining metal plates, shapes, bars, sheet, pipe, mill products and tubing to custom or standard design for factory or field assembled products.

Switchgear and Switchboard Apparatus ....65,000 employees
Products of this industry include power switches, circuit breakers, power switching equipment and similar switchgear for general industrial application; switchboard and cubicles, control and metering panels, power fuse mountings and similar switchboard apparatus and supplies.

Plating and Polishing 59,000
All types of electroplating, plating, anodizing and coloring, and finishing of metals and formed products.

(Industry Profiles, 1970, pp. 267-296)

So far discussion has been centered on the one hundred largest industries in manufacturing. This group might be compared with the total labor force to determine the extent of coverage, of the whole technology. These figures are summarized in Table 3 by listing a breakdown of the working population under some general headings.

The division of the technology into the areas of manufacturing, construction, communication, transportation and power reflects the workers in most of the nonagricultural establishments above. Manufacturing is listed specifically in Table 3. Wholesale and retail trade is omitted from specific mention in the five areas of technology but elementary grade children usually have a unit relating to local stores and they have direct contact with them. The transportation area touches on wholesale trade as trucks are used to deliver goods and the construction area deals with the buildings used. Government is not directly included in the five areas except as government agencies regulate industry. For example, the Department of Labor sets and enforces safety regulations for factories and the Civil Aeronautics Board regulates transportation by air. A minor part of the service

Table 3

1968 EMPLOYMENT STATUS

Non-institutional population, 16 and older	135,562,000 workers
Employees in nonagricultural establishments	67,860,000
manufacturing	19,768,000
wholesale and retail trade	14,081,000
government	11,846,000
services	10,592,000
transportation and public utilities	4,313,000
finance, insurance and real estate	3,383,000
contract construction	3,267,000
mining	610,000
Farm population	10,454,000

(Statistical Abstract, 1970, pp. 213-218)

establishments are touched upon in transportation; auto repair and miscellaneous repair services employ about 500,000 workers, who constitute about one-twentieth of that category. The rest of the service establishments deal with such things as lodging places, health services, educational services and others. Finance, insurance and real estate establishments are not included in the industrial arts areas unless the children organize a mass production project where they are considered. Mining establishments are included as the children study the metals used in manufacturing and the fuels used for power. Therefore the five areas of the industrial arts technology give a very comprehensive picture of how people earn a living and provide the goods and services of this technological society.

Some of the areas like textiles and food preparation may be covered under the art or home economics curriculum of the school. That is good, because there are many other areas that industrial arts activities can cover. However, if the home economics specialist does not teach about textiles and food preparation in the K-6 grades the industrial arts activities should include them. It should not be an issue whether it be labelled art, home economics or industrial arts. The concern here is that the children obtain a comprehensive picture regardless of the curriculum label that the school might apply to it. The total curriculum plan of the school should be carefully coordinated to avoid any duplication.

As noted above, *The Statistical Abstract* may be used for further information as units of study are developed in the five areas of the technology. Table 4 illustrates how this might be done for the construction area. The number of employees indicate that the area should include units in building construction, heavy construction, and highway construction with highlights in special trades like plumbing and heating, electrical work, masonry and sheetmetal work. These are the areas of construction that employ the largest number of workers and could be used as a starting point. As a second or third unit is organized, reference might be made to the statistics to give a comprehensive coverage of the industry.

Children Study Technology

This Chapter sets a general direction for the comprehensive coverage of industry. As schools seek reference material to study industry they might refer to texts such as those by Miller and Boyd (1970), Gerbracht and Robinson (1962), Gilbert (1966), and Scobey (1968). Another source of help may come from the industries. Usually local industry is very cooperative in providing help for the schools. Once a school has obtained resource information it may be shared nationwide through an organization like the American Council of Elementary School Industrial Arts. The newsletter of this national organization might announce available material so schools can request the material that would be useful. After some years of this interchange the Council might publish a compilation of resource material.

FORMAT FOR RESOURCE UNITS

As resource material is compiled it would seem that a common framework of reference would be necessary to publish the material in a useable form. Each school may plan its own direction and emphasis to best utilize the abilities of the staff and adapt to the peculiar needs of the children in that school. Each school will need to adapt to the facilities available, the monetary resources and the

Table 4
EMPLOYEES IN SELECTED CONSTRUCTION INDUSTRIES IN 1967

Industry	Number of Employees
Total contract construction industries	3,401,000
general building contractors	873,000
heavy construction	871,000
highway and street construction	307,000
heavy construction	565,000
special trade contractors	1,588,000
plumbing, heating, air conditioning	371,000
painting, paperhanging, decorating	139,000
electrical work	241,000
masonry and other stone work	144,000
plastering and lathing	48,000
terazzo, tile, marble, mosaic work	32,000
carpentering	80,000
floor laying and floor work	38,000
roofing and sheetmetal work	133,000
concrete work	83,000
water well drilling	14,000
structural steel erection	42,000
glass and glazing work	12,000
excavating and foundation work	51,000
wrecking and demolition work	10,000
installing building equipment	19,000

(Statistical Abstract, 1970, p. 668)

particular emphasis in the school program. Therefore this curriculum plan is not intended as a blueprint for every community. However, it might be considered as a goal to strive towards if all conditions were favorable.

This outline might be used by the American Council for Elementary School Industrial Arts to coordinate the development of resource material. As members develop, test and revise units in their local schools, they might contribute a copy of the resource unit to The Council Publications Committee. The latter might use the outline presented here to categorize the units and then combine similar materials to expand them. After a time some members might volunteer to develop units that would fill in voids of information. In this way the Council Publications Committee might assume the leadership in developing a broad, comprehensive compilation of resource material reflecting the technology. It is hoped that financial support might come from industry or a government grant to publish and distribute the material to any schools who could use the resources.

The material from *Industry Profiles* which is quoted earlier in this chapter served the purpose of highlighting the technology and providing descriptive material for an introduction. The statistics were based upon analysis of the one hundred largest manufacturing industries and covered about twelve million of the sixty million employees (civilian, non-agricultural, excluding government and unemployed). These statistics would not provide a comprehensive enough basis for a framework reflecting the whole technology. To develop the latter, material was abstracted from several tables throughout the *Statistical Abstract.* This was supplemented by more current information from the *Survey of Current Business* (1972). The latter is a monthly publication from the United States Department of Commerce that gives current economic data about the technology. One of the many tables is called Labor Force, Employment and Earnings, which gives current employment figures. The November 1972 figures were used to update the 1968 figures from the *Statistical Abstract.*

The Format for Resource Units which is given in Table 5 combines the resources from *Industry Profiles, The Statistical Abstract* and *Survey of Current Business.* The third column in the table gives the source of the figure quoted. The Format is divided into the five areas describing the technology: Manufacturing, Construction, Communications, Transportation and Power.

Each category of employment listed might be a topic for a resource unit. For example in the Manufacturing Area one resource unit might be for Machinery and another unit for Food and Kindred Products. Reference to Industry Profiles would give basic information describing these units of the technology so resource information might be developed. To show how this may be done a sample resource unit is shown in Table 6. The author worked in cooperation with the Tandy Leather Company and other educators to compile this information.

Table 5

FORMAT FOR RESOURCE UNITS

Industry	Number of Employees	Source of Data
	MANUFACTURING AREA	
Machinery, except Electrical	1,936,000	Survey of Current Business, p. S-13
Food and Kindred Products	1,743,000	Survey of Current Business, p. S-13
Fabricated Metal	1,399,000	Survey of Current Business, p. S-13
Apparel and other Textile Products	1,351,000	Survey of Current Business, p. S-13
Primary Metal	1,277,000	Survey of Current Business, p. S-13
Chemicals and Allied Products	1,014,000	Survey of Current Business, p. S-13
Textile Mill Products	1,009,000	Survey of Current Business, p. S-13
Stone Clay and Glass	672,000	Survey of Current Business, p. S-13
Rubber and Plastic	649,000	Survey of Current Business, p. S-13
Lumber and Wood Products	621,000	Survey of Current Business, p. S-13
Furniture and Fixtures	506,000	Survey of Current Business, p. S-13
Miscellaneous Manufacturing	428,000	Survey of Current Business, p. S-13
Leather and Leather Products	298,000	Survey of Current Business, p. S-13
Ordnance and Accessories	193,000	Survey of Current Business, p. S-13
Hardware	170,000	Industry Profiles, p. 266

Corrugated and Solid Fiber Boxes	101,000	Industry Profiles, p. 265
Tobacco Manufacture	70,000	Survey of Current Business, p. S-13

CONSTRUCTION AREA

General Building Contractors	873,000	Statistical Abstract, page 668
Heavy Construction	565,000	Statistical Abstract, page 668
Plumbing, Heating, Air Conditioning	371,000	Statistical Abstract, page 668
Highway and Street Construction	307,000	Statistical Abstract, page 668
Construction Machinery	295,000	Statistical Abstract, page 220
Electrical Work	241,000	Statistical Abstract, page 668
Electric Lighting and Wiring Equipment	209,000	Statistical Abstract, page 220
Household Appliances	182,000	Statistical Abstract, page 220
Masonry and Other Stone Work	144,000	Statistical Abstract, page 668
Roofing and Sheetmetal Work	133,000	Statistical Abstract, page 668
Painting, Paper Hanging and Decorating	139,000	Statistical Abstract, page 668
Concrete	132,000	Industry Profiles, page 266
Concrete Work	83,000	Statistical Abstract, page 668
Carpentering	80,000	Statistical Abstract, page 668
Veneer and Plywood	72,000	Industry Profiles, page 266
Logging Camps and Contractors	72,000	Industry Profiles, page 266
Sheetmetal Work	70,000	Industry Profiles, page 266
Metal Doors, Sash and Trim	67,000	Industry Profiles, page 226
Paint and Allied Products	66,000	Industry Profiles, page 266
Excavating and Foundation Work	51,000	Statistical Abstract, page 668
Plastering and Lathing	48,000	Statistical Abstract, page 668

Structural Steel Erection	42,000	Statistical Abstract, page 668
Floor Laying and Floor Work	38,000	Statistical Abstract, page 668
Terazzo, Tile, Marble and Mosaic Work	32,000	Statistical Abstract, page 668
Installing Building Equipment	19,000	Statistical Abstract, page 668
Water Well Drilling	14,000	Statistical Abstract, page 668
Glass and Glazing Work	12,000	Statistical Abstract, page 668
Wrecking and Demolition Work	10,000	Statistical Abstract, page 668

COMMUNICATIONS AREA

Graphic

Regular United States Post Office	546,181	Statistical Abstract, page 221
Newspapers	366,000	Statistical Abstract, page 221
Commercial Printing	346,000	Statistical Abstract, page 221
Paper and Pulp Mills	224,000	Statistical Abstract, page 221
Paperboard Containers, Boxes	200,000	Statistical Abstract, page 221
Books	97,000	Statistical Abstract, page 221
Paperboard Mills	73,000	Statistical Abstract, page 221
Blankbooks and Bookbinding	51,000	Statistical Abstract, page 221
Periodicals	25,000	Statistical Abstract, page 221

Electronic

Telephone	883,000	Statistical Abstract, page 222
Communication Equipment	525,000	Statistical Abstract, page 221
Radio and TV Equipment	428,000	Industry Profiles, page 266
Electronic Components, Accessories	410,000	Statistical Abstract, page 221

Radio and TV Broadcasting	131,000	Statistical Abstract, page 489
Telegraph	32,000	Statistical Abstract, page 489

TRANSPORTATION AREA

Air		
Aircraft	414,000	Industry Profiles, page 266
Transportation by Air	351,000	Statistical Abstract, page 222
Complete Guided Missiles	214,000	Industry Profiles, page 266
Aircraft Equipment	201,000	Industry Profiles, page 266
Aircraft Engines and Parts	191,000	Industry Profiles, page 266
Land		
Trucking and Warehousing	1,088,000	Statistical Abstract, page 222
Motor Vehicles and Equipment	901,000	Statistical Abstract, page 221
Railroads and Equipment	688,000	Statistical Abstract, page 222
Local and Interurban passenger transit	283,000	Statistical Abstract, page 222
Water	235,000	Statistical Abstract, page 221
Ship and Boat Building, Repair	187,000	Statistical Abstract, page 221
Pipelines	19,000	Statistical Abstract, page 222

POWER AREA

Electric Companies and Systems	275,000	Statistical Abstract, page 222
Petroleum and Coal Products	190,000	Survey of Current Business, p. S-13
Combination Gas and Electric Companies	183,000	Statistical Abstract, page 222
Transmission Equipment	170,000	Industry Profiles, page 266
Gas Companies and Systems	158,000	Statistical Abstract, page 222

Measurement of Power	130,000	Industry Profiles, page 266
Motors and Generators	107,000	Industry Profiles, page 266
Refrigeration Machinery	103,000	Industry Profiles, page 266
Fabricated Platework	96,000	Industry Profiles, page 266
Switchgear and Switchboard Apparatus	65,000	Industry Profiles, page 266
Plating and Polishing	59,000	Industry Profiles, page 266
Water, Steam and Sanitary Systems	47,000	Statistical Abstract, page 222

The topic of leather was selected for this unit in order to show how these units might reflect technology. For many years leather work has been used in industrial arts classes as a hobby activity. Children decorated and assembled a leather project primarily for the enjoyment of using the material. Note how the sample units differ. The children experiment with tanning the leather, consider career opportunities and experiment with the manufacturing process in addition to making something with leather. This emphasis reflects the leather manufacturing industry as the thirteenth largest listed in Table 5 so children acquire a broader appreciation of the technology.

The sample units are constructed so they can be used by a classroom teacher who has little or no assistance in teaching from an industrial arts consultant and by a teacher who has had no experience with industrial arts activities. If the tools and materials are supplied as listed, the classroom teacher can proceed with the planning and teaching. The principal considerations in the development of these units were:

1. Practical for classroom use by teachers without technical experience.
2. "Hands on" or construction activities for children to motivate learning.
3. All the tools, materials and teaching resources needed for the unit.
4. Teacher directions including ideas for correlation with other work.
5. Inexpensive enough for schools to purchase.

6. Flexible in the amount of time a class might devote to the unit.
7. Brief instructions the teacher might use for planning.
8. References and resources for expansion of the unit.

Perhaps school suppliers will package units like this and sell them to schools to simplify the teacher's work in preparing materials for children to use. This technique has been used successfully in other curriculum areas such as math, science, social studies and language arts. The sample unit which follows has been tested by elementary classroom teachers and revised to improve its use.

SAMPLE RESOURCE UNIT

Kit of Teaching Materials for Children to Study

LEATHER — A USEFUL MATERIAL

Suggestions to Classroom Teacher for Use of the Kit

I. Unpack all of the materials and spread them out for inspection.
II. Browse through all of the information for general comprehension.
III. Identify all of the materials with the kit.
IV. Follow the directions to decorate and finish several coasters to use as examples for the children to examine.
V. Plan to use this kit to make a comprehensive learning experience.
   A. Encourage the children to learn about leather as a useful material in addition to making coasters.
   B. Use the natural interest children have in making coasters to motivate a practical application of other classroom subjects.
      1. Arithmetic: use measuring in cutting the felt.
      2. Language arts: have the children make a list of directions and follow them; add new words about leather to their vocabulary; telephone for information; make oral and/or written reports.
      3. Social Studies: have the children organize their own work groups and supervise the cleanup.
      4. Science: gather information about animals used for leather (ecology); study the chemical process of tanning.
      5. Art: apply the basic principles of design.

List of Materials to be included in the kit (numbers from Tandy Catalog)

100 cowhide rounders
plastic dish for water
4 wooden mallets #1823
saddle soap #1995
Neat Shene #2011 (one quart)
1 Beginners Home Tanning Kit #2044
2 finished coasters
4 stamping tools: P368, S350, C425, V745
4 tooling boards #2224 (12" by 12" hardboard)
2 sponges for saddle soap #2222
scrap felt to back coasters
New England Tanner's Club: *Leather Facts*

Tandy booklets: *Nature Designs for Leather*
Leather Knowledge
3 *Tandy Catalogs*
Leather Industries of America: *American Leather Chart*
Leather in Our Lives
The Ohio Leather Company: *The Story of Leather*

Materials Needed in the Classroom

scrap paper, pencils, erasers	sponge to wipe up spilled water
scissors to cut felt	scrap board 2' by 2' for tanning

newspaper to place under gluing and waxing
Elmer's GlueAll to affix felt to leather

I. Behavioral Objectives.
   A. The children get acquainted with leather by making a coaster.
   B. The children read about animal skins and hides that are used.
   C. The children learn how skins and hides are prepared for use by the class tanning and using a rabbit skin.

II. Introduction.
   A. Ask the children to bring in different leather goods to display on a table to show the various uses of leather.
   B. After different items are on display, ask the children to describe the characteristics that tell why leather is used to make the different objects (strong, soft, smooth, breathes, flexible, durable, colorful).

III. Demonstrate making a coaster to the class.
   A. Select a precut piece of cowhide.
   B. Moisten it by dipping it in water for about 10 seconds.
   C. Decorate the leather.
      1. Plan a design on paper (see pamphlet on Nature Designs for Leather).
      2. Place the moist leather on a tooling board.
      3. Hold a stamping tool in place and strike it with a wooden mallet.
      4. Repeat the stamping until the design is complete.
      5. Clean the leather with saddle soap and a clean sponge.
      6. Allow the leather to dry and apply the wax (Neat Shene).
      7. Cut a piece of felt slightly larger than the leather.
      8. Use cement to fasten the felt to the leather (put cement on leather).
      9. Use a scissors to trim the felt neatly to the edge of the leather.

IV. Teacher and class plan children's work.
   A. Teacher and class list directions to follow (Part III above for steps).
   B. Plan location in room of tools, materials and work area.
   C. Plan rotation of children to work with leather.
   D. Plan cleanup after each work session.
   E. Have all children make a first coaster.

V. Children make a second coaster.
   A. This time each child make a design on paper first.
   B. The teacher may make suggestions for improvement of the design.
   C. All children rotate at the work table to make a second coaster.
   D. Have a student committee pick out the five best coasters and display them.

VI. Read about procuring and tanning leather in industry.
    A. Encyclopedia.
    B. Science and/or social studies reference books.
    C. Pamphlets with this kit.

VII. See yellow pages of phone book for local manufacturers or retail sales.
    A. Have children phone them for information.
    B. Have the class as a group or children with parents visit if practical.
    C. Children share the information by oral or written reports.

VIII. Tan a rabbit skin.
    A. Have the children read the directions in the kit aloud to the class.
    B. Discuss the tanning process with the class.
    C. Plan a small group activity or a class demonstration of the process.
    D. Discuss the completed process with the class.
    E. Display the completed skin with the children's description of the process.

IX. Evaluation.
    A. Teacher leads a class discussion to review the unit.
    B. Teacher makes suggestions to improve the unit.
    C. Teacher makes revised plans for using the unit next year.

Directions for Using the Beginners Home Tanning Kit in an Elementary Classroom

1. The directions indicate the materials are poisonous. This is true if they are swallowed. However, the chemicals are not strong enough to burn the skin if they are used as directed. Avoid use if the fingers have open sores or cuts. Care should be taken to wash the hands thoroughly and immediately after handling the materials. If ordinary precautions and good work procedures are followed this kit is safe to use in the middle or upper elementary grades.
2. Prepare a salt solution to soak the rabbit skin for an hour. Add two tablespoons of salt to a pail containing two gallons of water.
3. As the rabbit skin is removed from the plastic bag, rinse the paradichlorobenzene crystals off the skin by holding it under running water. As soon as the skin is thoroughly rinsed, drop it in a pail of salt water. Wash the hands with soap.
4. After an hour remove the skin from the pail of salt water and rinse it. Wring it lightly to remove the excess water.
5. While the skin is wet place it flesh side up on the board.
6. Stretch the skin and nail it down (use small wire nails at about 2" intervals around the edge). Leave nail heads stick up so nails can be pulled easily.
7. Remove the fleshy tissue. If a dull knife is used to lift the edge of the membrane it can be peeled off in sections. Start working at the edges so if an error is made it will not ruin the whole skin. The rabbit skin is very thin and will wear a hole through easily.
8. Open the tanning solution and stir it. Use a spoon to apply a layer of it to the flesh side of the wet skin. It will not be necessary to use the whole can on a thin rabbit skin.
9. Leave the tanning solution on for 24 hours. This is the chemical that soaks into the skin to preserve it.
10. After 24 hours remove the dried crystals and dispose of them. Rinse the skin thoroughly and allow it to dry completely.
11. After the skin is dry, sandpaper is used to smooth any rough spots. Remove the skin from the board.

12. Clean the hair by rubbing flour or clean sawdust into it and brushing it.
13. Mix the oil with warm water. It is a water soluble oil. The ratio should be five parts of water to one part of oil. Rub the mixture into the skin slowly and evenly. Keep working it until the skin becomes soft enough.
14. The skin is now ready for use. It may be used like other leather: cut, sewn, laced, etc. The skin might not be as smooth and soft as commercially tanned skins. This is an experiment to show tanning. High quality tanning takes skill and experience. Materials needed in the classroom:

pail to hold 2 gallons or more water	2 tablespoons of salt
newspaper to cover work area	¼" plywood about 2' square
hammer	spoon
flour or clean sawdust	paper cup to mix oil

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CHAPTER IV

Industrial Arts and Technology in the Elementary School: Designing a Curriculum

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STRATEGY FOR DEVELOPMENT OF AN ELEMENTARY INDUSTRIAL ARTS CURRICULUM

Combine the complexity of the human being: psychologically, physically, socially and his technological society . . . .

Infiltrate this phenomenon with research, experimentation, development, design, invention, discoveries, construction, processes, products, mechanisms, humanisms

Stir in various theories, concepts, systems, principles, philosophies . . . .

Agitate these with accelerating changes, unknown futures, social, cultural, political, economical, environmental concerns . . . .

Shake the roles of educators and education for the present and future . . . .

Blend together with the catalyst: human drives . . . .

Then what do you have? THE CURRICULUM HAS BEGUN!

SPECIAL ACKNOWLEDGEMENTS TO THE DEVELOPMENTAL STAFF OF THE PROJECT, "A TECHNOLOGICAL EXPLORATORIUM, K-6"

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There is no doubt of the seriousness of the task for educators in developing strategies for the curricula for the youth of today and adults of tomorrow. The complexity of such planning might well be analogized to that of the human mind. Both have so many known and unknown variables. Yet both can develop contributing, *beautiful resources within the environment.

Man has been involved in education since his appearance upon this planet. The responsibility for mentally and morally developing the individual has befallen many of the man's institutions and has taken continually evolving forms of pedogogy and of administration. Education has perenially been a serious task for its undertakers, and likewise the planning of the strategies for its implementation. It is this planning for the education of the individual, the curriculum, not education, which continues to be a much argued, and in fact at times, a nebulous conflict of thought and interests. Man will always educate if he is to progress, but curriculum, the plan for education, has changed, will change, and must continue to change likewise, or man and his goals for the future may not be realized.

What is the proper plan . . . strategy . . . *curriculum* for the education of our youth? Needless to say that the hue and cry for a new plan, a new approach to education, has once again rung out. It seems to arise more often in these recent years than in decades past. Why is this so? Why do educators and their communities once again feel a need to overhaul and revise their plan for education? We have seen numerous attempts over time to innovate, initiate, and implement new educational strategies. We have seen them glow briefly in the sun of professional and public approval only to flicker and die into oblivion; falling short of meeting the learners' needs.

In retrospect the only point of universal agreement from time to time among educators seems to be to educate in a more relevant and effective method. At this juncture unanimity and rapport fractures into fractionalized segments of psycho-philosophical campus of theory and tradition. Thus we enter into a quagmire of curriculum theory, planning, and practice.

Let us attempt to delve into this riddle by first examining education itself. We shall take a position, one which would seem at least historically consistent, that education has and should continue to be a process of developing the individual both morally and men-

*Beautiful in youth meaning being knowledgeable, productive, et cetera as well as having values and morals.

tally in order that he may become acclimatized to his environment and subsequently efficiently operate within and upon that environment. Be this what education is, there then lies the problem of how or in what way this developmental process should proceed? How do we approach the matter of planning, or determining what the individual's environment consists of, how to go about relating it to him, and what skills and knowledge are essential to him in order that he may fulfill his needs within this environment as they arise?

We have once again entered into the wilderness too frequently traveled in past decades, and hear voices howling: "Educators should be accountable! Traditional programs are failing contemporary youth! The schools discourage creativity! Education is irrelevant!" Why is this so? It has occurred before and it happens again. Why? Academia does intermittently agree, yes, there must be a change. This change will occur, once again to be called for and invoked a few short years later.

Why have there been these continual demands in an ever-increasing frequency for new educational strategies? A clue may be found by reviewing man's history. Retrospectively scanning the past there seems to be one historical constant that can prove of some aid in our search for the solution to this cyclical curricular turmoil. The constant is simply that in general man has, does, and will continue to attempt to raise and enhance the level of his material welfare. These attempts have, of course, taken various forms and directions, yet they may all be characterized by man's unique abilities. That is a high degree of mental development and manual dexterity. With these abilities man has been able to both continually develop and implement technology. When man applies his technology, forces of change occur that set into motion new potential for personal, economic, social, political, cultural, and environmental changes that affect the nature and distribution of man, the planet and its surrounding atmosphere.

Granted that change has not always been rapid or even common place. At times change has been imperceptible to generations of men. Nonetheless, it has been a constant when viewed in the total perspective of man's history.

For an analogy: It took man more than 50,000 years to make the transition from hunting and gathering societies into those of agriculture. Another 5,000 years transpired before the first civilizations took root in the Tigris-Euphrates Valley. Change was slow, but it did occur and continued to occur as man experimented with civilizations and invented and developed the tools and processes with which to enhance his material welfare. As he developed this technology, it in turn precipitated changes in his institutions and in his modes of life. These changes have at various times and places influenced his social, political, economical, and even his spiritual life (Olson, 1963).

The educator not only must make particular note of change as being a constant in man's history, but especially become aware of the phenomena that this change has in recent times been rapidly accelerating.

As man has gained understanding of both his natural and man-made environment, he has increased his ability to comprehend and utilize resources, tools, processes, and organizations for the creation of technological systems. These sophisticated systems have in turn precipitated change within his environment at an ever-increasing rate. The following time line illustrates the rapid acceleration of technological progress accomplished by man over the centuries. It does not take a great wealth of insight or perception to analyze the changes that this technological progress has wrought upon man and the environment.

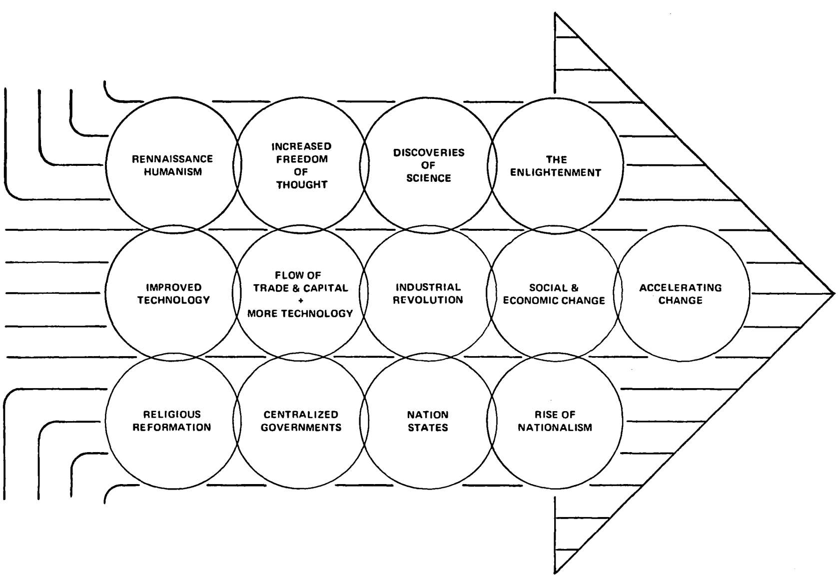


Fig. 1. Time Line—The Chains of Western World Change 1600—?

Herein lies the crux of the educator's paradox! Educators have traditionally planned to enlighten the individual about the world in which he lives, yet this world is now changing at such a pace that, at the risk of triteness, what is new today will become obsolete tomorrow. The first graders of 1973 will be graduated from high school in 1985. By deducting 12 years from the present we can plainly ponder the changes wrought since 1961, and then ask what will the world of 1985 hold for a first grader? In the words of Margaret Mead, "We must educate people in what nobody knew yesterday, and prepare people for what no one knows yet, but which some people must know tomorrow."

How can educators develop curriculum that will come near to equipping a child for the future he does not know and that most cannot even envision? Is it any wonder that we hear the cry for change in education more and more frequently?

The first step would seem to be the rejection of a "rear view mirror" philosophy. That is, the quite human tendency to physically exist in the present but psychologically live in the past. As McLuhan points out, modern man may be likened to the individual speeding down an expressway while viewing his travels through the rear view mirror of his vehicle. Of course we must make reference to where we have been, but we must also become aware of where we are going if we are to have any control in the directions we take. Not to do so is folly and invites disaster.

Accept it or not, feel comfortable or uneasy, the most pervasive and prevailing influence of modern urban industrial societies, if not the entire world, is technology and the ramifications it creates. It may be more comfortable to reflect upon the "good old days" in a rear view mirror, but educators must prepare youth to become conscious of the looming horizons and develop them to be able to effectively cope with the avenues before them. One cannot do so by formulating strategies solely on what has passed or what is occurring, but must also continually consider where man is going, what is his mode of travel, and how may he best control it?

Man is traveling in a vehicle of modern technology. Curriculum must be planned to educate the individual about this vehicle of change. Teaching about technology in a technological world must become a major concern of our nation's educational system if all students are to be adequately prepared for the present and their future. To ignore the accelerating phenomena of technology and the subsequent impact of change it creates within the learner's environment is to deny youth the tools with which to meet one of man's greatest challenges. It is a paramount consideration to be made when attempting to plan curriculum. A comprehension of technology and its effects is analogous with the contemporary individual's capability to adapt to change, make decisions, implement plans, and solve problems. As these abilities are developed so will the horizon for life's fulfillment broaden.

This continuing acceleration of change in our technological society is the basic challenge of traditional education. To enable the individual to assume a meaningful role in such a society he must not only study his environment, but also the "catalyst" of its evolution—man and his technology.

Contrary to the argument that technology is dehumanizing, it is of human creation. Man must first understand himself before he can thoroughly understand his endeavors, and through the study of his endeavors he can better decide his role in life. Through the power of his imagination man has the potential to willfully direct his technology to insure life's continuum. By being able to control the catalyst of change he can attempt to affect the most desirous changes.

The challenge of planning relevant curriculum with value for the future is to realize and develop avenues that the individual can use to explore and comprehend the forces that permeate his environment. Students involved in an industrial arts curriculum can experience "real" possibilities and opportunities to realize and interpret the environment as it is, so that they will be better prepared to shape their environment as it could be.

> Students should not play life, or study it merely while the community supports them at this expensive game, but earnestly live it from beginning to end. How could youths better learn to live than by at once trying the experiment of living? (Walden)

What are the implications for elementary industrial arts if we are to adequately prepare children for living in an ever-changing environment? The content that follows has been designed as an attempt to develop a structure for thinking and planning a meaningful, relevant education cognizant of the challenge of change. This may be "one tool" used in "beginning" curriculum development.

WHAT IS CURRICULUM?

Curriculum can be considered:

—a *tool* for educators,

—a *system* for learning,

—a *means* of promoting desired behavioral changes.

Reaves and Good (1968, p. 15) state, "The curriculum includes all those learning activities provided by the schools for the education of children." Taba's (1962, p. 76) definition is: "A curriculum is essentially a plan for learning." Mary-Margaret Scobey (1968) suggests that curriculum is a "set of dynamic actions."

Education is responsible for developing cognitive skills, certain psychomotor skills and affective feelings. As skills and attitudes are developed the "whole" child may begin to blossom as an individual and as a significant part of a society. Therefore, for use within this chapter, curriculum is defined as a plan of experiences designed by and for educators to nurture various aspects of the "total" development of children.

WHY HAVE A CURRICULUM?

A well designed curriculum, based on research, experimentation and thorough evaluation, provides a structure for educators as they deal with the many variables of their concern. This serves as a "guide" to help those who are inexperienced and to give the experienced ideas that will spark new and different approaches for the educational process.

PLANNING A CURRICULUM

Saylor and Alexander (1960, p. 64) in their discussion of curriculum planning analyzed the implications of the broad concept of curriculum and summarized their work in this way:

1. All phases of the school's program must be included in curriculum planning —all experiences and all factors which determine those experiences.
2. The interrelationship of the many factors influencing the curriculum and its various phases must be considered, since it is the impact of the total program (that is, all effects) with which we are basically concerned.
3. Since the function of the curriculum is to achieve "desired learnings," the purpose of curriculum planning is to identify the learnings desired and find ways and means of attaining them.

Logically, curriculum development can be analyzed as that of a problem solving situation. This is not unfamiliar to those involved in a study of technology since most of our technological inventions have developed from some type of problem or concern. This is not an easy undertaking, for in the words of Hilda Taba (1962, p. 10), "Scientific curriculum development needs to draw upon analysis of society and culture, studies of the learner and the learning process, and analyses of the nature of knowledge in order to determine the purposes of the school and the nature of its curriculum."

It is suggested here that the search for solutions should progress in two steps.

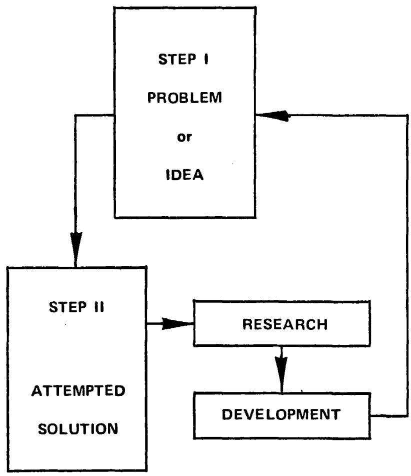
STEP I.
RECOGNIZE THE PROBLEM

How can educational strategies be designed that will lead to the most beneficial "learning developments" for all children?

STEP II.
DEVELOP AN APPROACH TO A SOLUTION

The involvement suggested in the remainder of the chapter is aimed toward developing a curriculum structure. The developmental process will proceed in two phases:

CURRICULUM DEVELOPMENT



RESEARCH AND DEVELOPMENT

Phase One, RESEARCH, will include extensive planning involving analysis, experimentation and evaluation.

During Phase Two, DEVELOPMENT, (which will include on-site research) implementation of diverse investigations, organizations, involvements in a variety of experiences, and comprehensive evaluation should occur.

BASIC ELEMENTS for CURRICULUM DEVELOPMENT

The following flow chart is vital to any curriculum development venture. Because industrial arts at the elementary level is our major thrust, many of the examples cited in the narrative have this emphasis. These are provided only as examples and are not suggested as absolutes.

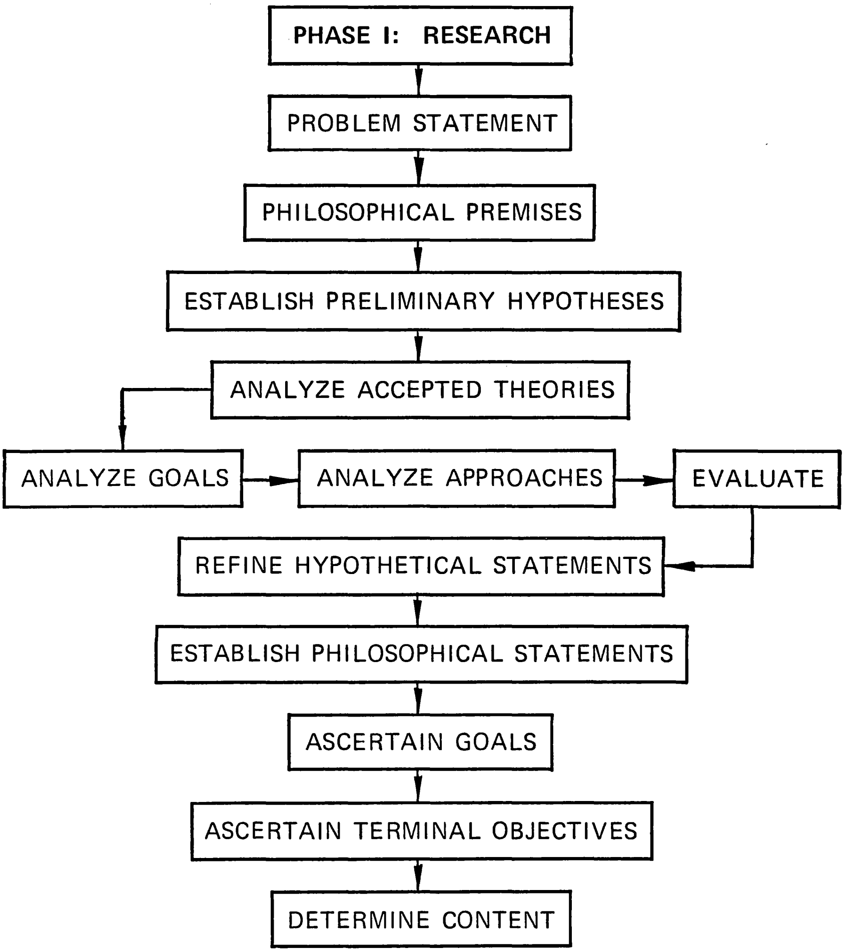


Fig. 2. Flow Chart of Curriculum Development

PHASE I: RESEARCH

Research is a process whereby man can use his intellectual skills for his own well being. It has played a significant role in all of man's attempts to solve problems. Man contemplates that educational research will lead to increasingly improved opportunities for developing the learning potentials of contemporary youth. To this end he continually strives.

Statement of the Problem

Curriculum revisions are varied and innumerable. They may be teacher/student and/or community initiated. They may be created by new textbook adoptions or new school organizations or changes in the administrative staff. Contemporary books, such as Toffler's *Future Shock* (1970) or Silberman's *Crisis in the Classroom* (1970), may shed new light on serious educational considerations. Environmental changes and new technological thrusts may create the need for changes. Whatever the source of conflict between what does exist in curriculum and what someone believes could be developed for learning improvements, when the need has been created, the problem begins to take form.

It is best to make a firm statement of the problem. This indicates recognition, develops a commitment for change, and establishes a base for the beginning of a new curriculum.

Philosophical Premises and Hypothesis

Any individual or group of individuals undertaking the task of developing a curriculum, because of experience, have various philosophical beliefs and ideas about directions and emphasis on who, what, where, when, and how learning should happen.

Philosophical premises should be stated as beliefs which will produce certain kinds of activities to develop the product wanted—the successful, happy child. (Many curriculum developers choose to call these premises assumptions.) The hypothesis in relationship to the philosophical belief will provide a basis for further investigation and study for a scientific approach toward a solution. These statements of belief and unproved theories will provide a foundation for explorations and considerations.

The philosophical premises presented here as examples are considered by the author to be essential for all curriculum development in a contemporary, technological society. As stated, these premises emphasize the significance of providing for understanding of man, society, environment, and technology.

Philosophical Premise I: Needs

Every individual is unique unto himself. His physical appearance and mental capabilities are his alone. He has his own growth "pattern." However, all individuals experience similar *developmental stages* and similar *needs and desires* as they progress throughout life.

Every society is unique because of the individuals within its structure. However, every society has similar needs in its existence.

Hypothesis. No matter who the individual is or what society he is a part of, there are *needs* fundamental to existence and *desires* necessary for psychological, physical, and social well being.

Philosophical Premise II: Skills

Living is not an isolated experience. Rather it is an integrated congolmerate of experiences involving the individual in creative, problem solving, interacting, decision making opportunities. Involvement may be psychological, social, and/or physical.

Hypothesis. A curriculum designed to provide for development of skills for living will include interrelated experiences that are an essential part of life.

Philosophical Premise III: Environment

Individual man, society, the environment, and technology are interlocking considerations for present and future development of one of our greatest natural resources, the human.

Hypothesis. Study of the environment and the interactions within is essential if individuals are to be prepared to live successfully as contributing parts of the societal system.

Philosophical Premise IV: Education

Education is essential for the individual and for the society. (This is not limited to "formal" education.)

Hypothesis. Education is the means for meeting the needs of thinking, reasoning individuals who understand, appreciate, and participate in their society.

Philosophical Premise V: Humanism

Humanism is essential to the individual and to the society.

Hypothesis. In all societies educators have the opportunity and responsibility to develop regard for mankind in individuals.

Analyze Accepted Theories

A curriculum design identifies the elements of the curriculum, states the interrelationships, and indicates the principles of organization and the requirements for administering the operation. This design needs to be supported by an explicit curriculum theory which defines the problems and elaborates on the systems of concepts (Taba, 1962).

Taba (1962, p. 79) believes that "All theories of learning rest on a concept of man and behavior." The nature of the individual, nature of learning, goals of the culture, and the role of the individual in the culture must be considered. However, different views on important factors create both philosophical and psychological conflicts when analyzing and accepting curriculum theories.

Even in the area of industrial arts there are conflicts of emphasis. What is more important, product or process, content or method? Should industry and/or technology be studied? Does the learner need a general education or vocational education? What is the relationship between industrial arts, career and vocational education?

Given here are examples of two theories in practice, one an experimental project on Open Education, the other an experimental project on Learning Systems for the Future.

Open Education

Experimental Project

(Information taken from Vito Perrone's work, "Open Education: Promise and Problem.")

Emphasis:

—Explore the more integrative qualities of knowledge, skills, appreciations and understanding.

—Stress personalization of educational process.

—Skills taught in a learning context which stimulates imagination and thought.

—Communication is important.

—Children should be able to initiate activities, be self-directed and be able to take responsibility for their own learning.

Minnesota Experimental City

Living Learning System

(Information taken from Ron Barns' work, "Learning Systems for the Future."

Emphasis:

—Learner is the center of an active process.

—Dedicated to understanding change.

—Based on continuous life-long approach to learning.

—Education means to individualize.

—Ends: self-discovery and the realization of one's potentialities.

—Emphasize decision-making processes.

—Recognize uniqueness of the individual.

—Use human approach.

—The system is at all times accountable to the learner.

- —Children should exhibit intense involvement in learning and this intensity should arise out of the pupil's wonder, imagination, and curiosity leading ultimately to concern and commitment.
- —Open Education philosophy is based on writings of Jacques Rousseau, Leo Tolstoy, Johann Pestalozzi, Maria Montessori, Frederick Froebel and John Dewey, as well as contemporary works of Jean Piaget, Jerome Bruner, John Holt, Joseph Featherstone, Herb Kohl, George Dennison and James Herndon.
- —Decentralized classroom character.
- —Learning areas—diverse learning environments.
- —Freedom for independent work.
- —Planning sessions—involve teacher/students.
- —Balanced teacher/student direction.
- —Teacher and students are learners.
- —Outside environment becomes a learning center.
- —Communication is the base for reading.

Goals of Open Classroom are:

- —Critical thinking.
- —Independence in learning.
- —Trust.
- —Ability to face new problems with confidence.
- —Commitment to reading.
- —Positive attitudes about learning.

- —System designed to use educational technology and all possible sources throughout the community and world.
- —Stress interaction of the entire living environment.
- —Stress student evaluating himself as a person and as a learner.
- —Learning is a responsibility.
- —Goal to have student become a self-reliant learner.
- —Involvement for both teachers and students in unlearning/relearning, disorienting/reorienting experiences.
- —Use all types of resources.
- —Essential components to learning processes are people, tools, equipment, and facilities.
- —Key to system is access to information.
- —Many technological means used.
- —Use community people as resources and advisors to students.
- —Entire community is the classroom.
- —Experiences happen in various centers.
  - —Beginning life centers.
  - —Stimulous centers.
  - —Gaming centers.
  - —Project centers.
  - —Learner's bank.
  - —Interaction centers.

The booklet, "Curriculum Planning and Development," *Review of Educational Research,* presents a review of the literature for a three-year period. Hilda Taba (1962, Chapters two-six) offers insight into various other theories.

There are also various theories on teaching methodologies. A brief description contrasting two, expository and discovery teaching, is submitted as an example.

EXPOSITORY TEACHING

PROPONENTS

Ausubel	(1963)
Carrol	(1964)
Glaser	(1966)

BELIEFS

Teacher—Presenter of Ideas and Information

Organizer of Knowledge

Student—Gains clearer more precise and explicit abstract understanding qualitatively superior in terms of generality, Ausubel (1963).

STRESS EFFICIENT USE OF TIME

GOALS

Student will possess an organized body of information in a particular area.

DISCOVERY TEACHING

PROPONENTS

Bruner	(1961)
Worthen	(1968)
Cronbach	(1965)
Gagne	(1965)

Similar Philosophies

Taba (1960)

Strategy Teaching

Suchman (1960)

Inquiry Training

DEFINITION

DeCecco (1968) Discovery Teaching involves situations in which the student achieves the instructional objective with limited or no guidance from the teacher.

BELIEFS

Bruner (1961) Major Advantages

1. Increases intellectual potency.
2. Increases intrinsic motivation.
3. Teaches the student the heuristics of discovery.
4. Results in better retention of what is learned.

Students are active in otherwise passive educational environment.

GOALS

Student will understand how to learn.

The value of analyzing various theories is the broadening effect they can have on the investigators as they critically evaluate findings. This is a significant phase of research because it can shed new light on the "possibilities" for curriculum improvement.

Analyze Goals

Goals are of primary importance in designing a curriculum. They provide the curriculum developer with a framework for categorizing significant behaviors of learning. This structure provides a point of reference from which strategies may be designed for the most comprehensive educational experiences. The learned behaviors can then be assessed.

A goal is something broader, longer-range and more visionary than an objective (Bloom, et al., 1971, p. 21). Kappel's (1960, p. 38 as stated in Bloom, et. al., 1971, p. 21) definition of a goal is . . .

> something to strive for, to move toward, or to become. It is an aim or purpose so stated that it excites the imagination and gives people something they want to work for, something they don't yet know how to do, something they can be proud of when they achieve it.

Educators have long advocated that the schools are designed to help the child develop to his fullest potential and become a productive, responsible citizen in his society. Reaves and Good (1968, p. 4) state that the development of the individual to the limit of his capacity for complete living in our society is the major purpose of education.

Hilda Taba stresses that in curriculum development we must consider the nature of humans, the nature of the learning process, and the nature of the environment, the nature of society. According to Taba:

> The school is created by a society for the purpose of reproducing in the learner the knowledge, attitudes, values, and techniques that have cultural relevancy or currency. (1962, p. 17)
>
> All decisions about education, including those about curriculum, are made within the context of a society. (1962, p. 25)
>
> If the society and the culture are changing, then it is the task of schools to play a constructive role in that change. (1962, p. 25)

Gardner Murphy (1952) suggests that if human potentialities are to be realized, the directions in which human needs may be guided as well as the individual's learning power and the potential directions of cultural evolution must be studied.

All educators will agree that the schools should be designed to provide experiences so that the student will be able to satisfy his needs and desires and those of the society of which he should be an important participant. What are these basic needs and desires?

Wilhelms (1972, p. 22) states that all of us need to be able to live competently and comfortably in our technological world, read with understanding, get the feel of the scientific approach to problem solving, and contribute to sensible policy decisions involving science and technology.

Reaves and Good (1968, p. 21) believe "the life needs of children in our society determine what should be taught and the nature of children determine method."

An old Chinese Proverb says, "By nature all men are alike, but by education widely different." Hilda Taba says, "Every man is in certain respects (a) like all other men, (b) like some other men, (c) like no other men." Certainly it cannot be denied that every individual has a unique design for growth. Individuals have different learning styles and differ in their approach to learning both in rate and content. Educational experiences that provide for intellectual, physical, social, and creative growth, therefore, must be planned for and by "the individual." There must be "real" appreciation and understanding of the uniqueness of each individual if learning that allows children to develop at their own pace in the crucial early years of school is to be accomplished.

How can educators even begin to consider the variabilities? Why not commence by analyzing the similarities, allowing that the freedom for individualizing will come at the time when each child will be involved with the educator in directing his own interests into constructive behaviors? Let's consider that although children do differ mentally, physically, emotionally, socially, and culturally, they all have similar needs and motivations and learn in about the same way. There are common stages of development (See Chapter II) through which all children pass, although at different rates. The magnitude of a child's needs and desires depends on environmental influences that result from both external and internal interactions.

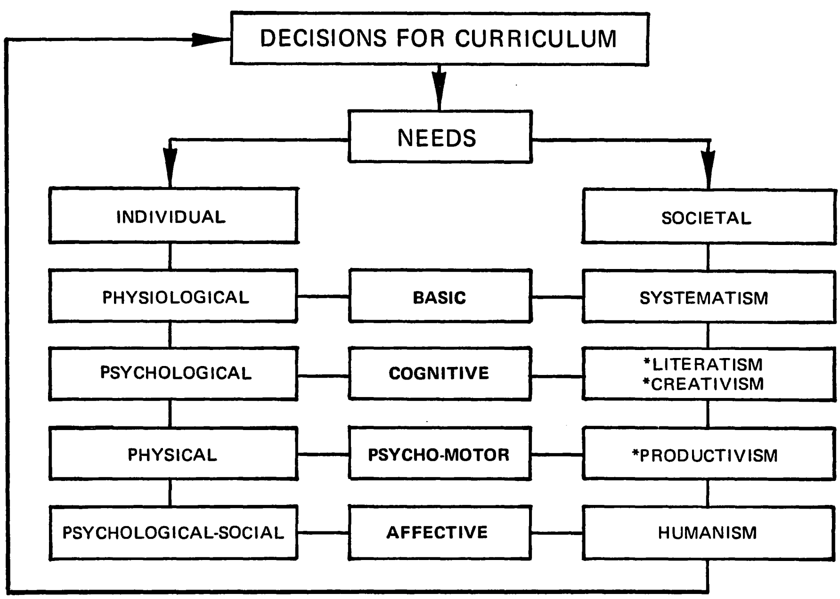
Williard C. Olson in *Curricular Concerns in a Revolutionary Era,* (1971, p. 36) states:

> It remains true, whether for biological, cultural or statistical reasons, that children viewed as wholes are more alike than when a single attribute is considered. Education should provide for the core of relative similarity as well as for the enormous variability in specific aspects.

Societies, created by men, differ but also have similarities. Ina Corinne Brown in the chapter "What is Valued in Different Cultures?" in *Curricular Concerns in a Revolutionary Era,* (1971, p. 277,) emphasizes;

> All human beings have the same fundamental needs and all societies must to some degree meet the needs of their members. We can even say that all human groups have essentially the same problems to meet and basically the same resources with which to meet them.

The needs and desires of the individual and his society should be carefully considered when beginning curriculum planning and determining goals. An analysis of likes and differences will aid in planning educational strategies. Once these have been determined educators must decide what their responsibilities are and how a curriculum can be developed. To assist in the decisions, an attempt has been made herein to present a concise illustration of common individual and societal needs "basic" to decision making for curriculum development.



*Literatism, state of being literate.
*Creativism, state of being creative.
*Productivism, state of being productive.

Fig. 3. Needs Common to Individuals and Societies

ANALYSIS OF NEEDS FOR CONSIDERATION IN CURRICULUM DEVELOPMENT

INDIVIDUAL	SOCIETAL
BASIC NEEDS	
PHYSIOLOGICAL **ABILITY TO ADAPT** **FOOD** **CLOTHING** **SHELTER** **SAFETY** **SECURITY** **SEX** REPRODUCTION	SOCIAL **(ORGANIZATIONAL SYSTEMS)** **GOALS** **POWERS** LEADERSHIP POLITICAL ECONOMIC SOCIAL CONTROLS SECURITY SURVIVAL **INTERACTION** COMMUNITY PRODUCER-CONSUMER COMMUNICATION TRANSPORTATION **RESOURCES**
COGNITIVE NEEDS	
PSYCHOLOGICAL **SKILLS** KNOWLEDGE UNDERSTANDING SELF EXPRESSION DECISION MAKING ORGANIZE INFORMATION PROBLEM SOLVING CRITICALLY, CREATIVELY, ANALYTICALLY ADJUST TO CHANGE	PERSONAL/SOCIAL **LITERATE MEMBERS** KNOWLEDGE UNDERSTANDING CREATIVE IDEAS MAKE DECISIONS CREATE EVALUATE ADJUST TO CHANGE
PSYCHO-MOTOR NEEDS	
PHYSICAL **INVOLVEMENT** COORDINATION ACTIVITY CONTROL	PHYSICAL/SOCIAL **CONTRIBUTING MEMBERS** SKILLED WORKERS PRODUCTIVE CONSTRUCTIVE
AFFECTIVE NEEDS	
PSYCHOLOGICAL/SOCIAL **AFFILIATION** LOVE SECURITY ACCEPTANCE **ACHIEVEMENT** SUCCESS SELF AWARENESS SELF REALIZATION SELF SATISFACTION SELF ACTUALIZATION SELF RELIANCE	SOCIAL **VALUE ORIENTED INDIVIDUALS** **SERVICE:** **CONTRIBUTING MEMBERS** ECONOMICALLY POLITICALLY SOCIALLY **QUALITIES** COOPERATIVE RESPONSIBLE TOLERANT **INTERACTIONS** FREEDOM CONFORMITY COMPROMISE DIVERGENCY LOVE FOR MAN'S CONTINUUM

The lists of needs provided are designed to relate prevalent requirements necessary for the satisfactory existence of all individuals and all societies. They are suggested as a "take off" point for launching curricular plans. It must be remembered, however, that although these needs and desires are common to all, the feelings, attitudes, maturity, cognitive, and psycho-motor development of "individuals" should be a focal point for planning for the most effective learning. Changes of any nature must always be a concern, and the degree and variability of the needs and desires of each individual as he interacts to create himself and his society must be carefully analyzed as all learning experiences are planned.

The child grows as a whole being with his social, emotional, intellectual, physical, and moral growth closely interwoven and interrelated. Educators must be concerned with the development of each of the facets of the whole child. They must realize that learning is a continuous process in which a child builds an awareness of himself and his environment. Children's thinking is characterized differently at various stages of development. In the early stages, they learn mainly from the testimony of the senses and not so much through words. The majority of primary school children cannot merely be told what they should know. A learner has to organize material into his own behavior, which is a constant process of assimilating and accommodating.

Many in the past have felt that schools were where learning took place and intellectual development was of the greatest concern. Educators today, while continuing to stress intellectual development, also realize that adequately preparing children to cope with, adjust to and make changes on their environment requires other skills and feelings. They realize that real learning will provide the child skills not only to endure his every changing environment but to determine direction and control of his experiences within this environment. They realize, too, that learning may happen in public and/or private institutions, industries, businesses, services, or even informally in recreational activities, or family and community participation.

Scholarship will remain significant of course. Reaves and Good (1968, p. 5) state that "scholarship is important in a democracy because the quality of man's thinking depends upon the range, the validity, and clarity of his ideas; and his character depends largely upon the nature and strength of his ideals." We must be ever aware, however, that all experiences have in some degree a preferential or valuing element. Feelings are very important, often more important than knowing. Planned experiences should provide for all categories of behavior; knowing, feeling and doing.

Unquestionably underlying value judgments color the determination of curriculum goals. Decisions are not made easily nor should they be where the lives of children are concerned. What influence can educators have? What beliefs and desires are preferable? Who makes these decisions? What needs can education satisfy?

Perhaps a most important consideration in goal analysis should be derived from the words of Wilhelms (1972, p. 41):

> What we need is education which uses organized content, drawn from high in the culture, but uses it always in the making of a human being. Toward that fulfillment the great essentials are readiness for a fine lifetime career, effectiveness as a citizen, and above all, enrichment of the inner self to its full potential.

If our goal is to successfully prepare all individuals for their present and future lives, what type of curriculum is needed? What goals are evident? What will be the role of elementary industrial arts?

Beginning with some type of skeletal structure and continuing to search in all directions to fill the voids, a curriculum will begin to take shape. As the initial goals are analyzed there should also be an on-going evaluation of the philosophical premises, hypotheses and various educational theories so that future decisions may be efficiently and effectively made.

Analyze Approaches

> School is the one institution that touches the lives of all Americans during their formative years and is therefore the agency looked to for the realization of most of our deepest aspirations and the relief of our deepest anxieties. (E. J. Shoben, Jr. In Huebner's *A Reassessment of the Curriculum,* 1964, p. 61.)

Several considerations influence decisions made in planning the curriculum for the schools. Content, method and organizational schema for implementation of learning experiences must be analyzed. The heterogeneous character of the intellectual, creative, environmental resources that are a part of the society must be regarded as of major significance.

Controversy over curriculum must be dealt with. Decisions must be made to answer questions. What is most important; project or method? Should the curriculum be child-centered, subject-centered, community-centered or society-centered? What regard should be given social processes or life functions? Should the design be correlated studies, unified studies, broad fields, or core curriculum? Will the curriculum be one of activity or experience? Will the instruction be departmentalized or team taught? Will the approach be group or individualized?

Educators in their search for direction have devised many systems of organization for learning experiences. Experiments in cooperative teaching, team teaching, living/learning systems, dual-progress planning, core curriculum, continual progress curriculum and non-graded schools have been on-going for the past decade. Let us consider for example some of the thinking of our great educational philosophers:

> Rousseau asserted that education is living.
>
> Pestalozzi believed in the child's capacity to learn for himself through living "according to nature."
>
> Froebel aimed to "stir up, to animate and to strengthen the pleasure and power of the human being to labor uninterruptedly at his own education."
>
> John Dewey believed that learning results from doing and, therefore, to preserve the unity of the child's experience, the project method of learning should precede studying separate subjects.
>
> Maria Montessori emphasized the importance of the environment and the necessity for children to learn through their senses.
>
> William Kilpatrick advocated project method and the use of an organizing principle based on the internal needs of the learner.
>
> William Bagley crusaded for essentialism in education.
>
> Piaget implies that the nature of the child's experience at each level of thinking is the determining factor both in the timing of transition to the next level and in the quality of thinking at that level.

Organizational emphasis may be placed on the environment, as in the open classroom. Those in favor of this organization imply that an environment in which the possibility for exploration and learning of the self and the world are unobstructed is vital. The best way to help a child utilize his capabilities is to create a climate in which there is both support and motivation for him to do so. They support a spatial openness of schools. Changes occur when needs arise. Children are free to move about. Time is open. Curriculum is open. People are open. These advocates believe that when children are involved in a responsive environment, initiative is promoted into a sense of responsibility and self-discipline. Children do need to feel independent at an early age in order to grow into healthy, independent adults.

There are educators who feel that the child's own motivation should be the focal point of his learning; that this will provide the most effective, efficient, and relevant growth. Elizabeth Hunt has done considerable research using this approach.

Programs for inquiry, involvement and independent study make these assumptions:

The learner ultimately must organize his own learning in his own way.

Problems and personal interests rather than "subjects" are a most realistic structure by which to organize learning experiences.

Students are capable of directly and authentically participating in the intellectual and social life of their community.

Programs utilizing this approach may include independent study projects, community based offerings, teacher offered courses, seminars, topics and others.

Content emphasis may involve an interdisciplinary approach when industrial arts is considered an "interlocking" discipline; perhaps even a "core" for curriculum development. In the words of Paul DeVore in *Industrial Arts in Senior High School,* (1973, p. 208):

> Technology can be a powerful tool for man if he is educated in the use of the language and tools. There is a direct relationship between man's tools and the satisfaction of man's needs, from the most basic physiological needs to the attainment of self-actualization.

Various approaches have been used to reach similar goals. In elementary industrial arts programs a variety of approaches are utilized to implement philosophies. In New Jersey we have Technology For Children (T4C) Episodes; in Bertie County, Analysis of Textbooks; Florida's Project Loom; Career Education; Pennsylvania's Centennial Elementary Schools; Experience Centers; and in A Technological Exploratorium, K-6, Technology is the Curriculum Core. These, of course, are only a few of the many programs currently in operation in the United States.

One will read that the purpose of A Technological Exploratorium, K-6, is the enrichment of the elementary curriculum through the interdisciplinary involvement of students and teachers on a variety of experiences. The total involvement of all these educational variables is essential for developing understanding of man and his technologies and how they shape the environment. The utilization of materials and tools, and involvement in processes, projects, environment research, creative and critical planning, thinking, organizing, acting and evaluating are vital elements in technological explorations that give new dimensions for learning both in and out of school.

The purpose of Project Loom, Florida State University:

1. Development of learner-oriented occupational materials that meet the needs of today's youth in a rapidly changing technological age.
2. Identification of a relevant rationale and content structure to guide the development of instructional models, including program facilities and teacher competencies.
3. Development of a sequential foundation structure for a K-6 program and a 6-8 or 7-9 program as part of the comprehensive vocational curriculum K-14.
4. Development of teaching techniques and methods to provide a relevant awareness to the world of work for elementary and middle grade students.
5. Design potential pilot programs which may be implemented with a minimum of cost and training.
6. Establishment of a state-wide system of curriculum development and experimentation centers, in selected counties representing various types of schools (i.e., and develop a cadre of teachers in these centers who will become local authorities on Project LOOM materials.)

According to the staff of the Technology for Children Program, the curriculum has both academic and technical aspects. They believe that through this curriculum, children see the world of work as it really is—society serving society by satisfying man's needs and wants. Early in their schooling they come to recognize the importance of individual jobs to the whole. While exploring and increasing their interests and aptitudes they develop a meaningful understanding of the real reason for studying and learning.

The Technology for Children curriculum is developmental. In the early stages of activities, when tools and materials are being learned to be used safely and intelligently, the emphasis is on the technical aspect of the curriculum. Later, when the children have some confidence with these things, the emphasis is on the needs and interests of the individual pupil. He then begins to research his interest or need, to relate it to others, and to develop some expertise therewith.

Modern textbooks are filled with references to technology, references which are only touched upon by most elementary teachers. The Bertie County Project staff carefully analyzed their textbooks and developed their curriculum in correlation with the existing studies. They stress that technology is a most important segment of life and living and should be brought out in all learning situations. Industrial arts offers an avenue through which our evolving technological culture can be related to all aspects of a child's world of living. It contributes to the learning process by introducing children, at an early age, to technical concepts of design, instrumentation, tools, materials, processes and products by allowing each child to deal with these concepts as applied to daily life situations.

The Industrial Art Centers in the Centennial Elementary Schools provide children with "a richness of experience." They are considered laboratories where students are given an opportunity to explore and experiment with the technological and aesthetic aspects of their experiences in the classroom. Children come to the Centers as individuals, small groups, or occasionally as an entire class. The approach taken in this project presently is not based on teaching a predetermined body of knowledge that children are expected to master. The children come into the I.A. Center by appointment and spontaneously (since there are no scheduled classes) to work on problems that are meaningful to them and are related to activities in their regular classroom.

These are only a few examples of existing programs of course. Information provided in other chapters will guide the curious in further investigating the similarities and differences of various strategies employed in the curricular structures for elementary industrial arts programs.

In final analysis, however, no matter what approach is used, an elementary industrial arts curriculum can provide experiences for a child's total development as he progresses through various stages.

Experiences may provide opportunities for INTERACTIONS. These interactions may be child to child, child to teacher or child to materials. Lines of *communications* are easily opened because interest is at a peak and cooperation is often essential. Interactions are usually positive. Recognition of new skills frequently results.

Experiences may provide opportunities for DEVELOPMENT OF UNDERSTANDINGS. By direct research, experimentation, exploration, and manipulation of tools, including books, magazines and other printed materials, resources, including people, and processes, children can better comprehend their total environment which includes technology, businesses, industries, services and education. Appreciations for efforts and contributions of others logically result.

Problem solving skills and expression of creativity become a part of a realistic study. The child has the opportunity not only to study the work of others but to study and "get to know" himself.

Conceptual understandings can be developed through first-hand contact not with isolated facts but with interlocking abstract and concrete useful information. Learning becomes more effective as the child utilizes concepts to develop his own generalizations.

Learning occurs when a child is totally involved in his own exploration and discovery. It is an active, rather than a passive, process. Children learn from experience, from exploration, and from active participation in discovery, with time for reflection and practice.

Experiences develop SELF MOTIVATION. Interest is apparent. Motivation is both intrinsic and extrinsic. Tangible projects provide for feelings of success and satisfaction. One success leads to others. A chain reaction begins. Positive feelings encourage the child to strive for other skills. When a child drives himself and determines his own higher goals he begins to individualize his own instruction and a maximum learning opportunity can evolve. Self expectation becomes an important aspect of motivation. Learning becomes child-directed. The teacher serves as a guide in this educational situation. The potentialities of the child to learn can begin to become actualities.

Experiences provide SATISFACTION OF NEEDS. An elementary industrial arts program has the potential to help children satisfy many of their needs. These have been mentioned previously and will not be elaborated upon at this point other than to reiterate that the feelings and attitudes that are possible are often immeasurable.

Experiences have UNEXPECTED RESULTS. Unlimited opportunities for involvement, interactions, and experiences reap undetermined results. Often these can only be evaluated subjectively through observations or conversations. Positive behavioral changes often surprise all who are involved in the learning process.

Evaluation

This is the point of examination. The purpose of this initial period of evaluation is to critically review current literature and existing curricular programs to make decisions that will lead to the refinement of hypothetical statements which will become the basis for philosophical statements, goals and terminal objectives. The decisions made from this research will provide the foundation for the implementation stages. This examination of experiences, experiments, investigations, and observations, should result in an internal/external validation of the structures of existing curricular theories and practices.

Is there empirical data to support the curriculum in question? Is it reality based? Answering these questions and determining whether philosophical premises "make sense" sequentially and in scope will establish an internal validity. External validity can be derived from a collection and examination of data that supports the claims of the theories and practices under investigation.

If curriculum development is to be rational and scientific, decisions about the various elements need to be made on the basis of valid criteria. Formulation and application of criteria for the selection and organization of the curriculum becomes a device for making decisions.

Criteria should be established both for selection and organization of the curriculum content and for the selections of learning experiences. At this point of development, however, curriculum content should be the point of concentration.

Categories for analysis should be established. Criterion, generated from research, should then be developed within these categories. Philosophy, goals, objectives, content (subcategories: knowledge, skills, scope, sequence) are examples of possible groups.

In the ASCD publication, *Curricular Concerns in a Revolutionary Era* (1971), Harvey Goldman suggests in his chapter "The Nature of Curricular Relevance" that the conceptual framework of a relevant curricula should be based upon these five criteria:

1. There should be active rather than passive experiences.
2. Experiences that deal with values must be considered.
3. Familiar experiences of interest to children should be included.
4. Experiences should guide children's learning into new areas of concern.
5. Important conceptual understandings should be gained through relevant curriculum experiences.

Saylor and Alexander (1960, pp. 14, 15) provide this checklist for appraising a school curriculum.

1. Does the curriculum promote continuity of experience? (pp. 19-21)
2. Does the curriculum provide for all educational goals? (pp. 21-25)
3. Does the curriculum maintain balance among all goals? (pp. 25-29)
4. Does the curriculum emerge in learning situations? (pp. 29-31)
5. Does the curriculum use effective learning experiences and needed resources? (pp. 31-33)

These questions are elaborated upon in subsequent narrative.

The following are examples of criteria for evaluating curriculum content. The structure used provides a tool for recording decisions.

Program objectives and purposes are clarified enough to serve as a basis for planning learning experiences.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Key concepts, generalizations and themes have been identified.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

The content included in the curriculum provides basic conceptual structures for planning future learning experiences that will develop student ability to adapt to a rapidly changing environment.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Content is organized logically around a cohesive set of ideas that can be used to generate continuing learning.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

The curriculum develops the knowledge and perspective commensurate with the environment in which the learners live.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

The curriculum is designed to strengthen the learner's capacity to transfer knowledge to new situations.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

The curriculum encourages creative problem solving approaches allowing the learner to gain methods of discovery and inventiveness.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Levels of content are appropriate for student levels of understanding.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

The order of methods for learning experiences flows in a proper cumulative progression.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

There is evidence of both breadth and depth within the curriculum content.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Taba (1962, p. 364) states:

To translate the criteria for effective learning experiences into an actual program, it is important, first, to visualize what students need to do or experience in order to acquire certain behavioral competencies and what the order of these experiences should be.

Examples of criteria for evaluating learning experiences are:

Experiences are provided that will aid the student's problem solving ability used in everyday life.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Experiences involving interaction of students, teachers and resources allow opportunities for divergent outcomes.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Experiences are effective, practical and integrated for the most beneficial learning.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Learning experiences include opportunities for growth in the cognitive, psychomotor and affective domains.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Learning experiences are designed to provide for individual needs and interests.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

Curriculum Development Theory and Practice, written by Hilda Taba, is an excellent reference for further clarification, ideas and suggestions. Dr. Taba devotes several pages of text to evaluation for curriculum development.

The evaluation phase is important for decision making and, therefore, should not be overlooked or treated lightly but rather should be given utmost consideration as a significant segment of research for curriculum development.

Refine Hypothetical Statements and Establish Philosophical Statements

The solid foundation for any construction is vital. This always involves careful and select planning and developing. A sound base for educational experiences is crucial. This base, the philosophy, is the foundation upon which the total curriculum will be developed. It is the basis for decision making for implementation of experiences. The refinement of hypothetical statements should precede the final philosophical statements.

This can be one of the most difficult undertakings in curriculum development. Often educators will "haggle" about semantics. Different points of view are brought to bear and communication and compromise may become increasingly difficult throughout the process. Wording may be changed several times before being accepted by the group.

All is not in vain, however, because once the philosophical basis is established the goals, objectives, experiences and evaluations can be derived from this point of reference. The reward for this endeavor is well worth the initial struggle.

The National Conference on Elementary School Industrial Arts began their work by establishing this definition of elementary school industrial arts:

> Industrial Arts at the elementary school level is an essential part of the education of every child. It deals with ways in which man thinks about and applies scientific theory and principles to change his physical environment to meet his aesthetic and utilitarian needs. It provides opportunities for developing concepts through concrete experiences which include manipulation of materials, tools and processes, and other methods of discovery. It includes knowledge about technology and its processes, personal development of psychomotor skills, and attitudes and understandings of how technology influences society. (Hoots, 1971, p. 3)

This group then established philosophical bases for an elementary industrial arts curriculum. For further information contact the President of ACESIA and request the booklet, "Industrial Arts in the Elementary School: Education for a Changing Society." This work is concise but comprehensive and will prove to be a good reference source.

"A Technological Exploratorium, K-6" Summit County Schools, Akron, Ohio, based its philosophy on the significance of technology in the American society. This is the philosophy which has been the basis for a three-year curriculum development and research project.

> In a technological society the acceleration of change challenges traditional education. What is relevant today may become obsolete tomorrow. Therefore, to enable the individual to assume a meaningful role in such a society he must not only study his environment, but the "catalyst" of its evolution—man and his technology.
>
> Contrary to the argument that technology is dehumanizing, it is of human creation. Man must first understand himself before he can thoroughly understand his endeavors, and through the study of his endeavors he can better understand his purpose in life. Through the power of his imagination man has the potential to willfully direct his technology to insure life's continuum!
>
> The challenge of contemporary education is to realize and develop avenues the individual can use to explore and comprehend the forces that permeate his environment. Elementary students involved in a study of technology can experience "real" possibilities and opportunities to realize and interpret the environment as it is, so that they will be better prepared to shape their environment as it could be.

Mary Margaret Scobey in her book *Teaching Children About Technology* elaborates on several definitions of industrial arts. On pages 5-7 statements from such authors as Robert J. Babcock, Frederick Bonser, Carl Gerbracht, Harold Gilbert, Lois Coffey Mossman, Delmar Olson, Frank E. Robinson and Gordon O. Wilber are given.

These references certainly will provide a background for considerations. Coupling these with knowledge and background of the curriculum group involved should prove to provide reciprocity in establishing the beginning of a workable, quality elementary industrial arts curriculum.

Ascertain Goals and Terminal Objectives

"The goal of education is not teaching but the facilitating of learning." (Carl Rogers)

This is a most significant phase of curriculum development and will "set the stage" for implementation of learning experiences within the curricular structure. Goals and terminal objectives are designed to guide learning "over a period of time." Goals are usually stated in general terms to provide the teacher direction but also allow the freedom to plan for varying individual student needs and desires. The following are examples of goals.

All students will be able to deal with ever-changing life situations to their greatest capability because concrete and abstract experiences will be taxonomically designed for developing thinking, comprehending, and reasoning skills in an academically-technologically oriented "school within life" environment. ("A Technological Exploratorium, K-6.")

The Pennsylvania State Board of Education adopted these goals in 1965:

I. Self Understanding
II. Understanding Others
III. Basic Skills
IV. Interest in School and Learning
V. Good Citizenship
VI. Good Health Habits
VII. Creativity
VIII. Vocational Development
IX. Understanding Human Accomplishments
X. Preparation for a Changing World

A Quality Education Program Study then reviewed, defined, and through narrative form added clarity to the ten goals. Each goal was related to a middle school industrial arts curriculum but may also be applied to the elementary level since each major heading is essential for productive human development and the narrative is written in general terms. Dr. George E. Raab, who is Executive Director, Bucks County Public Schools, guided this work. The following is the excellent elaboration of these ten goals as presented on pp. 11-13 of the pamphlet "Middle School Curriculum Study."

GOAL #1: *SELF UNDERSTANDING*

Industrial arts provides concrete tangible experiences which enable each student, independently, and as a group member to explore, discover, and develop his interests, values, intellect, and motor skills. The student, in attaining his degree of success through these experiences develops a realistic understanding and attitude of his own self-actualization process. This will enable him to choose a way of life rewarding to himself and society.

GOAL #2: *UNDERSTANDING OTHERS*

Industrial arts activities will expose the student to different social, cultural, and ethnic groups. Through inter-action, students help each other to attain a mutually acceptable goal. This action-oriented setting will enable him to adjust, accept, and understand his peers and develop a better appreciation of other's problems.

GOAL #3: *BASIC SKILLS*

Industrial arts (content and experiences) enable each student to acquire and use the basic skills to read, listen, communicate verbally and visually, to manipulate math concepts and make logical decisions.

GOAL #4: *INTEREST IN SCHOOL AND LEARNING*

Industiral arts provides each student with opportunities to utilize his interests and abilities while solving problems. These opportunities will help each student to acquire positive attitudes towards school and the learning process.

GOAL #5: *GOOD CITIZENSHIP*

Activities in the industrial arts afford students the opportunity to become effective leaders or responsible followers. A student working within a group, a team, or as an individual will perceive his rights and responsibilities by developing positive attitudes towards human, technological, and natural resources within his society.

GOAL #6: *GOOD HEALTH HABITS*

The student is made aware of and is afforded the opportunity to experience realistic safety procedures. The student becomes aware of the potential hazards that exist in the environment and the possible results of negative behavior.

GOAL #7: *CREATIVITY*

Industrial arts experiences encourage and provide opportunities for creativity. Given freedom of expression, the student can experiment, explore, and carry out ideas with a variety of tools, materials, and processes.

GOAL #8: *VOCATIONAL DEVELOPMENT*

Industrial arts affords the opportunity(ies) for each student to develop his self-interests and to experience individual success. Understanding the opportunity (ies) available to him in preparing for a productive life, the student can make independent decisions related to his future education and career.

GOAL #9: *UNDERSTANDING HUMAN ACCOMPLISHMENT*

The student in industrial arts will be made aware of man's interrelationship with the changing world of science and technology through new materials and processes. He will become familiar with the principles of good design, production techniques, and develop a sense of values to critique and appreciate the products of nature and society.

GOAL #10: *PREPARATION FOR A CHANGING WORLD*

Society continues to change with resultant technical, environmental, social, and cultural problems. Industrial arts will develop a student to be a thinking, problem-solving individual capable of adapting to or coping with a changing society.

Statements of objectives or the outcomes desired from educational experiences should serve the following purposes in curriculum planning:

1. Provide a basis for making curriculum decisions.
2. Guide the development of pupil purposes.
3. Establish the criteria for judging the adequacy and appropriateness of the total program of education.
4. Establish the criteria for evaluating pupil growth and development. (Saylor and Alexander, 1960, p. 240).

The following is an example of a terminal objective.

STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF MAN, MATERIALS AND TECHNOLOGY.

Given any activity related to the technological unit being studied, students will be able to relate the significance of the technology studied to man and work and materials in written and oral communication and through the development of a demonstration and/or experimental project. Criteria for acceptable performance and determining significant educational growth will be developed by cooperative teachers' and students' efforts.

Philosophy, goals and objectives are essential to assist the teacher in the selection and decision making processes in planning learning experiences. Once these have been established they should be carefully and critically analyzed so that the dimensions of possibilities can be realized, and when necessary, changes and/or additions may be made. The book, *Handbook on Formative and Summative Evaluation of Student Learning* (Bloom et. al., 1971) offers a wealth of information and is recommended as an excellent reference for future work.

Determine the Content

Disciplines come into being because knowledge has certain inherent growth structures or dynamic generative possibilities. The National Committee of the NEA Project on Instruction (1963) emphasized that the key to the instructional task is the structure of a discipline. The Committee defined structure as "the body of concepts that limit the subject matter and control research about it."

The roots of the discipline technology are the concepts that guide man's search for understanding of himself as he relates to and interacts with his environment. Therefore, the base for a study of industrial arts at any level should be focused upon concepts related to individual man, society, environment and technology. The structure for this study should be organized by specialists in the field and should act as a guide for the individual educator as he plans various learning experiences.

PHASE II: DEVELOPMENT IMPLEMENTATION STAGE

Having completed the research phase, the *framework* for curriculum planning has been established. This provides the structure for the most important consideration, the implementation of learning experiences in the developmental phase of curriculum building. Here each individual child, a "real" living, "actual" being, enters the scene and must be a major consideration in planning meaningful learning experiences. Here the curriculum developer must move from the abstract to the concrete if he is to apply his knowledge and plans for constructive development. Here the curriculum becomes *creative, dynamic* and *individually oriented* if it is to be significant.

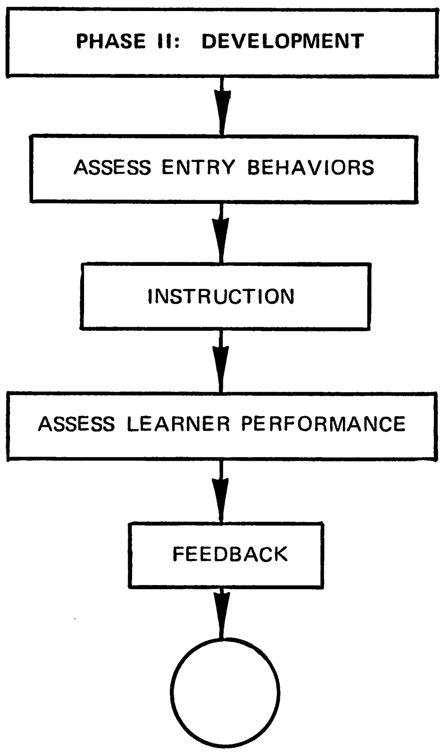
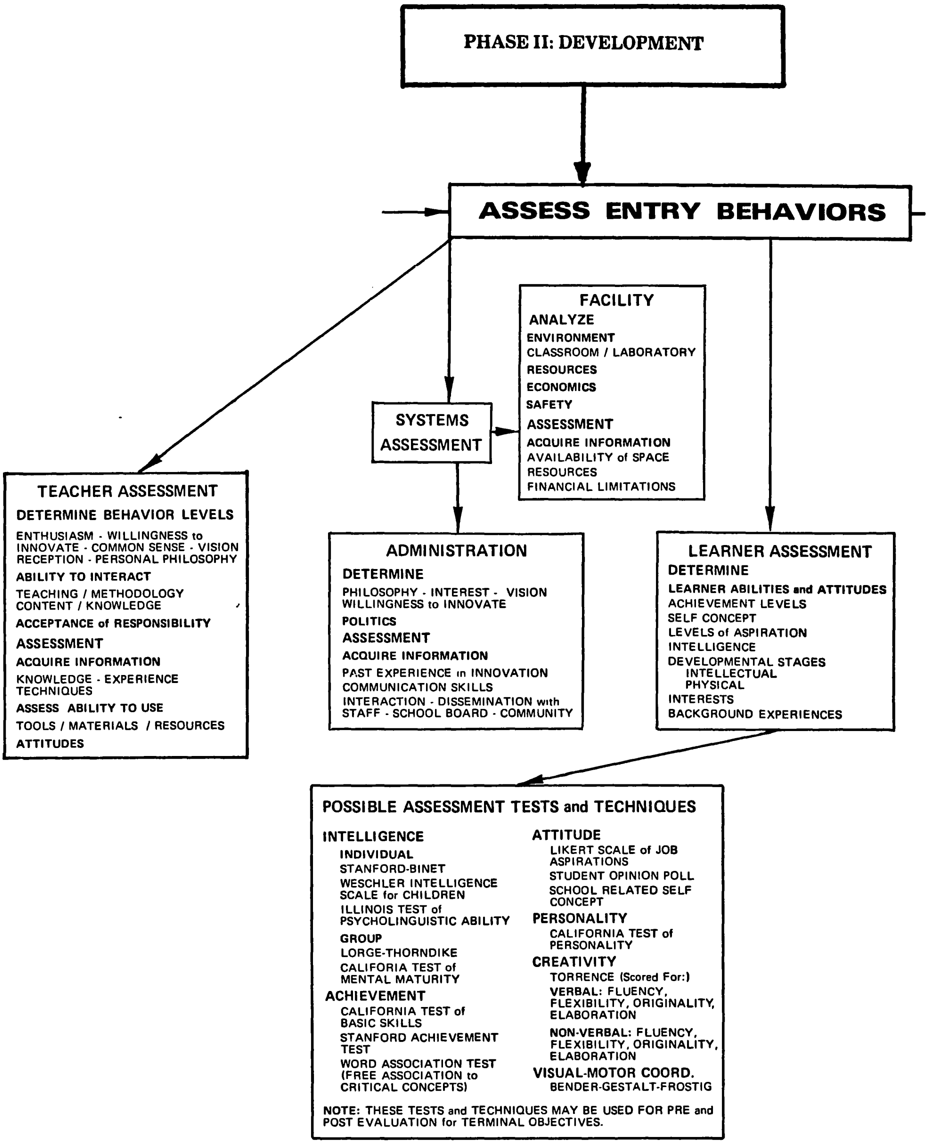


Fig. 4. Basic Elements For Curriculum Development

Many factors must be considered before the actual implementation of any program. This is especially true when planning a study of elementary industrial arts and technology. In-service training of teachers including philosophical, psychological, and physical involvement and environmental organizations for learning are major considerations.



The chart above lists several examples for considerations.

Fig. 5. Assessment of Entry Behaviors.

This is the time, too, to determine, as much as possible, learner aptitude and attitudes. This will help in planning for instruction and will be the pre-consideration for evaluating the effect of the curriculum.

Since considerations to be made at this point are highly individual, according to situation, no further narrative will be provided. An excellent supplementary reference, however, is *Part 2,* "What Major Factors Must Be Considered in Curriculum Planning?" in the book, *Curriculum Planning,* by J. Galen Saylor and William M. Alexander (1960).

Instruction

We have come to the moment of reason. All the efforts exerted to this point will now be incorporated into the instructional program and implemented into classroom experiences. Ideas will be tested and evaluated both objectively and subjectively not only by curriculum developers but by teachers, parents, community, and most importantly by the student.

Curriculum, the plan for learning, is for teachers. It is a scheme, a check list for the makers of human adults to determine if the growing, changing child creature is having the obstacles removed that will allow him freedom as a member of the human race. This freedom encompasses the child's acceptance of his freedom and his skills as an adult in using it.

The child, complex and expelling, has obstacles that are real; honest fear, for example. The obstacles of fear can impair the human capacity to understand his relatedness to other people and his relatedness to the natural forces enveloping him. But fear can be eliminated by developing the child's understanding about his environment, giving the child a system for continual learning. Fear can be eliminated by application of a teacher's merciful care and appreciation of what the child is and can be and by understanding of the processes that are at work with his changing energy systems. Embrace this formula with good human relatedness and a "sense of orderliness," and the power of the child to remove obstacles will be progressively strengthened.

Is it true that man is haphazardly bringing his children to fruitfulness in an age of fantastic human abilities? Is it true as a society we haven't prized our young or the power to procreate and continue the species as we should? Our vociferous cry for a better world seems often to be processed through our manipulative hands instead of our unique ability to reason. The results of our American society as of this day of maturation are jokes to the "possibilities" that exist in the human capacity.

If a quality of life is what we intend to ripen our children to, what is quality in relationship to human life? What contributes to the dignity of persons? Is it possible to give answers that do not deal with interactions and communications?

A curriculum is designed and built out of the experiences and the spirit of people. We need only to perceive it to create it. We have the necessary tools and capabilities. We but need the mutual agreement that we haven't done what needs to be done and we must if human life is to persist.

While some portions of the human society are committed to the survival of the human society, powerful portions seem to be bent on annihilation, not only of human life but of all life. This may be interpreted as a sinister, pessimistic outlook, but there is evidence that man's optimism about human life is yielding to doubt. Man's existing and invented value systems, his education of the new-born generation has not magnified those things contributing to his relatedness to all being nor to the posterity of man. Man, the creator, tool user, manipulator, is yet to become if he is to prosper at being.

In the last chapter of the book *On Being Human,* Ashley Montagu deals with "The Improvement of Human Relations Through Education." As one of the searchers for life's meaning and in support of his beliefs that man lives within principles of cooperative behavior, he concludes that improvement of human relatedness must be accomplished through education.

Children do learn human relations in the act of relating to others, and they do learn about relatedness to all other beings by acts of relating to parts and/or the whole of the environment. Today teachers can have organized exploration into human behavior and people interaction, and they can allow a child organized exploration of the organic and inorganic relationships that exist in the environment.

According to Dr. Montagu and many others, "The teacher is the most important of all public servants." Certainly what service can be more important than molding the mind and channelling the social behaviors of the new generation? Therefore, the teacher, the enactor of the curriculum, who accepts this responsibility as his cooperative effort of participation in life must realize the commitment is no shallow nor easy task. It is most noble, and the self cannot remain small but be in a constant grace of growth in human insight, a loving will, and centered with a relatedness to all other being.

The teacher, this most important being in the educational process, must have an open mind and must ever strive for meanings in what often seems unexplainable. Let us consider for example: Science technology has been accused of destroying philosophical and religious significance of mankind. But within the realm of science technology and its systems of exploration are possible the answers to ultimate secrets and the significance of human life. Not only has man's technology produced effects of antisignificance on the human existence but antibiotic effects on the environment. Yet the application of technology frees man from much of nature's brutality and enhances beauty, tranquilizes and stimulates his hungers, and blinds and enlarges his visions.

In man's growth he has conceived himself as intended potentate of this planet, and he flaunts a perversion that he is essential in the scheme of being. He does not conquer the nature without and within but retains temporary control of factions not the interactions of factions.

Figure 6
Photograph by Daniel Shenk,
Elementary Industrial Arts Consultant, Hudson Public Schools, Ohio

The teacher must ever be sensitive to the realism that man's understanding about his technological development in adapting to and shaping his environment is a most incomplete and dangerous education if his attitudes are not humane and committed to preserving man's destiny. The heterogeneous character of the intellectual and pedagogic resources is a valuable contribution to the child creature, but a common goal of teaching relatedness seems necessary.

Any substantive subject is related to people because people perceive it. A persistent pursuit by teachers to enable pupils to understand themselves in relation to the subject being taught, to the society, and to the environment is the extra effort every teacher can make no matter what faction of the whole is being taught, or what obstacles are being removed that will allow the new adult freedom, the acceptance of this freedom, and the skill in using it.

What greater challenge is there than working to help prepare a human, a most precious resource, for life?

Planning for Instruction

The time has come to accept individual differences in children as a reality and to work with them without trying to blame them on anyone or to feel guilty that they exist. Resistance to easy modifiability is man's insurance of stability, and the possibility of change his hope for the future. Individual differences among people are a precious asset. A constructive program to meet them promises large returns. (Williard C. Olson in *Curricular Concerns in a Revolutionary Era,* 1971, p. 37)

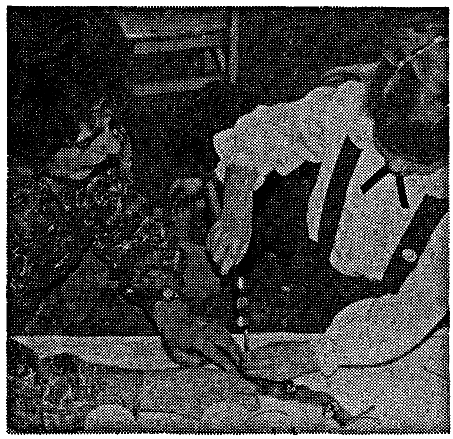


Figure 7
Photography by Daniel Shenk,
Elementary Industrial Arts Consultant, Hudson Public Schools, Ohio

At this point the basics of the curriculum have been established. Now the crucial test begins. The subject of what to teach and how to teach must be carefully analyzed and constantly reviewed.

In planning instruction there is much to deliberate. Individualizing instruction, developing creativity, providing for divergent thinking and inductive approaches to the development of generalizations, logically structuring units, developing the use of concepts to analyze issues, developing the use of comparative and inquiry methods, using multi-media approaches and the role of intrinsic motivation are some of the considerations. Planning for instruction, even after the curriculum framework has been established, is no easy undertaking.

Educators have the responsibility to equip children with knowledge and skills so that they can determine their course of action. In his chapter, "What is Worth Knowing," Edgar Dale (1972) relates knowledge which enhances or is worthy as that which:

1. Provides for a sense of individual and social identity.
2. Develops a sense of mutuality of human beings, a sense of community.
3. Enables a person to live close to his higher limits of physical, mental, and emotional powers.
4. Generates knowledge allowing one to rework and reconstruct what is already known.
5. Develops independence in learning.
6. Enables one to see wholeness of life; i.e., organize, conceptualize, synthesize, pattern.
7. Enables one to critically analyze; to see the difference between fact and opinion, evidence and propaganda, logic and illogical.
8. Develops communicative abilities.
9. Develops the joy of discovery, heightens awareness and sensitivity to surroundings and experiences, allows sharper focus and enables compassion.
10. Enables persons and societies to know when it hurts, what to do to eliminate the pain and cure it, the cause, the effects and the ability to foresee consequences.
11. Enables recognition of the knowledge that is most worth knowing.

Educators have the responsibility to help children see the relevance of the intellectual resources of the culture for their own lives as productive workers, as citizens, and as individuals.

Educators have the responsibility to help the child develop humanitarian ways, for if man is responsible for discoveries, he must have a compatible value system to be able to use technological discoveries for constructive rather than destructive purposes.

Educators have the responsibility to help students expand their horizons to see a bigger picture, to realize, interpret and interact with the environment and the forces of technology within the environment.

Educators have the responsibility to help students develop an open mind, to view with a questioning mind, to realize the value of questioning and the value of learning from past knowledge as well as present experiences.

Changing the curriculum, changing instruction, involves changing individuals. There are instructional problems such as choice and organization of experiences. There are questions to be answered. What activities should be experienced? What content should be included? What are the objectives and what method will be used to most satisfactorily achieve them? What skills will be gained? How, when, where will the experiences be developed? Who will do the planning? Who will make the decisions? These are only a few of the questions confronting educators. What role should children play in planning their experiences? Now that they are actively involved in the process, what is their responsibility? What do children feel they need? Since the place of action now is the classroom, the children must be a major consideration.

An interesting survey was made in a second and a sixth grade class. The following lists were given to each child in each class.

.... food	.... security	.... work
.... clothing	.... success	.... play
.... shelter	.... friends	.... family
.... love	.... safety	

The students were instructed to look at each list of words. They were told to mark a 1 beside the item they felt was most needed, a 2 beside the next most needed item, a 3 beside the next most needed item, and a 4 beside the next most needed item.

The following are the frequency results of the total survey. The items are circled to emphasize the contrast in feelings at the two levels.

FREQUENCY of CHOICES for CHILDREN in GRADE 2

CONCEPTS	CHOICES 1	2	3	4
FOOD	(11)	9	4	1
CLOTHING	3	5	14	3
SHELTER	4	7	7	7
LOVE	7	4	0	(14)

FREQUENCY of CHOICES for CHILDREN in GRADE 6

CONCEPTS	CHOICES 1	2	3	4
FOOD	7	(16)	1	0
CLOTHING	1	0	11	12
SHELTER	3	1	11	9
LOVE	(*13)	7	1	3

CONCEPTS	CHOICES 1	2	3	4
SECURITY	4	7	10	4
SUCCESS	1	6	8	10
FRIENDS	3	7	6	9
SAFETY	17	5	1	2

CONCEPTS	CHOICES 1	2	3	4
SECURITY	5	4	3	12
SUCCESS	1	9	8	6
FRIENDS	12	2	8	2
SAFETY	5	10	4	5

CONCEPTS	CHOICES 1	2	3
WORK	3	17	5
PLAY	3	2	20
FAMILY	19	6	0

CONCEPTS	CHOICES 1	2	3
WORK	1	16	7
PLAY	1	7	16
FAMILY	22	2	1

The results proved very interesting. Admittedly this was certainly a small sampling and perhaps allowing the students to create their own list of needs would have reaped different results. It is significant to note, however, the similarities in answers of students within the grade level and the differences in answers of students from grade 2 to grade 6. Certainly more of this type of investigation should be attempted and results analyzed for curriculum studies.

Shouldn't we consider too, that most of the children felt that work was needed more than play? Educators should be ever aware that although children love to play they also feel the need for work. *Children do feel the need to be actively productive.*

What do children value? Let us consider these thoughts from fourth grade students at McDowell Elementary School in Hudson, Ohio.

MY VALUES . . .

I value the food that gives me strength to work and play,
I value my home in which I live,
I value this country, the United States, and the world I live in,
I value my rights, but most of all I value the people.

Carol Brisbin

WHAT DO WE VALUE?

What do we value?
We value a lot of things.
We value our natural resources.
And we value man-made resources.
I value my family and my home.
And I value my friends.
And I value love most of all.

James Piascik

SOME THINGS I NEED IN LIFE

Some things I need are food, water, and shelter so I can live. I need a wife so my children can grow into men. I need technology so I can use things, so I can make them. I need machines so I can plant things and grow things. I need cars or busses, airplanes, and boats to go places. I need tools to fix things and make things. I need money to buy things, so I can support my family. And for money I need to work.

Ted

These values and needs expressed by children with one decade of human experience are quite valid for aiding the establishment of philosophical premises and hypotheses. The children who can think like this should be encouraged to be active members of the input team for curriculum planning.

Figure 8
Photograph by Daniel Shenk,
Elementary Industrial Arts Consultant, Hudson Public Schools, Ohio

There are continual challenges such as that presented by Rubin (1969, p. 24):

> We must find a way to make use of the larger classroom, life itself. We must find a way to develop the child's natural capacity to teach himself within his entire environment—by exercising his ability to analyze, reason, and understand.

Once the teacher frees himself and his students from restrictions he creates the possibility for new and different situations using any variety of resources available. He can help the child:

> . . . to see the past in terms of what might have happened, to see the future in terms of alternative possibility: I know of nothing more important, in the study not only of history but of other social disciplines as well. There is nothing more important than to accustom our own minds and the minds of our students to thinking in terms of possibility. (Max Lerner as cited in Huebner, 1964, p. 71)

Once a child feels freedom, with assurance, his imagination and body can be set free to explore and create. The excitement begins!

CURRICULUM CONTENT: CONCEPTS AND GENERALIZATIONS

> "Factual information is too vast, is increasing at too great a rate, is too much subject to obsolescence, and is too difficult to retain even if it were useful. Research has shown that about 80% of disconnected facts are forgotten in two years or so."
>
> Taba (1962, p. 212)

A strategy of education must be designed to overcome this. A conceptual approach seems to be the answer. According to Taba (1962) each discipline has its own fund of acquired information and a specialized strategy for acquiring that knowledge. She suggests that learning content should be organized around central ideas or "recurrent themes" that run through the entire curriculum.

Brandwein (1969) emphasizes that all disciplines have identifiable concepts that can be applied to a study of man's behavior. These concepts allow for an ordering in the curriculum that will enhance learning. He believes that a conceptual structure reduces random encounters with experiences and he suggests that there is presently data that supports that conceptually ordered curriculum can:

1. Reduce as well as strengthen random encounters with experiences.
2. Stimulate children to effective reality investigations.
3. Coordinate teacher/student communication because concepts can become instructional tools.
4. Stabilize the curriculum because although the environment and events change, concepts remain much the same.
5. Help the child understand his environment because concepts remain relatively stable.

Let us consider technology, as a discipline. Because of its nature, it is most certainly interrelated with all other disciplines. Integration of material from many disciplines should be encouraged. It not only exposes students to comparative methods that can lead to divergent thinking but creates the necessity for using different levels and types of logic and abstraction. The child can gain skills in analyzing and applying knowledge in diversified ways. Surely a study of technology offers the educator the opportunity to correlate disciplines for a broad study of man and his environment.

The elements of technological concepts and generalizations form a complex pattern of relationships which provides a structure for study. The concepts for this study can be organized in statement form and ordered into a scope and sequence curricular framework.

	TECHNOLOGY	COMMUNICATION	TRANSPORTATION	POWER
STAGE III	MAN'S COMPREHENSION OF HIS CIVILIZATION THROUGH SYMBOLS AND COMPLEX SYSTEMS ALLOWS HIM TO UNDERSTAND THE BREADTH OF TECHNOLOGICAL ADAPTATION AND SHAPING OF THE ENVIRONMENT.	Man's growing complex technological society demands that he create new means of communication to transmit information further, quicker, and more effectively to broaden comprehension of the environment.	Man's growing complex technological society demands that he create new ways of conveying resources further, quicker, and more efficiently within the expanding environment.	Man's growing complex technological society demands that he find new and more efficient means of utilizing energy.
STAGE II	MAN'S INTERACTION WITH OTHERS ALLOWS HIM TO WORK WITH THEM IN THE BUILDING OF TECHNOLOGICAL MEANS OF SHAPING THE ENVIRONMENT.	Man's interaction with his fellow man creates the need for an efficient means of communicating about the environment.	Man's interaction with others creates the need for an efficient means of conveying resources within the environment.	Man's interaction with others demands he harness energy to work for change upon the environment.
STAGE I	MAN'S UNIQUENESS ENABLES HIM TO UNDERSTAND AND SHAPE HIS ENVIRONMENT THROUGH TECHNOLOGY.	Man's unique sensory system enables him to communicate with his fellow man about his environment.	Man's unique nature enables him to move himself and his resources from place to place within the environment.	Man's unique nature enables him to harness energy and make it work for him in the environment.
	TECHNOLOGY IS A MANIFESTATION OF MAN'S INTELLECT AS DEVELOPED BY HIS ADAPTATION TO, AND SHAPING OF HIS ENVIRONMENT.	**COMMUNICATION** IS THE MEANS OF CONVEYING INFORMATION NECESSARY FOR ADAPTING TO AND SHAPING THE ENVIRONMENT.	**TRANSPORTATION** IS THE MEANS OF CONVEYING RESOURCES WITHIN THE ENVIRONMENT.	**POWER** IS THE RATE AT WHICH ENERGY IS USED BY MAN TO PERFORM WORK TO SHAPE HIS ENVIRONMENT.

These statements enable educators to deal with different levels of experiences and understandings. They allow for the designing of learning situations that focus on conceptual understandings.

The study of technology can be structured with concepts and generalizations constructed from the building blocks of fact. The concepts can then be used as tools by which meaning is lent to sets of facts. By using the concepts to analyze social situations, conclusions, and thus generalizations, may be derived. These generalizations may then be further combined to produce more inclusive generalizations about human behavior (Orlandi as cited in Bloom, et al. 1971).

In way of an example, the work done by the staff of the project "A Technological Exploratorium, K-6" ordered the conceptual

<table>
<tr><td colspan="2">Man's growing complex technological society demands that he create new means of manufacturing and producing commodities more quickly and efficiently to adapt to a rapidly expanding environment.</td><td>Man's growing complex society creates new needs for service expertise to handle the unique demands evolving from a technological environment.</td><td>Man's expanding technological society provides increasing leisure time for him to find means of self fulfillment and enjoyment of the environment.</td></tr>
<tr><td colspan="2">Man's interaction with his fellow man demands a means of producing commodities necessary for adaptation to the environment.</td><td>Man's interaction with his fellow man to achieve expanded mastery over the environment creates the need to distribute individual efforts.</td><td>Man's interaction with his fellow man allows him collective means of enjoying the environment.</td></tr>
<tr><td colspan="2">Man's unique mental capabilities and physical structure enables him to create tools for more effective adaptation and shaping of the environment.</td><td>Man's unique nature enables him to employ others in his adaptation to the environment.</td><td>Man's unique nature enables him to provide the time to play with his environment for his own enjoyment.</td></tr>
<tr><td>MANUFACTURING IS THE SYSTEMATIC PROCESS FOR PRODUCING COMPONENTS AND COMMODITIES NECESSARY FOR ADAPTING TO AND ACTING UPON THE ENVIRONMENT.</td><td>CONSTRUCTION IS THE BUILDING AND MANIPULATION OF COMPONENT PARTS TO BETTER ADAPT TO THE ENVIRONMENT.</td><td>SERVICE IS A FUNCTION PERFORMED BY INDIVIDUALS TO HELP OTHERS IN THE ADAPTATION TO AND SHAPING OF THE ENVIRONMENT.</td><td>RECREATION IS MAN'S UTILIZATION OF HIS LEISURE TIME FOR SELF-FULFILLMENT AND THE ENJOYMENT OF HIS ENVIRONMENT.</td></tr>
<tr><td>MANUFACTURING</td><td>CONSTRUCTION</td><td>SERVICE</td><td>RECREATION</td></tr>
</table>

strategy for their study in this way:

Two main thrusts are represented within the scope and sequence of the conceptual hierachy:

I. The uniqueness of man

II. Man's interactions with his environment

The uniqueness of man is dealt with in the basic areas of: COMMUNICATION, TRANSPORTATION, POWER, MANUFACTURING, CONSTRUCTION, SERVICE and RECREATION. The selection of this scope is based upon its ready applicability to elementary level educational endeavors and due to historical definition of these areas as significant facets in the study of technology (Warner, 1947, Olson, 1963).

Man's interactions with his environment present the sequential development for the technological exploration. The levels of this progression have been divided into three stages of understanding: THE INDIVIDUAL, THE GROUP, and THE SOCIETY. These stages provide a logical sequence which attempts to parallel the native mental development and social awareness of the learner (Piaget, 1952).

The structure on pages 130 and 131 is felt to provide for a simultaneous flow of understanding through both the horizontal and vertical scope and sequence. Refer to it while examining the generalizations which follow.

Some examples of generalizations:

TECHNOLOGY:

Man's resources, values, and attitudes determine the direction of developing and employing his technology.

Intellectual endeavors of civilizations produce interdependent convergent and divergent systems resulting in a technology which affects all phases of life.

Man attempts to alter the form and nature of resources in his environment to meet his needs.

When technological systems are applied, forces of change can occur that set in motion new potential for personal, economical, social, political, cultural and environmental developments that affect the nature of man and his world.

Every culture utilizes a technology.

COMMUNICATION:

Although man's dynamic and unique being permits him to interact with others, with his environment, with various technological devices, and with himself, these same interactions ultimately affect his independent, interdependent, and/or dependent behavior.

MANUFACTURING:	Manufacturing is a systemization of technological processes for the production of mass commodities to meet the needs of a society. Man's involvement with his natural and physical resources determines the kinds of decisions made and materials used in manufacturing.
CONSTRUCTION:	Man's values are evidenced in his construction. Man's creative endeavors with materials requires that he gain understanding of their nature, conditions, and relations so that his interactions can provide for the most potential developments.
TRANSPORTATION:	Men are dependent upon transportation for their existence.
POWER:	All civilizations utilize various forms of power.
SERVICE:	Service systems develop from and perpetuate compromise between the needs of individuals and the needs of their society.
RECREATION:	Man's use of technology has enabled him to alter his environment, make diversified use of materials, use knowledge of natural systems, gain more control over the environment and time, and expand his opportunities in media and involvement for broadened use of leisure.

The following diagrams of conceptual ideas are submitted to initiate alternative thinking that may lead to the development of another basic structure for planning an elementary industrial arts program. It is submitted as an incentive for your questioning. Much analysis still needs to be done. Concept and subconcept statements need to be written. See Figures 9 and 10.

Once this work is begun let the scope of ideas have unlimited dimensions so that new and creative thinking can be implemented at each phase. Consider throughout your analysis that life is a responsibility to self and to others. Interrationships reign high on man's list for being. It is significant as educators to consider not only what man has done to improve situations but to *wonder* what can still be done.

It is essential that concepts and generalizations for a given discipline be recognized and stated as a crucial part of curriculum development. This will serve as a tool for the teacher as she begins to plan experiences for understanding. However, she must be ever aware that each child will and should be encouraged to develop his own

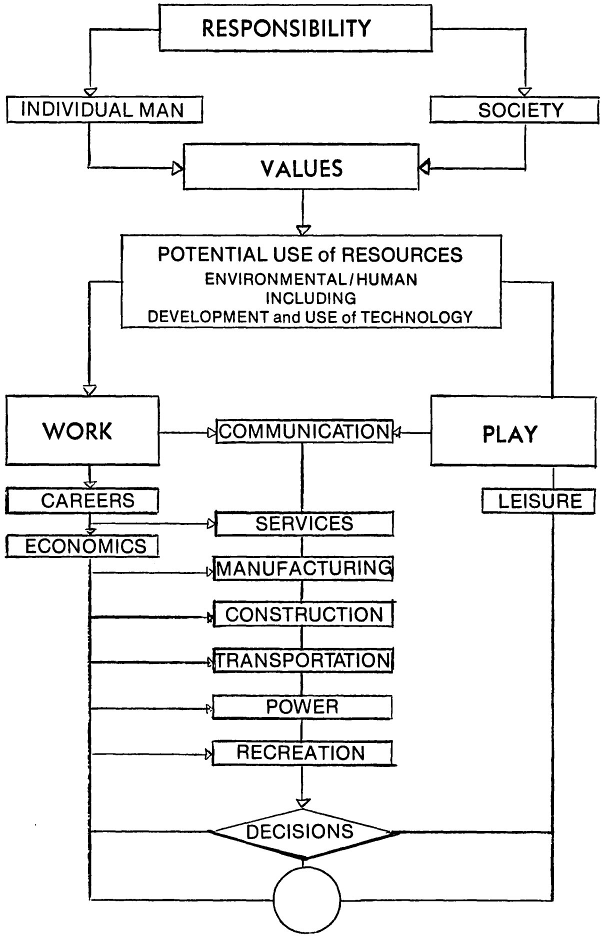


Fig. 9. Conceptualization of Societal Values and Roles

concepts and generalizations. Richard S. Crutchfield reinforces this thought in his chapter "Nurturing the Cognitive Skills of Productive Thinking" in *Life Skills in School and Society, 1969,* p. 55.

> "The problem posed by the intake of a given piece of information is unique to each individual. He must seek to assimilate the new information in his own conceptual world. And since no two individuals possess an identical conceptual world, his solution must be to some degree distinctive and innovative."

The individual will use his skills and the resources available to him to come to his understanding. It is significant, then, that in the study of technology a wide variety of tools, and materials, a

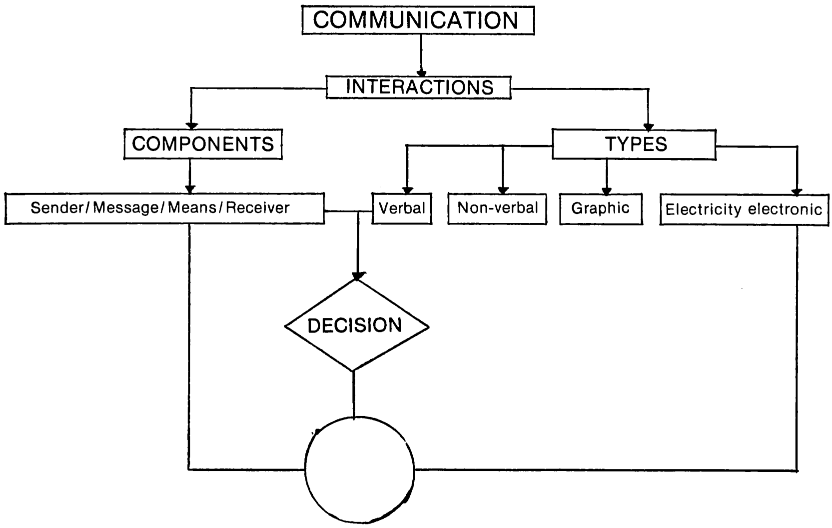


Fig. 10. An Example of a Subconcept Structure

multi-media environment, be provided to encourage creative understanding for each and every child.

Skills for Living

Education, if it is really education should send (youth) forth with some unified sense of the kind of world in which they live, the direction in which it is moving, and the part they have to play in it. The schools should have given them some sort of intellectual and moral key to their contemporary world. . . . . As for methods, the prime need of every person at present is a capacity to think; the power to see problems, to relate facts to them, to use and enjoy ideas.

These statements by John Dewey (1946, p. 90) are unquestionably true but there are so many varying circumstances. To the human, the environment can be a bewildering experience with its bombardment of sensory data, both external and internal. In order to effectively cope with his environment the human must devise means of organizing all the information into "systems for understanding." A prime educational purpose is developing skills. Which are the essential skills for living? Rubin (1969, p. 26) states,

The skills of knowing how to find out, of thinking, of acting independently, and of continually modifying our behavior will be of most worth; and those of recalling information, of adhering to a fixed way of life, and of acting out of conditioned habit will be less important.

Certainly these skills are most important in a society of continual change. Robert M. Hutchins (as cited in Rubin, 1969, p. 26) asserts that,

> The most obvious fact about society is that the more technological it is the more rapidly it will change. It follows that in an advanced technological society futility dogs the footsteps of those who try to prepare the child for any precise set of conditions. Hence the most impractical education is the one that looks most practical, and the one that is most practical in fact is the one that is commonly regarded as remote from reality, one dedicated to the comprehension of theory and principles.

Bruner (1966, p. 34) intensified this purpose,

> We know we are living in an emerging society where the nature and rate of change is unpredictable. The child needs to be able to cope with expectation of change and have the skills needed for social adjustment. . . . . Considering man's evolution, principal emphasis in education should be placed upon skills—skills in handling, seeing, imaging, and in symbolic operations, particularly as these relate to the technologies that have made them so powerful in their human expression.

Sociologist Wilbert Moore (as cited in Rubin, 1969, p. 18) advises,

> Nothing is less practical than a practical education if the result is a trained incapacity for adaptation to change, or continuous learning, and for some degree of creativity. The school will fulfill its function as an agency of developmental change only if it prepares its graduates for a somewhat uncertain world, where no niche is absolutely secure and few niches even hold their shape well.

One of the greatest needs in our technological age is for individuals to develop the ability to solve problems. Systematic thought must be given to methods of inquiry and thinking that will lead to greater understanding. The contributions of a field of study lies in the generation of a structure for forming and answering questions, relating ideas in logical ways and developing and using rational methods of inquiry.

Meade, Jr. (as cited in Rubin, 1969, p. 51) states,

> Five basic skills necessary for a worthwhile life are likely to be of critical importance:
>
> 1. The ability to reason.
> 2. The ability to readjust oneself on one's own terms to cultural flux.
> 3. The ability to control and spend one's time with intelligence and rewarding purpose.
> 4. The ability to achieve and sustain rewarding relationships with others.
> 5. The ability to persevere and extend one's uniqueness while participating harmoniously in the society.

(The structure for emphasis here is this author's.)

Educators should strive to develop the student's ability:

—to manage his emotions.

—to take advantage of his creative potential.

—to cope with difficult problems.

—to spend leisure time wisely.

—to think rationally.
—to know himself.

Educators must find avenues to:
—Create a *desire for learning.*
—Encourage *acceptance of the challenge* of a questioning world.
—*Individualize instruction.*
—*Develop a drive within the student to understand* the environment.
—Develop within the student an *attitude, feeling of concern* for self and for others.
—Develop within the student the realization that *learning is a continuous process.*

Individuals must have skills:
—to know.
—to think.
—to feel.
—to value.
—to act.

Relevancy in education is not only the learning of skills, but also the learning of how to apply these skills. "Real learning" will provide the child skills not only to endure his ever-changing environment but to determine, direct, and control his experiences within this environment.

How can educators determine the skills so essential at various levels of development and organize these into a structure for planning learning experiences? One may assume that the structure of thought is analogous to other structures, beginning with smaller bits and pieces that are combined to create larger units. Cognitive learning begins with the acquired cognitive bits and pieces such as knowledge which includes generating, classifying, conceptualizing, relating and ordering which become the necessary "blocks" for building.

Higher order cognitive skills deal with the acquired building blocks but are also concerned about how the building is being done. Higher level terms like, synthesis, analysis, and evaluation include the process of building as well as the ingredients of building. Using a house as an example, the primary cognitive skills can be viewed as nails, wood, plaster, etc., while the higher order skills can be seen as a wall and the building of the wall.

Thus the higher order cognitive skills fall into two areas. They exist as the result of the application of the acquired skills, but they are also being created or acquired for a larger whole, as is the wall of a building. Therefore, higher level cognitive skills are being acquired and applied both at the same time. The application involves problem solving situations as well as research and development of both abstract and concrete constructions. The development of problem solving skills has been emphasized because these skills allow an individual to make decisions in a logical way.

In all skill areas creativity should be stressed. Torrance (1973, p. 7) states that the creative thinking process involves skills of:

—developing an awareness of problems and gaps in information.
—defining problems and gaps.
—collecting, contrasting and comparing information from previous experiences and accumulated knowledge.
—producing possible solutions.
—developing criteria to evaluate solutions.
—using these criteria to make judgments about solutions.
—determining the best solution.

He adds that all skills require practice and can be enhanced by teaching.

Education for a well-rounded individual must include the realms of affective and psychomotor learning as well as the cognitive. It is evident that there is a strong relationship between the psychomotor skills and the area of cognitive application (Krathwohl, 1964). The necessity of a distinction rests with the development in the psychomotor realm of the basic motor skills of the student, in addition to the application of his cognitive processes.

In the realm of affect, suffice it to say that as long as humans are feeling creatures capable of a gamut of emotions, education will have a responsibility to direct these emotions in areas that society deems healthy and constructive. Here the realm of affect is the development of interpersonal sensitivity and appreciation of the environment and is often measured in such intangibles as a child's spontaneous laughter.

Once a mental structure is acquired for adaptation, it follows that there are various ways of applying the structure. The structure provided herein has been divided into application of two areas; one where the manipulation and application of the environment is a mental nature, and the other where it is a physical or manual application. For the most part, the mental application has been centered on the basic scientific model which is so important in adaptation to today's technological society. The physical application then, being inclusive of various elements of mental structuring, is distinguishable by the act of application upon the environment.

The research for this development was conducted by the staff of the project, "A Technological Exploratorium, K-6." Matrices, organizing the following skills were then designed.

FUNDAMENTAL COGNITIVE SKILLS CLASSIFIED WITHIN SUBJECT AREAS

I=Introduce
D=Develop
R=Refine

LANGUAGE ARTS SKILLS

ACQUISITION of COGNITIVE SKILLS	K	1	2	3	4	5	6
Analyzing Words	I	I	D	D	D	R	R
Spelling Words	I	I	D	D	D	R	R
Defining Words	I	I	D	D	D	R	R
Using Words	I	I	I	D	D	D	R
Comprehending	I	I	I	I	D	D	D
Locating Information	I	I	I	I	D	D	D
Organizing Ideas	I	I	I	I	D	D	D
APPLICATION of COGNITIVE SKILLS	**K**	**1**	**2**	**3**	**4**	**5**	**6**
Expressing in Written Form	I	I	I	I	D	D	D
Expressing in Oral Presentations	I	I	I	I	D	D	D
Expressing Oneself Creatively	I	I	I	D	D	D	D

SOCIAL STUDIES SKILLS

ACQUISITION of COGNITIVE SKILLS	K	1	2	3	4	5	6
Listening	I	D	D	D	D	R	R
Observing	I	I	D	D	D	R	R
Communicating	I	I	D	D	D	D	R
Ordering	I	I	D	D	D	D	R
Classifying	I	I	I	D	D	D	D
Translating	I	I	I	D	D	D	D
Analyzing		I	I	I	I	D	D
Generalizing		I	I	I	I	D	D
Inferring		I	I	I	I	D	D
Predicting			I	I	I	D	D
APPLICATION of COGNITIVE SKILLS	**K**	**1**	**2**	**3**	**4**	**5**	**6**
Interacting for Decision Making and Problem Solving	I	I	I	I	I	D	D
Relating Relevant Information		I	I	I	I	D	D

MATH SKILLS

ACQUISITION of COGNITIVE SKILLS	K	1	2	3	4	5	6
Number Theory	I	I	I	I	D	D	D
Basic Operations	I	I	I	D	D	D	R
Measurement	I	I	D	D	D	R	R
Geometric Understanding	I	I	I	D	D	D	R
Statistics and Probability			I	I	D	D	D
Functions and Graphs			I	I	D	D	D
Logic	I	I	I	I	D	D	D
APPLICATION of COGNITIVE SKILLS	**K**	**1**	**2**	**3**	**4**	**5**	**6**
Problem Solving	I	I	I	D	D	D	D

SCIENCE SKILLS

ACQUISITION of COGNITIVE SKILLS	K	1	2	3	4	5	6
Observing	I	I	D	D	D	R	R
Classifying	I	I	I	D	D	D	D
Communicating	I	I	D	D	D	D	R
Generalizing		I	I	I	I	D	D
Inferring		I	I	I	I	D	D
Predicting			I	I	I	D	D
APPLICATION of COGNITIVE SKILLS	**K**	**1**	**2**	**3**	**4**	**5**	**6**
Hypothesizing	I	I	I	I	I	D	D
Relating Relevant Data		I	I	I	I	D	D
Operationalizing	I	I	I	I	I	D	D
Experimenting	I	I	I	I	I	D	D
Interpreting Data		I	I	I	I	D	D
Evaluating Results		I	I	I	I	D	D

The interdisciplinary approach characterizing this curriculum allows for the development not only of cognitive skills but also psycho-motor skills and affective states. The classification of the psycho-motor skills and affective states listed on the chart entitled Behavioral Skills Essential for Environmental Adaptation should be incorporated as a necessary and integrated part of the learning experiences involving the fundamental cognitive skills classified within all subject areas.

FUNDAMENTAL SKILLS CLASSIFIED WITHIN FINE ARTS SUBJECT AREA

ACQUISITION of SKILLS	K	1	2	3	4	5	6
Sensory Awareness	I	I	D	D	D	R	R
Psycho-Motor Movements	I	I	D	D	D	D	D
Aesthetic Awareness	I	I	D	D	D	R	R
Generating Ideas	I	I	D	D	D	R	R
Communicating	I	I	D	D	D	D	R
Recognizing Art Forms		I	I	I	D	D	D
Knowledge of: Resources	I	I	I	D	D	D	D
Knowledge of: Processes	I	I	I	I	D	D	D

APPLICATION of SKILLS	K	1	2	3	4	5	6
Expressing Oneself Creatively	I	I	D	D	D	D	D
Appreciating Art as Communication	I	I	I	D	D	D	R

Music **Dance** | **Literature** **Drama** | **Visual** **Arts**

Psycho-motor movement skills and appreciation of the arts as a means of communication are major fundamental considerations for skill development in the area of fine arts. Therefore, these have been included within this structure.

(Heasley as cited in Stamm, 1973, p. 52)

BEHAVIORAL SKILLS ESSENTIAL

	ACQUISITION of COGNITIVE SKILLS						APPLICATION of COGNITIVE SKILLS																	
							MANIPULATION of IDEAS										MANIPULATION WITH IDEAS UPON the ENVIRONMENT							
							HEURISTIC of PROBLEM SOLVING										RESEARCH			DEVELOPMENT				
	KNOWLEDGE*	COMPREHEND	SYNTHESIZE	ANALYZE	EVALUATE		IDEATE/CREATE	RECOGNIZE PROBLEM	HYPOTHESIZE	RELATE RELEVANT INFORMATION	COLLECT DATA	EVALUATE RESULTS	GENERALIZE	INFER	PREDICT		RESEARCH	DESIGN (ABSTRACT)		PLAN (CONCRETE)	PROCURE	CONSERVE	UTILIZE	CONSTRUCT
K	I	I					I	I									I	I		I				I
1	I	I	I	I	I		I	I	I	I	I	I	I	I			I	I		I		I		I
2	I	I	I	I	I		I	I	I	I	I	I	I	I	I		I	I		I		I	I	I
3	D	I	I	I	I		I	I	I	I	I	I	I	I	I		D	I		I	I	I	I	I
4	D	D	I	I	I		D	D	I	I	I	I	I	I	I		D	D		D	D	D	D	D
5	D	D	D	D	D		D	D	D	D	D	D	D	D	D		D	D		D	D	D	D	D
6	D	D	D	D	D		D	D	D	D	D	D	D	D	D		D	D		D	D	D	D	D

*Within the category of knowledge the following processes are developed: classifying, conceptualizing, relating, and ordering. These processes are used in retrieving information necessary to problem solution.

The established structure here, while not infallible, is a combination of several points of view. Because it covers a multitude of possibilities, adaptation will have to be applied to deal with individual needs and problems. It has been developed to provide the curriculum designer and teacher with a breadth of ideas and categories for use in planning instructional procedure. It should contain enough breadth to provide alternatives and enough coherence to give direction and meaning to educational planning.

The basic skills in each fundamental subject area have been analyzed and decisions have been made concerning the level for introduction, development and refinement. In keeping with elementary curriculum in most instances, usual practice has been followed. However, in some cases skills have been introduced at a much younger age. Research has been done and results indicate that some children are ready and capable of learning at these levels.

The thinking of authorities in the field of child development/

FOR ENVIRONMENTAL ADAPTATION

ACQUISITION of PSYCHO-MOTOR SKILLS				APPLICATION of PSYCHO-MOTOR SKILLS				ACQUISITION of AFFECTIVE STATES			APPLICATION of AFFECTIVE STATES			
REFLEXIVE MOVEMENTS	BASIC FUNDAMENTAL MOVEMENTS	PERCEPTUAL ABILITIES		PHYSICAL ABILITIES	SKILL MOVEMENTS	NON-DISCURSIVE COMMUNICATION			RECEIVING AND ATTENDING		RESPONDING	VALUING	ORGANIZATION	CHARACTERIZATION
I	I	I		I	I	I			I		I	I		
I	I	I		I	I	I			I		I	I		
D	D	D		D	D	I			D		I	I	I	
D	D	D		D	D	I			D		D	D	I	
D	D	D		D	D	D			D		D	D	I	
R	R	R		D	D	D			R		D	D	D	I
R	R	R		D	D	D			R		R	D	D	I

I=INTRODUCE D=DEVELOP R=REFINE

educational development has been followed in order to design the matrices entitled "Behavioral Skills Essential for Environmental Adaptation." These are the skills specifically essential not only to a study of technology but to the development of a "thinking" individual.

Was Aristotle correct when he observed that "all men desire by nature to know"? Is it true that children learn best by doing?

Certainly, a captive audience, with an initial desire for learning, and an active means for gaining skills and understanding is ours. The structure herein can be one more tool to help in the quest for a continuing better education for all children.

SCOPE AND SEQUENCE

The rapidity of change requires a broad and flexible scope and sequence of the planned curriculum. These organizations must be designed for both content and method which includes both mental and physical processes. Scope, sequence, continuity, and integration are central problems of curriculum organization.

Since curriculum development requires orderly thinking, both the order in which decisions are made and the way in which they are made must be analyzed to make sure that all relevant considerations are carefully deliberated before decisions are made. Taba (1962) suggests this order might be as follows:

Step 1 Diagnose needs.
2 Formulate objectives.
3 Select content.
4 Organize content.
5 Select learning experiences.
6 Organize learning experiences.
7 Determine what and how to evaluate.

Tyler's syllabus (1950) suggests similar sequential development.

Sequence in curriculum development should be an overall plan, but individual growth rate should be considered in determining learning experiences. A well planned sequence will provide continuity of learning leading toward the formation of ideas and the use of cognitive processes.

The sequence of experiences should be taxonomically ordered considering the complexity and abstractness of ideas and cognitive processes. An analysis of the cognitive processes must be made to determine the increasingly demanding intellectual rigors, such as the range and precision of application of skills and understandings. The scope of the study should include the range of important ideas and concepts and kinds of behavior desired.

The sequential flow of units that are in developmental stages of the Technological Exploratorium, K-6 research are presented here as examples. Other ideas for the scope and sequence of this program were suggested in the conceptual strategy presented earlier.

A WORD ABOUT UNITS of STUDY

Units of study may be developed by the individual teacher or purchased from a publisher. Commercially prepared units of study can guide and supplement a teacher's own skills and sensitivity toward educating children. They may provide multi-sensory experiences and references which will enhance the total development of the learner. These units should be considered a *foundation* upon which the teacher will build rather than the structure in its entirety since each teacher should evaluate, select, and adjust suggested experiences to meet the needs of each individual child in her class. Whether the teacher starts from "scratch" to do her research and development or acquires written aids, careful analysis must be made before plans for classroom experiences reach the point of implementation.

A WORD ABOUT OBJECTIVES

Objectives, to be or not to be ....?
Analyzed, stated, evaluated ....?
By Students ....?
Teachers ....?
Administrators..........................?
Boards of Education ....?
Et cetera?

This quandary has been a part of education ad infinitum. There are those camps that would say objectives are unnecessary, that they inhibit the student's creativity, that they, because of the preconceived notion of experiences, in fact eliminate the opportunity for student participation in an activity that is to be for his benefit. They would ask, "How can others prejudge the interests and needs of each individual child?" These educators would most certainly agree with John Stuart Mills' statement in *On Liberty* (1859, p. 3),

> Human nature is not a machine to be built after a model, and set to do exactly the work prescribed for it, but a tree, which requires to grow and develop itself on all sides, according to the tendency of the inward forces which make it a living thing.

James D. Kaths in his chapter "Teaching Without Specific Objectives" in the book *Curricular Concerns in a Revolutionary Era* (1971), lists these criteria for worthwile activities. It seems that he is suggesting here that while one may teach without specific objectives, a form of evaluation should be an integral part of selection and implementation of all learning experiences.

1. Permit children to *make informed choices* and *to reflect on the consequences of these decisions.*
2. Allow the children opportunities for *active roles in the learning situation.*
3. Encourage children to *inquire about ideas, apply intellectual processes* and *analyze current problems.*
4. *Involve* children with *relia.*
5. Allow for *successful completion of projects* for children of varying abilities.
6. Encourage children to *examine,* in a new environment, *ideas, applications of intellectual processes* or *current problems* that may have been encountered previously.

7. Encourage students to *analyze topics and issues that may be typically ignored.*
8. Encourage children to *take chances although the outcome* (success or failure) *is uncertain.*
9. Encourage children to continue to *strive for improvement.*
10. Encourage the *development, application,* and *mastery* of *meaningful rules, standards* and *disciplines.*
11. Allow the *opportunity for interaction in designing* and *executing plans.*
12. Worthwhile activities are *relevant to student purposes and interests.*

The words have been italicized to emphasize the role that industrial arts experiences could play in each criterion listed.
ment of instructional objectives.

The lists provided herein are quoted from the reference. The underlined words, however, are this author's choice to emphasize the role that industrial arts experiences could play in each criterion listed.

On the other side are those who would contend that educators have the responsibility to change behaviors of students and in so doing provide growth that will develop each into a potentially contributing member of a society. They advocate that because of an educator's experience he is capable of making judgments. Surely, they ask, if we are to adequately evaluate behavioral changes we must know what behaviors existed initially and what changes need

SEQUENCE for UNIT CONTENT
(BASED on MAN SHAPING his ENVIRONMENT through TECHNOLOGY)

DEVELOPMENTAL STAGES	LEVELS	BROAD SUBJECT AREAS
III	6	EFFECTS of TECHNOLOGY on MAN and SOCIETY
	5	EVOLUTION of TECHNOLOGY
II	4	INTERPRETING THE ENVIRONMENT THROUGH TECHNOLOGICAL DEVELOPMENTS
	3	UNDERSTANDING HUMAN INTERACTION THROUGH TECHNOLOGY
	2	TECHNOLOGY and the INDIVIDUAL'S ENVIRONMENT
I	1	TECHNOLOGY and the INDIVIDUAL
	K	INTRODUCTION to TOOLS, MATERIALS, RESEARCH and DEVELOPMENT
	EMR PNH INH	A STUDY OF TECHNOLOGY for CHILDREN WITH LEARNING DISABILITIES

(Heasley, as cited in Stamm, 1973, p. 51) to be made. These educators would concur with Hilda Taba (1962, p. 440) when she says,

> Creative innovations in types of learning experiences do not come about when decisions such as how to develop consistency between the objectives and what is taught or how to translate ideas about learning into curriculum sequences are deferred until *after* the framework is fixed, especially if these decisions are made by teachers under conditions which do not encourage theoretical thinking.

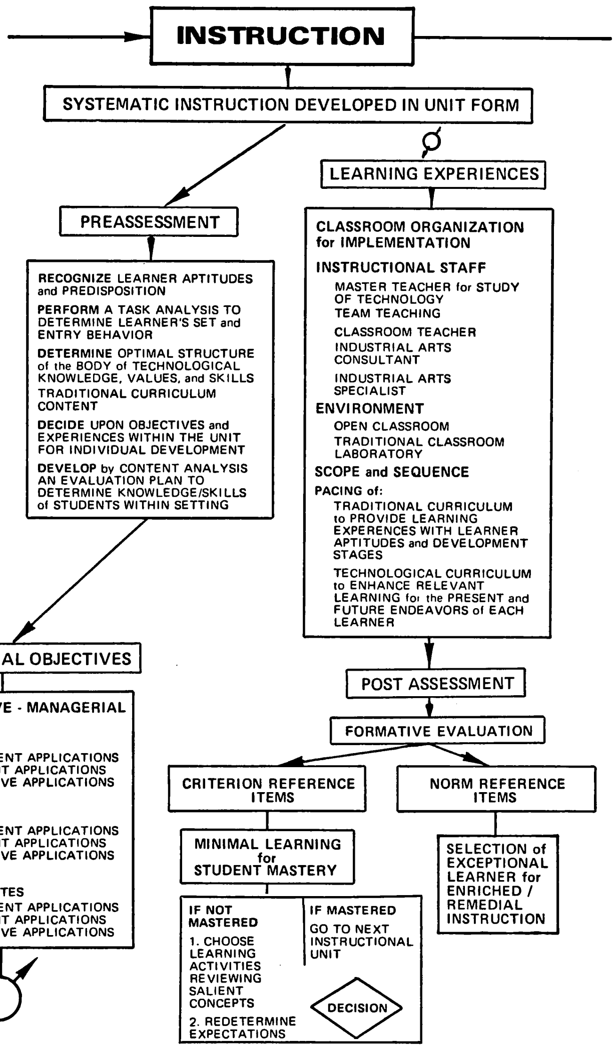


Fig. 11. Development of Instruction.
(Heasley, as cited in Stamm, 1973, pp. 48, 49)

The book, *Handbook on Formative and Summative Evaluation of Student Learning,* written by Benjamin S. Bloom et al. is suggested as an excellent reference for those who are interested in further study. Several well-known authors have contributed to this work. One entire chapter is devoted to the evaluation of learning in industrial education. While this is geared to high school industrial arts and vocational educational experiences, it does offer the reader some insight into thinking on evaluation in these educational areas.

EVALUATION

Evaluation is a tool for management. It involves the collection and interpretation of data for use in making decisions. To be useful it must be relevant to the goals and objectives. Ingredients of an evaluation strategy include:

1. Aims of the Study
2. Research Design
3. Instrumentation
4. Data Analysis
5. Timetable
6. Staff Responsibility
7. Estimated Expenditures

There are several types of evaluation. Some are: formative, summative, baseline, process, product, objective, subjective, individual, group, and et cetera. Needless to say, evaluation should be a continuous and/or cumulative process and an integral part of curriculum development and implementation. The type of evaluation used will be determined by the purpose set forth by those involved. (These may be psychologists, administrators, teachers, students.)

Diagnosis is an essential part of curriculum development. Decisions based on diagnostic research need to be made at varying levels of generality and importance. Diagnosis should and does operate on different levels and may be done either formally or informally. (Taba, 1962, p. 231)

In developing a model for evaluation a primary concern is the determination of methods to examine the criterion of effectiveness of learning. McCandless (1961) distinguishes three methods for evaluation of "learning effectiveness":

1. The student's performance is examined in terms of his own ability.
2. The student's performance is compared with other children in his classroom.
3. The student's performance is compared with national norms.

Therefore, defining evaluation as "grading," and reducing all that is known about a student's progress to one mark, is far too narrow an operationalization.

Shaplin (1961) suggests that evaluation must be concerned with both measurement of progress and measurement of degree to which students meet absolute standards. Measurement of progress requires a pre-test/post-test model of evaluation which can be used to assess individual students over time. This type of evaluation provides a means for determining the next step in learning. The second type of measurement involves student performance compared with an absolute standard. Such measurement requires a distribution of learning performances on which children can be rated relative to one another. The purpose of examining the group is to provide information for curriculum decisions.

Another viewpoint on "evaluation" is presented by Tyler (1951). Tyler places evaluation within the stream of activities whereby education is expedited. There are three basic components to educational progress:

1. Identifying educational objectives.
2. Having sufficient information on students so as to design educational experiences.
3. Evaluating the degree to which students ascertain the objectives.

The evaluation model suggested here is used in the Technological Exploratorium curriculum. It reflects both Tyler's and Shaplin's viewpoint. The model is concerned with:

1. Clarifying objectives both terminal and instructional.
2. Determining entry behavior necessary for attaining objectives.
3. The development of activities which should result in achievement of instructional objectives.
4. Assessment of instructional objectives to determine student progress.
5. Assessment of terminal objectives to determine curriculum revisions and directions.

In this entire process of planning, acting, and evaluating, the learner must be of prime concern. His interests, abilities, objectives and self evaluation should always be stressed. The emphasis has been placed on this focal point in the evaluation structure. However, there are many elements in the educational system that affect decisions in curriculum development. An attempt has been made herein to identify some of the more obvious elements.

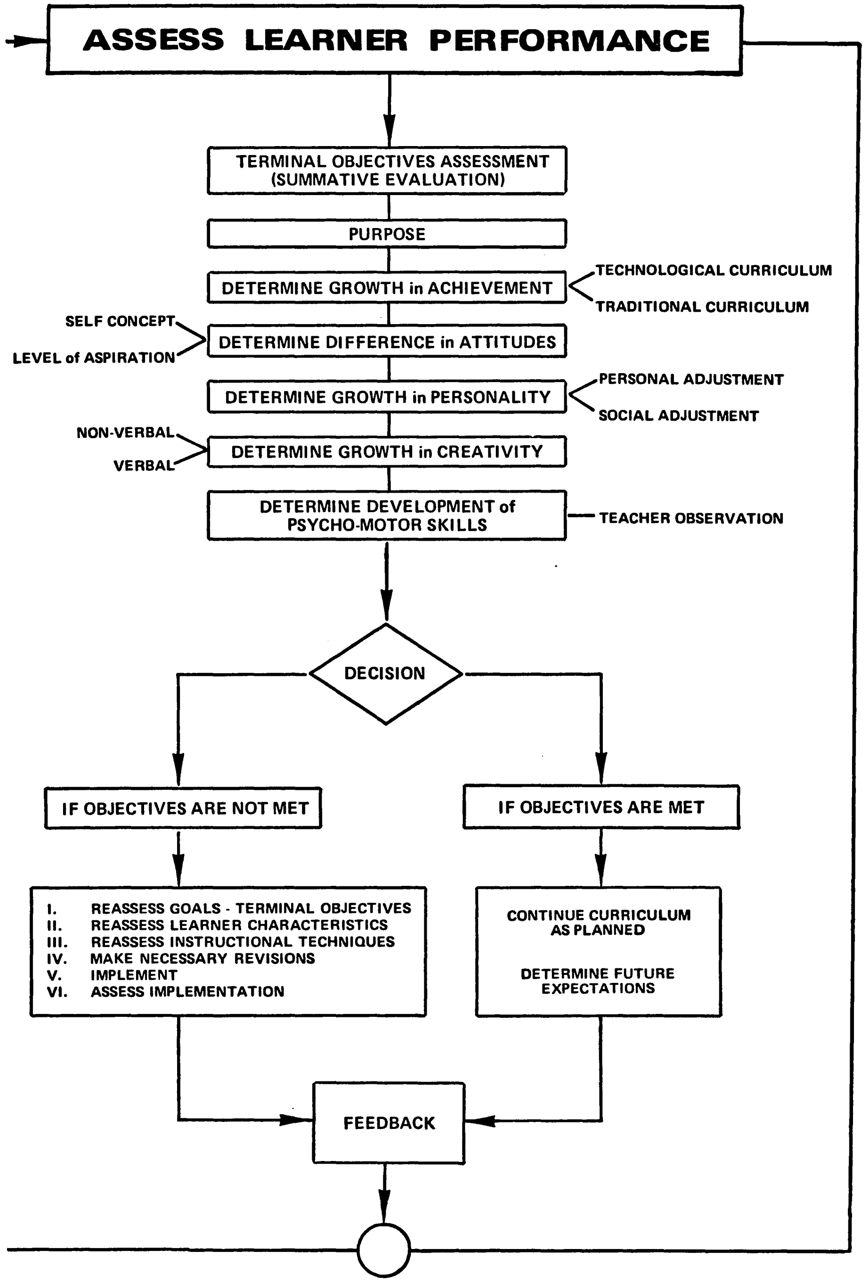


Fig. 12. Assessment of Learner Performance.
(Heasley as cited in Stamm, 1973, p. 72)

IN CONCLUSION

In final analysis, then, what are we as elementary industrial arts educators doing? We who can develop *wonder* in these children with rainbows of abilities! Are we prepared to create the genesis not only of technological developments but of human kindness and understanding? With a great potential at our fingertips, what directions will we take? What prescriptions will we design? What perspectives will we develop? What freedoms will we encourage? What are our visions?

. . . a process whereby one becomes aware of problems, difficulties, gaps in information, and disharmonies for which he has no learned solution; searches for clues in the situation and existing knowledge; formulates hypotheses, tests them, modifies them, and retests them; and communicates the results.

Changing education is surely a challenge to our creative powers. What can we do? Does change come about by someone's ideas . . . someone's dream? If so, have we dreamed long enough of the good life . . . the good education?

We, as advocates of the industrial arts education, not only recognize the problem but have the ways and means of meeting the challenge of providing more relevant educational experiences. This is a good beginning!

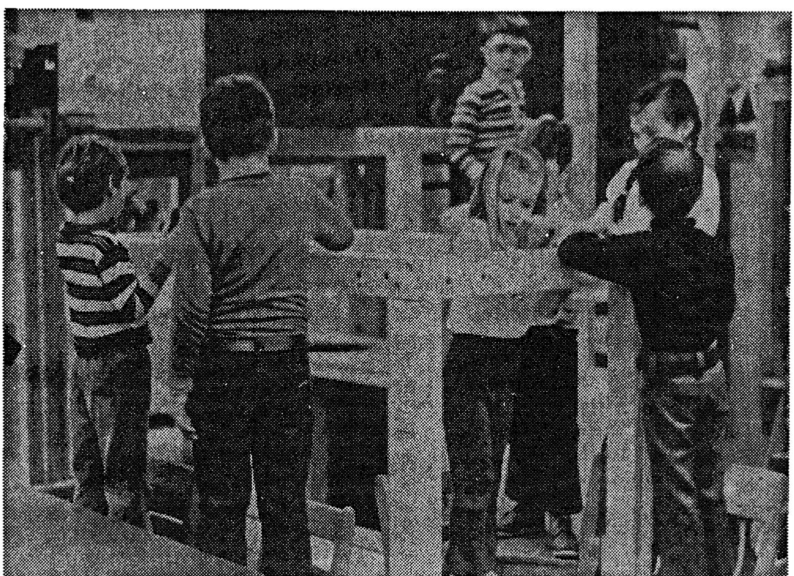


Fig. 13.

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CHAPTER V

Contemporary Programs

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INTRODUCTION

This chapter has been prepared in an effort to provide the profession with a broad description of programs of industrial arts in the elementary schools of the United States as they existed in the early 1970's. No attempt has been made to suggest guidelines for the development of programs of elementary school industrial arts or to classify certain programs as "desirable" or "undesirable." Basically, the chapter reports the results of a nationwide survey of the elementary school industrial arts programs.

A thorough review of the literature of the profession (1956-71) preceded the development of the survey instrument. However, no bibliography accompanies this chapter since Chapter XII is a comprehensive bibliography.

AN OVERVIEW

During the past fifteen years, there has been a significant increase in the amount of professional literature dealing with industrial arts in the elementary schools of the United States. This can be attributed, in part, to a national re-awakening of interest in participatory learning which emphasizes "hands-on" activities involving the application of tools and materials in the elementary school, as well as to the recent emphasis on "career education."

While there has been a recent emphasis upon industrial arts in the elementary school, this kind of program and the concepts which underlie it are not new to the contemporary educational scene. In fact, industrial arts as a program within the educational system in the United States had its beginnings in the elementary school during the latter part of the Nineteenth Century.

During the first quarter of the Twentieth Century, two individuals, Frederick G. Bonser and Lois C. Mossman of Teacher's College, Columbia University, seem to stand out as leaders in the attempt to apply the social philosophy of John Dewey to the elementary program through the "industrial arts." In their book, *Industrial Arts for Elementary Schools,* they attempted to apply this area of industrial arts to the elementary program as both content and method. As CONTENT, industrial arts was conceived as helping children to develop an appreciation and understanding of industry in the culture; a study of the related and resultant social problems, and the development of judgment in the selection and use of industrial products. As indicated here the emphasis was definitely shifted from the development of manipulative skill toward the conveyance of understanding through concrete experience. As a METHOD which would implement the understanding of certain content, it was thought that a given experience in industrial arts (broadly conceived) would be made up of a variety of things such as arithmetic, geography, history, science, and reading. This method was considered as a means of involving the individual in a variety of problem situations through which learning would take place.

Evidences of these various evolutional stages can be found in the modern elementary school. Many of the ideas advocated by the proponents of the activity centered school have found their way into the school curriculum. In some cases the concepts are implemented in much the same manner as proposed originally. However, in some instances the concepts have taken on new meanings and now take quite a different form than was proposed originally. For example, the study of industries or occupations that was advocated by Dewey and Bonser has been acknowledged as being in the realm of social studies at the elementary level. In fact, it is difficult to imagine an attempt to interpret the American culture without referring to the arts of industry which have played such a significant part in the development of the way of life in America. However, a full understanding of industry as a part of our culture at the elementary level is not likely to be gained without firsthand experience with tools and materials. When verbal abstractions alone are used to tell the story of America's people at work the elementary child is less likely to gain the depth of understanding or concepts that are possible when concrete, realistic experiences are provided.

Even though there has been a recent surge of professional interest and program development in elementary school industrial arts, the dominant programmatic thrusts continue to focus on industrial arts as both "content" and "method." Typical of the point of view which emphasizes the "content" or "discipline of industry" approach is the contention by Hackett, at the 1965 convention of the American Industrial Arts Association, that occupations (the work one does) and industries (the institutional setting or environment in which one works) could provide the basis for integrated units of study at each grade level. This "occupational awareness" approach is currently being amplified as a means of implementing the "career education" concept introduced by former Commissioner of Education Sidney B. Marland in January, 1971. At the present time, programs which place emphasis upon "occupational awareness" are receiving stimulation through special federal and state funding.

The value of industrial arts as a "method" at the elementary school level is emphasized by those who contend that activities related to tools, materials and processes provide the learner with (1) motivation, (2) reinforcement, (3) problem solving experiences, (4) reduced abstraction, (5) a purposeful learning environment, and (6) opportunities to apply knowledge through direct participation.

A more complete summary of the literature as well as a thorough analysis of ten innovative, contemporary programs of elementary school industrial arts can be found in a Master of Education thesis titled "A Description and Comparison of Selected Contemporary Elementary School Industrial Arts Programs in the United States of America" by Geoffrey T. Nicholls which was completed in 1972 in the Department of Industrial and Vocational Education at the University of Alberta under the direction of Dr. Darius R. Young.

THE SITUATIONAL PROBLEM

During the 1960's the program of elementary education in the United States faced unprecedented change in curriculum, instructional methodology, instructional materials and instructional technology. These changes came about as a result of an increasing body of knowledge, research in education, and an increased awareness of the individual nature of learning. Coupled with these factors were the advances in science and technology accompanied by changes in living patterns. As our society has become more complex, the curriculum developer is challenged to find ways and means of making educational programs more efficient and at the same time more relevant to the age and maturity level of the learner.

As the curriculum developer attempts to meet this challenge, there is the continual quest for models which can be adapted and applied. As one examines the results of program development efforts, new insight can be gained and further adaptations or modifications can be made.

Unfortunately, this approach is possible only after programs have been identified, analyzed and evaluated in terms of their objectives, content, learning activities, instructional materials and instructional strategies. Such an analysis provides curriculum developers with a theoretical and practical base from which plans for future programs can be made.

The situational problem which faces program planners in the area of elementary industrial arts is a lack of information regarding local programs of industrial arts in elementary schools. Without this base of knowledge from which to plan and develop, program developers cannot take into account the successes and failures of their colleagues.

With this situational problem serving as a point of focus, this study sought to provide a common understanding of contemporary programs of industrial arts in elementary schools and a knowledge base from which research and development activities involving industrial arts at the elementary school level might be launched.

THE PURPOSE OF THE STUDY

The purposes of this study were to identify programs of industrial arts being conducted in local school districts at the kindergarten through sixth grade level and to ascertain the program purposes as well as the procedures whereby these programs are implemented.

No formal hypotheses were generated or tested. However, the following research questions provided direction for the investigation.

1. What are the purposes of industrial arts at the elementary school level as identified by professional personnel?
2. What is the relative importance of selected program purposes as rated by professional personnel with direct responsibility for industrial arts in the elementary school?
3. Who conducts the program of industrial arts in the elementary school?
4. How are industrial arts activities scheduled in the elementary school?
5. What facilities are utilized in the conduct of the program of industrial arts in the elementary school?

6. To what extent are industrial arts activities organized as individual or group endeavors in the elementary school?

The investigation was planned in a manner which would permit data relative to each of the preceding questions to be grouped by geographic area (eastern, central and western), by teacher and administrator respondents and by grade level.

SOURCES OF DATA AND PROCEDURES

The population for this investigation consisted of all programs of industrial arts at the kindergarten through sixth grade level in elementary schools of the United States. Since no directory of these programs existed, a sampling procedure did not seem to be appropriate. Therefore, the investigator operationally redefined the population to encompass those industrial arts programs in elementary schools that could be identified by members of the American Council on Elementary School Industrial Arts and by state supervisors of industrial arts.

With the population thus defined, letters were mailed to all persons who held membership in the American Council on Elementary School Industrial Arts as of April, 1972, and to an individual in the State Department of Education who had supervisory responsibilities for industrial arts/industrial education programs in each of fifty states. Each of these individuals was asked to assist in the identification of programs at the elementary school level which (1) involved children in constructional activities with three-dimensional material and/or (2) provide special opportunities for children to experience technology related to one or more of the following: manufacturing, construction, communication, transportation and power, services, recreation, and/or (3) give attention to the needs of children to gain an increased awareness of the world of work, and/or (4) through other means seeks to provide educational experiences associated with the discipline of industrial arts. These four *identification criteria* were considered necessary since programs of industrial arts at the elementary school level do not lend themselves to easy identification. These programs are not standardized and may be designed to meet one or more of several purposes and may exhibit a wide variety of characteristics.

Therefore, some *identification criteria* seemed to be necessary in order to assist in the identification of the population.

The most common feature of programs that are categorized as "industrial arts" at the elementary school level is their activity orientation. However, this feature only compounds the identification and categorization process since all "activity centered" programs located in kindergarten through grade six cannot be categorized as "elementary school industial arts." In an effort to identify programs which could be categorized logically as elementary school industrial arts, the author reviewed the literature of the profession to ascertain program features or characteristics which could be used as *identification criteria.*

A total of ninety published articles, speeches cited in convention proceedings, and books dealing directly with elementary industrial arts for the period 1956 to 1971 were reviewed to provide the author with an information base from which program *identification criteria* could be established.

Instrumentation

In order to gather data whcih would provide answers to the previously posed research questions, it was necessary to develop a survey instrument which would be mailed to individuals comprising the population. In an effort to develop an instrument which would secure the necessary data while at the same time eliciting a high percent of response, the investigator designed an instrument which required a minimum of written responses. Most of the items on the survey instrument required the respondents to check or circle the most appropriate alternative among those listed. Opportunities were provided for the respondent to indicate program uniqueness that was not taken into account by the alternatives presented. The previously mentioned review of professional literature, including related research studies, enabled the investigator to provide the respondent with an array of alternatives which would keep written responses at a minimum.

Preliminary copies of the instrument were pilot-tested with a group of ten classroom teachers and the preliminary instrument was reviewed by the officers of ACESIA. After receiving input from these two sources, the instrument was revised into its final form and mailed to the population previously identified.

Recording and Analyzing Data. Of the 285 forms distributed to teachers and administrators of local program, 172, or 60.3 percent, were received. Only one follow-up was utilized due to the fact that the data collection was attempted in April and May of 1971. Additional follow-ups in late May and early June were judged to be inappropriate. When the responses were grouped by geographic region, approximately 50 percent were from the eastern one-third of the United States, with approximately 30 percent from the central region and 20 percent from the western region. The central region included the states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Arkansas, Louisiana, Mississippi, Alabama, Tennessee, Kentucky, Missouri, Ohio, Indiana, Illinois, Michigan, Wisconsin, and Minnesota. The western region contained the states of Washington, Oregon, California, Nevada, Idaho, Montana, Utah, Wyoming, Colorado, Arizona, and New Mexico. The remaining states comprised the eastern region.

Analysis of Data. The data gathered through the survey instrument were tabulated and classified according to the various categories identified within the purpose of the study. In addition to the reporting of frequencies, percents were calculated and grouped into tabular form. Although formal hypotheses were not established and tested, a statistical analysis was used to ascertain the extent to which observed differences in percent could be attributed to factors other than chance.

Even though the responses were grouped according to geographic area (eastern, central and western) the space limitations of this chapter do not permit reporting of responses in tabular form for the three geographic areas. In addition, the data were analyzed according to the position of the respondent, i.e. teacher or administrator, as well as by grade level. In instances where the responses of these sub-groups differed significantly, the investigator so reports, even though the data tables are limited to grouped data for the entire population.

FINDINGS: A DESCRIPTION OF CONTEMPORARY PROGRAMS OF INDUSTRIAL ARTS IN ELEMENTARY SCHOOLS

The reader is reminded that this chapter does not seek to describe a group of programs which are judged to be innovative or exemplary, but rather, it is a report which seeks to describe the common features and characteristics of approximately 170 programs of industrial arts at the elementary school level as reported by teachers and administrators of local programs. Due to the limitations of identifying the population and the data gathering procedure, it cannot be assumed with confidence that the program descriptions are entirely representative of the population. However, it is the author's opinion based on professional experience and a rather thorough review of the literature during the past fifteen years that the descriptions presented herein, although by necessity generalized, are not at variance with the descriptions provided through the American Council of Elementary School Industrial Arts.

Program Purposes

Even though there is a tendency in the professional literature to categorize elementary school industrial arts programs according to their primary emphasis, it is generally acknowledged that this program is multi-faceted as it has the possibility for meeting several purposes simultaneously. Teachers and administrators at the local level when asked to rate the relative importance of sixteen potential program purposes were willing to indicate that very few were unimportant to their students. As indicated in Table one, there was considerable variance in their ratings of the purposes in terms of their being "very important" as opposed to "moderately important."

The purpose "To develop desirable habits, attitudes, and appreciations . . ." was considered to be *very important* by more respondents than any other purpose. In fact, none of the respondents judged this purpose to be *unimportant.*

As indicated in Table one, seven of the 16 purposes were rated as *very important* by at least two-thirds of the respondents.

Only two purposes, "To develop proficiency in the use of common tools and materials" and "To provide increased opportunities for creative expression were judged to be *unimportant* by as many as one-fifth of the respondents.

When the responses were compared by geographic area, it was found that a significantly higher percent of the respondents from the western region of the United States rated the objective "To develop interest in and appreciation for manual activity" as *very important* than those from the central or eastern region. In fact, this objective was rated second in terms of importance by western respondents and eleventh by the total group of respondents.

In most instances there were no significant differences between the relative importance of the various purposes as rated by teachers and administrators. However, on the objective "To increase the student's occupational awareness," a significantly higher percent of administrators viewed this objective as being *very important* than teachers in the central and western regions; no differences were

Table 1

RELATIVE IMPORTANCE OF SELECTED PURPOSES FOR INDUSTRIAL ARTS EXPERIENCES AS RATED BY ELEMENTARY SCHOOL PERSONNEL

Purpose	Very Important		Moderately Important		Unim-portant	
	F*	%	F*	%	F*	%
Develop desirable habits, attitudes and appreciations, such as cooperation, self-discipline, emotional control, and self-reliance	133	81.6	30	18.4	0	0
Learn through concrete activities as well as verbal means	130	70.8	31	19.0	2	1.2
Increase student interest	118	77.8	40	24.7	4	2.5
Facilitate the development of planning and problem solving skills	109	67.3	51	31.5	2	1.2
Express ideas through media other than words	108	66.3	51	31.3	4	2.4
Reinforce various subject matter content of other curricular areas, such as arithmetic, science, etc.	110	66.2	50	30.1	6	3.7
Develop awareness of tools, materials, processes	108	65.8	51	31.1	5	3.1
Increase the student's occupational awareness	104	63.1	52	31.5	9	5.4
Develop knowledge, understanding, and an awareness of industrial technology in our society	91	54.9	68	40.9	7	4.2
Increase opportunities for creative expression	83	53.2	66	42.3	7	4.5
Develop interest in and an appreciation for manual activity	86	51.2	76	45.2	6	3.6
Promote psychological and/or social development	71	43.3	83	50.7	10	6.0
Construct three-dimensional objects which symbolize achievement to themselves and their parents	62	38.1	74	45.4	27	16.5
Experience activities which provide a break from regular classroom routine and involve a controlled energy release. (May be recreational and leisure time activity)	44	27.8	82	51.8	32	20.4
Facilitate physical development of students	43	26.7	95	59.0	23	14.3
Develop proficiency in the use of common tools and materials	41	25.2	89	54.6	33	20.2

*Frequency of Response varies from item to item due to the fact that all respondents did not respond to each item.

observed in the eastern region. With regard to the purpose "To increase student interest," a significantly higher percent of teachers than administrators in the eastern region rated the objective as *very important*; while there were no observed differences with regard to this purpose among teachers and administrators in the central and western regions.

Another purpose on which teachers and administrators disagree was "To construct 3-D objects which symbolize achievement . . ." with a significantly larger percent of the teachers in the western region rating this purpose as *very important* than administrators. Teachers and administrators from the other two regions did not rate this purpose in a significantly different manner, although all groups rated it as less important than did the teachers from the western region. Teachers in the western region also rated the purpose "To develop proficiency in the use of common tools and materials" as significantly more important than did administrators or teachers in the central and eastern region.

For the purpose "To experience activities which provide a break from regular classroom . . ." a significantly larger percent of teachers from the western and eastern regions rated the purpose as *very important* than administrators. The difference between teacher and administrator responses in the central region were not significant.

Personnel Conducting Programs. The survey results indicate that programs of industrial arts in the elementary school are conducted through the independent or collective efforts of elementary school classroom teachers and individuals who have specialized preparation in industrial arts.

In Table 2, the data reveal that in approximately 32 percent of the programs reported, the classroom teacher working (without the aid of specialists) conducts the activity program of industrial arts. A like percent of the programs surveyed utilize a specialist (consultant) who works with the classroom teacher in carrying out the program of industrial arts. A slightly smaller percent (29.4) of the programs were conducted by an industrial arts specialist who conducted the program without the direct involvement of the regular elementary classroom teacher.

Scheduling of Industrial Arts Activities. When teachers and administrators were queried regarding the scheduling of industrial arts activities, there appeared to be no dominant pattern, although approximately one-third of the programs were being conducted according to a predetermined schedule (specified hours per day and days per week). Respondents indicated that in the majority (68 percent) of the programs a wide variety of factors influenced the amount of time as well as the specified time for industrial arts activities. Some of the most frequently cited factors were (1) progress of unit, (2) relation to other learning activities, (3) student interest, (4) availability of tools (mobile cart) and (5) schedule of specialist.

Table 2

PERSONNEL DIRECTLY INVOLVED IN THE CONDUCT OF ELEMENTARY SCHOOL INDUSTRIAL ARTS PROGRAMS

Personnel	Number of Programs	Percent
Classroom Teacher	55	32.3
Classroom Teacher and Industrial Arts Consultant	55	32.3
Industrial Arts Specialists	50	29.4
Other	10	6.0
Total	170	100.0

Facilities for Elementary School Industrial Arts. The responses of teachers and administrators revealed that approximately fifty percent of the programs of industrial arts in elementary schools are conducted in regular elementary school classrooms and a like percent in some type of specialized facility (primarily industrial arts shops or laboratory with some multi-purpose and crafts rooms being utilized).

When the data were analyzed by geographic area, the only variation from the findings of the total group was for the western region where significantly more programs were conducted in the regular classroom than in specialized facilities.

Evaluation of Pupil Growth. Educational activities provide opportunities for growth in a variety of areas such as physical, intellectual, aesthetic and emotional. These areas of growth are important to an individual's total pattern of maturity. Observation of a child's participation in activities is a potential means of assessing the level as well as the pattern of his or her growth.

As indicated in Table three, 44.2 percent of the respondents formalized the evaluation of industrial arts activities by giving specific attention to the student's performance. The group was rather evenly divided in terms of their use of the evaluation results. Approximately the same number of respondents used the activity evaluation as a part of the student's grade and/or parent conference as used the evaluation only for the direct benefit of the student.

Analysis of the data by region (central, eastern, western) or personnel (teachers or administrators) revealed no significant differences among sub-groups or between a sub-group and the total group.

Table 3

EVALUATION OF STUDENT GROWTH THROUGH INDUSTRIAL ARTS ACTIVITIES

Evaluation Practice	Responses	Percent
Informal and Incidental	70	44.9
Formal: Part of Student's Grade and/or Parent Conference	35	22.4
Formal: For Student's Benefit Only	34	21.8
Other	17	10.9
Total	156	100.0

Types of Industrial Arts Activities. Individual and group procedures are both used extensively by those who direct programs of industrial arts in the elementary school. However, there are some variations in the way in which the procedures are used. In Table four, the data indicate that the respondents most frequently utilize the procedure whereby individual students work on their own student selected activity either independently or in a small group setting. In fact, nearly 83 percent of the respondents use this procedure either "frequently" or "occasionally." This finding is most readily contrasted with the data which indicate that nearly 44 percent "seldom" or "never" have students work on an individual project that is teacher selected.

Even though the individual project is used "frequently" by more respondents than the group project, the procedure whereby students work either independently or in small groups on a common project in which they have exercised considerable choice appears to be used with a greater degree of frequency than a teacher selected, individual project activity scheduled during a common work session.

When the data were analyzed according to region, it was found that a significantly smaller percent of teachers from the central states used teacher selected individual prescribed projects than their counterparts in either the eastern or western states. There were no regional differences in the usage of individual projects in which the students had considerable freedom of choice in terms of activity and work schedule.

The only other significantly different pattern of activity usage among the three regions involved the group selected group project. This type of activity was reported to be used "seldom" or "never" by significantly more teachers from the central (60 percent) and western (75 percent) states than by their eastern counterparts.

Table 4

TYPES OF STUDENT ACTIVITIES INVOLVED IN ELEMENTARY SCHOOL INDUSTRIAL ARTS

	Frequently		Occasionally		Seldom		Never		Total
	F	%	F	%	F	%	F	%	F*
Individual project, student selected, independent or small group work	86	54.8	44	28.0	23	14.6	4	2.6	157
Group project, group determined, variable work schedule	49	32.2	54	35.5	30	19.7	19	12.6	152
Individual project, suggested by teacher, all work at same time	36	23.7	5	32.9	44	28.9	22	14.6	152
Group project, suggested by teacher, all work at same time	15	10.0	71	47.9	47	31.9	15	10.1	148

*Frequency of response varies from item to item due to the fact that all respondents did not respond to each item.

However, the administrator respondents from all three regions reported a pattern of usage of the group selected group projects which was not significantly different than that of teachers in the eastern region where 65 percent used the procedure either "frequently" or "occasionally."

Only one significantly different response pattern was found between teacher and administrator respondents. It was reported by a significantly larger percent (33 vs. 17) of teachers that the teacher selected individual project scheduled for a common work session was utilized "frequently."

Industrial Arts Activities in the Elementary School Curriculum. One of the frequently cited purposes of industrial arts in the elementary school relates to its value as "support for" or "enrichment of" the basic curricular areas of mathematics, language arts, fine arts, physical education, science, and social studies. The results of this study verify this as a functional purpose for most of the programs of elementary school industrial arts.

As indicated in Table five, a majority of the respondents reported the integration of industrial arts activities with the elementary school curricular areas of mathematics, science, and social studies on a "frequent" basis. When the categories of "frequent" and "occasional" are combined, only the curricular area of physical education was supported in usage by less than one-half of the respondents. In fact, approximately one-fourth of the respondents indicated that industrial arts activities were "never" used to support or enrich the physical education curriculum of the elementary school. In addition to physical education, about one third of the respondents indicated that they "seldom" or "never" used industrial arts activities to support or enrich the curricular areas of language arts or fine arts.

Table 5

INTEGRATION OF INDUSTRIAL ARTS ACTIVITIES INTO THE CURRICULUM OF THE ELEMENTARY SCHOOL

	Frequently		Occasionally		Seldom		Never		Total
Curricular Areas	F	%	F	%	F	%	F	%	F*
Science	94	64.8	41	28.3	8	5.5	2	1.4	145
Social Science	83	59.3	43	30.7	10	7.1	4	2.9	140
Mathematics	80	54.4	53	36.1	10	6.8	4	2.7	147
Language Arts	46	33.3	49	35.5	33	23.9	10	7.3	138
Fine Arts	38	26.8	69	48.6	29	20.4	6	4.2	142
Physical Education	14	10.6	28	21.2	58	43.9	32	24.3	132

*Frequency of response varies from item to item due to the fact that all respondents did not respond to each item.

When the responses of teachers and administrators were contrasted, the only significant difference was the percent of teachers (34.0) who "never" utilized industrial arts activities to support or enrich physical education as contrasted with the 18 percent of administrators who made a like response.

When the data were analyzed according to regions, it was found that there were only three instances in which responses of teachers or administrators differed significantly among regions. In these instances, it was found that teachers from the central region integrated industrial arts activities less frequently with social studies and language arts than their counterparts in either the eastern or western regions. Even though a majority of all respondents "seldom" or "never" used industrial arts activities to support or enrich physical education, the teachers from the eastern region used it even less frequently than those in the rest of the United States.

CONCLUSIONS AND RECOMMENDATIONS

Under the assumption that the respondents represent the population of individuals responsible for programs of industrial arts in elementary schools and in so far as the facts obtained and the opinions expressed are valid and accurate, the following conclusions and recommendations are suggested.

1. Industrial Arts in the elementary school is viewed by persons responsible for the program as serving a wide variety of purposes.
2. Individual schools or school districts may design and develop specialized programs of industrial arts at the elementary school level that meet a narrow range of purposes or programs that seek to meet a broader range of purposes.
3. Professionals can be expected to design programs of industrial arts in elementary schools that seek to influence the child's affective development.
4. Professionals can be expected to design programs of industrial arts in elementary schools that seek to influence the child's cognitive development.
5. Professionals can be expected to design programs of industrial arts in elementary schools that seek to maximize the child's achievement in the regular elementary school curriculum.
6. There is a need for classroom teachers to be prepared to direct industrial arts activities in the elementary school.
7. There is a need for specialists in industrial arts who can assist classroom teachers at the elementary school level in the conduct of industrial arts activities.
8. Specialized personnel who will direct industrial arts activities in the elementary school must be prepared to assist elementary teachers in the utilization of both individual and group activities.
9. Specialized personnel who will direct industrial arts activities in the elementary school must be prepared to assist elementary teachers in the regular classroom with "make-shift" work stations and limited equipment as well as in specialized facilities designed for industrial arts activities.

10. Professional personnel who conduct programs of industrial arts in elementary schools should seek additional ways in which to support and enrich the curricular areas of language arts and fine arts.
11. Since the physical development of the elementary child was not considered to be one of the more important purposes of industrial arts activities in the elementary school, it would appear that professional personnel do not perceive a strong relationship between industrial arts activities and the child's perceptual motor development.

CHAPTER VI

Environmental Designs

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PART I

If you read this chapter because you think you are going to receive specific information on how to design an elementary industrial arts facility to meet all needs, you had better refer to another source or get yourself a crystal ball. If, however, you are interested in the aspects that you will have to consider when designing or redesigning a facility for an activity program which could be called "industrial arts" and if you're ready to ask yourself some searching questions and if you can honestly answer them, then you may continue to read this material.

What is Environmental Design? A few years ago, this chapter would have been entitled "Shop Lay-outs" and that title would have been adequate to describe a facility in a typical building that was built from the late 1940's up to the early '60's. The traditional school during that period consisted of one or more floors with a corridor separating boxes called classrooms, spaced on either side of the passageway. If it was a wealthy school district, you probably added such things as an auditorium and a cafeteria and certainly a gymnasium. As money became more and more a critical factor in designing the schools, a number of non-classroom facilities were combined and we began to see 'auditerias' and 'cafetoriums'. We also began to see open structures which resembled supermarkets. As a matter of fact, these were designed not so much because they represented an educational philosophy initially, but because they allowed the architect to save money on interior partitions by literally building a supermarket type structure. Architects were quick in recognizing the cost-saving factor of not having walls and began to substitute movable bookcases, closets on wheels that provided a hanging space for hats and coats and used those as movable walls. Both educators and the public supported the idea under the guise of open education. It soon became apparent that movable furniture once in position very seldom was moved.

We added an additional factor in sound control by installing carpets. Again, the cost-saving factor and not the educational concerns were in large measure responsible for going in this direction. Carpets did reduce noise and supposedly were easier to clean and maintain, thus saving on custodial staff. And, they did add color to what has always been a rather drab surrounding.

During this time period, the American schools were criticized for not meeting the needs of their students and regardless of the system being used, it seemed that reading scores did not go up; that math scores also did not go up, whether it was the new math or the old math in repackaged form. The United States as a whole went through a period of social and economic unrest and a type of liberation movement which could be described as anti-establishment.

In an effort to meet the needs of students and to show some compassion and humaneness, teachers began to consider programs relating directly to the student in which a student was diagnosed and prescribed for in educational terms. We began to see more and more open classrooms; more and more non-structure; more and more non-gradedness where students were grouped according to needs and according to abilities. Now this philosophy, regardless of whether it was modeled after the British open schools or whether it was dictated by economic necessity, indicated a need for a different type of building. No longer could you house thirty students in separate classrooms. It was necessary for students to be able to move and to relate to each other. Teachers did not and could not seek refuge in their rooms, but were exposed to the judgment of other students and also to the judgments of their peers. The principal became a person who was recognized by his desk out in the open, as opposed to being behind a counter and a glass wall in a separate establishment, removed from where the action was.

If a student was to pursue his interests according to his ability, then it was necessary to provide the means for him to do so. Libraries became instructional material centers. There was a need for students to be able to work independently and also be able to work in small groups in activities other than book related work. This dictated the design of buildings which put such activities as art, industrial arts, and home economics out into the middle of the area without sound barriers and established an activity program that was visibly and directly related to the curriculum of the elementary school.

Such terms as accountability, continuous progress, pass-fail, non-graded, independent study, learning packet, domains, relevant, in-depth, generalization, behavioral objectives, on-going, meaningful, hands-on, articulation, teacher-centered, pupil-centered, enrichment, and certainly the transformation of manual training to industrial arts and a shop to a laboratory, from exploratory to career education, from industrial to technology all influenced not only the physical facilities and the curriculum, but also the manner in which programs were utilized.

So, your first assignment is to take an inventory of your district. Look at not only the physical environment such as the buildings which are with you and in which you must operate, look also at the structures which are contemplated being built. Look at the direction of the leadership in the district and try to determine whether it is in harmony with the feelings of the community. Look at the new teachers and analyze whether they are reflecting the philosophy of the teacher-training institutions and, if so, what are these philosophies. And, lastly, look at the philosophy of industrial arts and vocation-technical education in relationship to a total K-12 spectrum. You must analyze all of these inputs and attempt to put them in perspective and develop an orchestration of music and lyrics which will allow your district and your school and you to offer the best program for its young learners.

PART II

You need to develop a philosophy, or in other words, the Board of Education wants to know where you are going.

A review of the history of elementary industrial arts, as presented elsewhere in this text, will quickly show that there are a number of viable philosophies under which elementary industrial arts can, has, will and may operate. These philosophies range from a typical traditional shop which serves only boys in a structured manner, making projects year in and year out to the type of facility which serves all the students in an open environment and may not even have an industrial arts teacher to supervise the operation of the program. And who is to say that one is right and the other is wrong? Each program has a time and it has a place.

It is up to you and your school district to determine if the industrial arts program is to be a hand-work-type program integrated with the curriculum, with the activities coming from the curriculum and in support of the curriculum. Such a program needs to have facilities which are broad in equipment and imaginative in design, incorporating the best elements of industrial arts, home economics, fine arts and science. It must be available for all teachers and all pupils and, therefore, requires that careful consideration be given to control of tools and supplies and specifically to the area of safety.

Tool control must be such that tools are readily available for use and easily and quickly checked for losses at the end of the session. Again, it is necessary to analyze your philosophy to determine what it is that you want to do and how the environment will meet your needs.

If your industrial arts program has a self-supporting curriculum and serves only that aspect of the school such as you may find in the middle schools or in the junior high years, particularly grades seven and eight in most states, then your design will obviously take a different direction. As this type of program requires a trained teacher, it may support a facility which is more sophisticated and in greater depth than the program which originates in the elementary school curriculum.

But even a technology-centered program needs to determine and design facilities for large group instruction, small group instruction and individualized learning situations. Consideration should be given to the establishment of work carrels utilizing the latest concepts in audio and visual presentation, allowing students to explore and work at their own level and at their own speeds. Schools utilizing a modular-type schedule, such as might be found in a non-graded environment, will need to design facilities that will allow the smooth transition of students in and out of the areas. The problem of facilities and programs is much like the question of the chicken and the egg and which came first.

Your assignment now is to determine which type of industrial arts program you wish to augment. Relate that to your assignment in part one and determine which type of school environment you need to operate in and you now have two parts of the equation.

PART III

Building considerations or a silk purse from a sow's ear.

The problem which we will consider here is quite simple. You either have an old building with no shop space available, or you have an old building with a shop or space available or you are in the process of designing or building a new building, again, with or without space devoted to industrial arts. Incidentally, if you find yourself in a position of attempting to develop or work on a new building design and you find that your district cannot afford, or will not afford an industrial arts facility, your ploy is to strongly support a room in the building which will be available for an activity program. If your district happens to be strongly oriented to the fine arts, then by all means support a fine arts facility in your elementary school. Do not, I repeat, do not attempt to substitute industrial arts for a fine arts facility when it is obvious that the climate in the community will not support both; and through quibbling and arguments, may end up supporting neither. It is much easier to convert a fine arts facility to serve the needs of an activity program than to convert a basement storage room or even a traditional classroom to an activity program. Capitalize on what you have and what the district can support. But, back to the problem. If you have an old building and you have no room, you obviously need to take an inventory of the building to determine whether there is any, and I underline the word *any,* usable space, regardless of its size. Do not hold out for a large area, which obviously cannot be given to you. Remember, in most cases, your program will not be utilized 100 percent of the day such as most classrooms will be. Remember, also, it is better to establish a small beachhead, than to be rejected entirely. You will be able to operate a satisfactory program out of a closet which will allow you to store some of your tools and equipment and supplies. It would even be possible for you to use this as a place where your machines, mounted on casters, can be stored at the end of the school day to be relocated during the day at the end of a corridor or in an unused alcove. I have seen very satisfactory and excellent programs operate out of areas which are too small to serve as instructional spaces for students.

You do not need to hold out for a sink or ventilation if you use the space only as your operating headquarters. Remember the fact that you are the most expensive part of the program and, therefore, what you *do* determines whether you survive and the program continues. The building and facilities will not decide whether you remain there, but the inhabitants of the building will. Therefore, take what is available and act like a martyr, while you are in the cheerful process of serving the students, and teachers and parents of your community.

If you have an old building and are fortunate enough to be given a classroom, rejoice. After all, you are an industrial arts teacher and, therefore, given a minimal amount of money for supplies, you should be able to design and build the type of facilities which will allow you to operate. The whole idea is to be innovative, be colorful, be original and be optimistic. Design your own area to provide work space for students and storage space and tool control for you. Again, safety is an overriding factor. In most cases, the younger children will not be operating the power tools with the exception of the vibrating type scroll saw. Since the advent of the sabre saw, it is possible to substitute this tool for many of the tools formerly operated only by the instructor. More about specific tools in part five.

Should you be in such a fortunate position as to be called upon to give your expertise to the design of a new building, you can figure that you have the battle practically won. It is when you are not called upon to have input into the building that you must use your knowledge of the elementary education scene to persuade those who are in a position to make a change to incorporate an activity program room or area into your school. This area may be called an interest center and, at that point, may best be sold by not only you, but also the fine arts and the home economics area and even perhaps the science teacher. You may also find an ally in the occupational education coordinator or director from your district if once you persuade him that this center will serve as a space for hands-on career education exploration area.

Regardless of the strides we have made in technology, one of the most popular areas in school remains the woodworking area. No need to apologize to your colleagues who have advanced to sophisticated equipment representing technology at its latest. Woodworking still provides experiences in both the cognitive and affective domains which are hard to duplicate with other materials.

I am still a firm believer in wooden floors because they seem to absorb punishment much better than tile or concrete. They may, however, be expensive and may need to be replaced by some more modern material. I would not be adverse to trying some type of the new kitchen carpets in certain areas of the environment, providing that there are vacuum cleaning facilities and that the material is stain repellant. What we need is perhaps an astro-turf for the shop. Regardless of what you use and what you design, your basic containment should be built for flexibility. So many changes have occurred in the last twenty years that it is important that you design electric fixtures which are readily movable as the need demands. Do not lock yourself into conduits embedded into concrete, rather try to establish an overhead grid system which will allow you flexibility. If possible, this grid system may be built into the floor also. However, it is more expensive this way.

PART IV

Getting on with it or given a hammer, a saw and some material, a student will be able to........

This part really relates to a number of aspects from the prior considerations, conditions given in part three. Let us assume you have an old building or even a new building and you have no facilities allotted to you. There still is a way of providing experiences and facilities of a kind for the school. The most desirable would be to provide an area in the openness of your environment or if you are in a traditional situation in a corner of the classroom which will be the work area, activity area, technology area or call it what you will part of the academic instructional area. This classroom corner should be designed for a workbench and a tool storage facility and for supply storage which will be able to operate with a minimum of teachers' supervision, particularly a teacher who does not know a claw hammer from a ball peen hammer. You start by finding a classroom teacher who has previously asked for direction, guidance, help in preparing her students for some type of activity. You work with this teacher in providing her direction and more than that, in providing her with the wherewithal to start a corner of her classroom that will allow her to operate in the manner in which you would if you were a member of that staff. This means that you may have to find a discarded workbench or one which you no longer are using in the senior high school; assign a teacher or some senior high school students to that elementary school for a period of time and, under their direction, build a unit which will function as a work area. Total investment, nothing except your time.

As this classroom corner becomes the focal point for that class, it will soon spread to other classrooms and other requests. It is obviously possible to meet some of these but would not be practical to meet all of them. Once you have your staff tuned to this point, you then make the pitch or have the elementary school make the pitch to the administration for the type of equipment and supportive services that will allow them to operate in the manner in which you desire. Again, it is a question of getting your foot in the door, operating successfully and then expanding from there. Do not wait until you have a full-time staff member and a full-time facility because, in most cases, these are additional expenses to the budget and your request generally will be considered low priority.

Try, as a second method, the portable tool cart gambit. This is not by any means new, having been used for many years by many teachers in many parts of the country. However, whatever style of tool cart you use, be prepared to have a teacher utilize the cart full-time for her own classroom. This is excellent because you now are in a position to swap the tool cart and provide the classroom with the necessary facility, once again freeing the tool cart. Your basic problem with the tool cart will be finding someone who will take care of it to make sure that it is operational. This can become a full-time headache, but can be corrected by training some students in the elementary school to assume this responsibility. If you are old enough, you will remember when it used to be a privilege to perform services of this kind. In reality, what most of us were doing was escaping instruction. But, at the same time, providing a needed service to the teacher and the school.

You may buy tool carts commercially designed for portability and security and completely equipped with an assortment of tools. For most programs these sets will contain some tools which will seldom be used, but it's much quicker and easier to do that than it is to design a new cart from the ground up. You will need to design and build your own cart only when there is a shortage of funds.

Some school districts have found it convenient to provide a portable unit housed in a trailer. In most cases, a professional teacher travels with the trailer. The advantage of this should be obvious. Again, this solution provides for instruction in communities that are too small to have a full-time teacher or too widely separated to share a teacher or too overcrowded to provide any type of in-house organization. Most trailer units are for small groups by necessity and are designed as an exploratory overview or specialized unit. Most school districts enter into this type of service only with the aid of federal or state funds. It should be considered as a motivational device meeting a need at a given time and place.

Another method of providing service will be for a professional teacher to travel from classroom to classroom or from school to school, without a facility, in essence providing the facility in the teacher's automobile. There are a number of small portable pieces of equipment which could be utilized this way. Schools in warm climates may utilize the open areas, courtyards, walkways of their schools, as outside instructional areas. Teachers not working in such fortunate climates will obviously have to utilize the hallways, the cafeteria areas, if available, or the stage and even gymnasiums when not in use.

PART V

So you've got a little room and you've got some money.

What you do with your money obviously depends on how much money you have and what it is specifically that you wish to do with it. If you are an administrator looking for a convenient shopping list of hand tools and equipment, one has been included at the end of this chapter. However, it would be much wiser to go back to parts one, two and three of this chapter and other chapters in this book and analyze what it is that you are trying to do and then determine what it is you need in order to do that. Too often we are tempted to purchase thirty hammers, only to find that very seldom do thirty students all hammer at the same time. However, it may be that your program dictates that thirty students are to hammer and saw and glue and paste at the same time, at which time you will purchase thirty of almost everything that you have, as long as you can afford it.

Interestingly enough, the size of most adult tools has not been a tremendous hindrance to their utilization by small children. You will find that where adults utilize one hand, the children will use two. They will be awkward in many instances, but will be able to improvise and get the job done at least to their satisfaction and with a reasonable degree of quality which can be directly related to their age, physical maturity and interest.

Perhaps the most difficult decision you will have to make will be in relationship to the height of benches. The standard industrial arts workbench is thirty-three inches high. Benches twenty-nine inches high are available, specifically for elementary school situations. It has been my experience that it is much easier for an older student to work on a lower bench than for a younger student to work on a higher bench. Therefore, when considering the purchase of equipment, I would suggest that two-thirds to three-quarters of the benches and tables be purchased in the lower heights. Some adjustable benches are available on the market. These benches tend to be like room dividers and once positioned are very seldom readjusted.

If your students come in compartmented sizes, you may be able to decide on a format which will meet all their needs. However, a typical classroom overview will indicate that even at a given age level students show a wide variety of physical development. All you can do is assume that what you have selected will meet the needs of the greatest number of students.

Make sure that your room layout includes a large sink, commonly called a custodial sink which will allow students to wash large objects and utilize buckets. This sink should also be mounted close to the floor as opposed to being mounted in a typical counter installation such as you might find in a kitchen. Island sinks have also proven to be popular as they allow students to congregate and utilize the sink on at least three sides as opposed to one side in the average installation.

Tool boards, if you use them and I urge that you do, should be mounted no higher than eighteen inches off the floor. Even at that, a standard four-by-eight piece of plywood used for a tool panel will be sixty-six inches high, much too high for the average elementary student; so consider dropping the tool board down to twelve inches off the floor. Again, a tall person finds it easier to stoop and bend than a small person does reaching. Also, there is a safety factor to be considered when tools are mounted high on the tool panel. A real danger exists in terms of tools falling down on the person removing the tool.

There is no necessity to go into tool board design in this chapter as there are excellent references including a yearbook which devote much space to proper tool holder design.

I am a firm believer in having equipment located where it is readily visible. Do not store equipment in drawers and cupboards because you will find it next to impossible to take a quick inventory at the end of the day.

Tool silhouettes and tool identification by name and a common sense holder design will assure that most of your tools are returned to their proper position. When you find that a student has difficulty in knowing where a tool is to be returned or how it is to be hung, don't blame the student, blame yourself because your design obviously lacks something.

Lumber should be stored in a vertical lumber rack. One rack four feet wide generally is adequate for most of the lumber that you will need in an elementary program. Placed near a wall with a twelve inch space between the wall and the rack, plywood and other four by eight panels are readily stored behind the rack.

A toploading kiln is almost a necessity in the area of ceramics. This kiln should be on the floor and should have some type of cut-off device. Again, experience has dictated that there are no foolproof methods of preventing a kiln from being overfired or burned out regardless of the device used. I would urge you to incorporate a red control light mounted on the wall which is activated and highly visible when the kiln is on. In conjunction, a timer circuit should be installed which will shut the kiln off automatically after a period of time. Ideally, kiln shutoffs should be related to temperature control. In practice, it has been found that teachers do not properly install the control cones.

Another area to be considered carefully is that of finishing. Most finishing benches tend to be backed against a wall which creates a spatter problem on the wall, Again, consider locating your finishing bench where it is readily accessible from at least three sides.

All power tools and circuits should be controlled by some type of magnetic shutoff from two or more places in the room. In an emergency, all power equipment can be shut off by pushing one of the shutoff's. The magnetic feature is desirable because it insures that all machines will be off when the power is turned back on.

Extension cords always provide a hazard, particularly with young children being active. Drop cords located on a grid pattern from the ceiling have provided an answer to this problem. To avoid unused drop cords from hanging like stalactites, you might consider having outlets installed on the ceiling with a twist-lock type of receptacle. Make sure that your electrical circuit provides for 208 to 220 voltage delivery. Your motorized equipment will be much more efficient utilizing 220 three-phase electricity.

In areas where space is at a premium, you might consider mounting some machinery on casters which are retractable. This will allow you to wheel the equipment into position for use during class time and storing the equipment when you do not need it. Generally, almost all age groups of youngsters are capable of operating the scroll saw and the drill press.

Equipment such as a band saw and a table saw should generally be reserved for teacher use. The latter two items would almost seem to be a luxury but experience has again dictated that the diverse needs of the elementary schools require ways in which the teacher must be able to prepare odd sizes of materials readily. The necessity for a band saw is diminished by the purchase of a number of sabre saws.

A separate storeroom is highly desirable, not only from the standpoint of storage of supplies but from a project storage point of view. Young fingers are inquisitive and occasionally it is advantageous to store items out of sight so that fingers will not be tempted.

Do not overlook the storage and distribution of safety glasses. Your facility should provide for approved safety glasses, goggles or shields for every student. It is remarkable how readily elementary students accept this safety equipment compared to their complacent older brothers and sisters.

Your environmental design should incorporate ready access to written materials such as reference books, manuals, technical pamphlets and other information of this type. In addition, your design should take into consideration today's youth which receives much of its information electronically. You should have areas incorporated which will enable a student to listen to instruction, to view instruction utilizing slides, film strips, 8 mm and 16 mm films and video tapes.

Consider ventilation also of prime importance. In today's technology, the use of plastics creates the need for exhausting any by-products to the outside where it will not interfere with any other parts of the building. Fumes from internal combustion engines must also be exhausted to the outside.

PART VI

Shopping lists or tell me what, where and how.

If you have stayed with me to this point and are still frustrated and need to have more information, don't despair. There is help available. May I suggest that you add the publications listed at the end of this chapter to your reading list?

In addition, you should contact the American Industrial Arts Association and the American Council for Elementary School Industrial Arts at 1201 16th Street, N.W., Washington, D.C. 20036. Both of these organizations will be able to put you in contact with individuals who can give you up-to-date information. Your best resource is an inquisitive mind, and common sense. Hang in there, straight shooters!

"GETTING STARTED" TOOL LIST FOR ELEMENTARY PROGRAMS

Quantity	Description	Quantity	Description
1	Cutting Tool Bernz	2	Steel Tape Rules, 10 ft.
1	Tin Snip Compound Lever 8"	4	Bench Rules, 12"
1	Aviation Snips, Straight	2	Steel Bench Rules 24"
1	Bent Trimmer Shears 8"	2	Screwdrivers 2-1/2" regular blade
4	Half-round Wood Files 10"	2	Screwdrivers 4" regular blade
1	Round Metal File 10" 2nd Cut	1	Screwdriver, Phillips

1 Half-round Metal File 10" 2nd Cut
4 Surform, File Type
7 Wooden File Handles
1 Round File, Surform
1 File Card
2 Hand Drills 3/8" Chuck Cap
1 Brace
1 Adjustable Open End Wrench 6"
1 Side Cutting Pliers 6-1/2"
1 Diagonal Cutting Pliers 5"
1 Needle Nose Cutting Pliers 5"
2 Combination Pliers 6"
1 Vise Grip Wrench
2 Try Squares 8" Blade
2 Combination Squares w/level 12"
1 Framing Square 24" x 2"
1 Expansion Bit
1 Set of 6 Spade-type Wood Bits
2 ea. Twist Drill (High Speed Steel) 1/16", 1/8, 3/16, 1/4
1 ea. Twist Drill 1/4" shank (High Speed Steel) 5/16", 3/8, 7/16, 1/2
1 Trammel Points
1 Scratch Awl 6"
1 T Bevel, 6"
1 Mallet, Rubber 12 oz.
4 Claw Hammers - 7 oz.
2 Claw Hammers - 13 oz.
1 Pop Rivet Set
1 Nail Set (2/32)
1 Nail Set (4/32)
1 Center Punch 3/8"
1 Cold Chisel 1/2"
1 Trimming Knife
2 Sloyd Knives
1 Butt Chisel 1/2"
1 Putty Knife - Flexible Blade
1 Wire Brush
1 Staple Gun
1 Grounded Extension Cord H.D. 25'
1 Countersink
1 Screwdriver Bit 1/4"
1 Screwdriver Bit 3/8"
3 Pocket Surform
3 Surform (Plane Type)
1 Block Plane
1 Smooth Plane 8"
4 Panel Saws (cross-cut) 20"—10 pt.
24 Coping Saw Blades (Standard 6-1/2" pin end)
3 Hack Saw Blades (10-1/2" x .025' 24 teeth per inch)
1 Keyhole Saw, 10"
4 Coping Saws
2 Back Saws 14"
1 Hack Saw Frame 10"-12" adj.
1 ea. Auger Bit #4, #6, #8, #12, #16
1 Soldering Kit (Instant Head) (#8200 PK Weller) (100-140 wt)
1 First Aid Kit
2 Bench Dusters, 8"
4 Spring Clamps #2 (Handy Clamp)
4 "C" Clamps 4"
4 "C" Clamps 6"
2 Bar Clamp Fixtures for 3/4" Pipe
2 3/4" x 36" Black Iron Pipe (threaded one end)
2 Woodcraft Vises
2 Woodworkers Vises (Portable)
2 Craft Vises (Portable)

POWER TOOLS

2 Scroll Saws, Vibrating Type
1 Electric Drill, 1/4"
1 Sabre Saw, 2 Speed, Medium Duty
1 Finishing Sander, Orbital Type
Safety Goggles - enough for each student. Consult your local regulations for approved styles.

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CHAPTER VII

Personnel: Their Role

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INTRODUCTION

The organization, implementation, and administration of an elementary industrial arts program requires dedicated personnel and strong leadership. The key to success of the program is dependent upon the philosophy, objectives, and effectiveness of the personnel who are charged with the responsibility of organizing and conducting it. To make the program truly a part of the curriculum, the classroom teacher and the school principal at the operating level are the people who must take the initiative in its operation. This is especially true in smaller school systems. Larger school districts usually employ industrial arts consultants who serve as specialists in the field. They have the responsibility of promoting and assisting classroom teachers and principals with a planned curriculum, continuity, and articulation of the program from grade to grade.

ROLE OF THE CLASSROOM TEACHER

The classroom teacher serves a most important role in terms of being responsible for the incorporation and operation of an elementary industrial arts program. Because of her educational background, the elementary teacher has a thorough understanding of child development and the curriculum to be taught at this level. In addition to this knowledge, the classroom teacher knows her children and understands their individual differences. These factors are very important since this program requires intelligent decisions regarding the nature of the activities to be included, the readiness of the children, the timing of the activities, assignments to children, and the responsibilities that each child can handle successfully. These are very critical phases of designing the teaching plan which will eventually determine the success or failure of the program.

In addition to the classroom teacher's knowledge of the elementary children and curriculum, she must also have a basic understanding of the contributions that industrial arts can make and how it can be integrated into the total elementary curriculum. This means that the classroom teacher will need to be well informed about the philosophy and objectives of industrial arts. The teacher should be skillful in the use of tools, materials and processes, as well as knowing where these materials can be obtained and how to write the specifications for tools and materials to be used. This kind of background requires special teacher education programs or in-service workshops.

Pre-Service and In-Service Education

Teacher education institutions or local school districts should develop specific courses to assist in the preparation of teachers who are already working in a program, and for those planning to enter this kind of program. Essential components of pre-service and in-service programs should include the following (Hoots, 1971):

1. *Philosophical Basis*—The success of any educational program is dependent upon the philosophy of those who are responsible for organizing and conducting the program. Pre-service and in-service programs should assist in developing an understanding of the uniqueness of industrial arts and the elements it provides which can enhance the learning process. Personnel charged with the responsibility of teaching elementary industrial arts must be well grounded in these facts: emphasis is upon the concrete experiences dealing with manipulation and exploration of materials, tools, and processes as well as the problem solving involved in the use of these materials—through these experiences children learn to live effectively in a technological culture—and a dynamic program fosters the development of personal abilities, self concept, and an understanding of the industrial processes and the world of work.

2. *Technological Content*—Teachers of elementary industrial arts need to have a fundamental background of knowledge about technology from which the content for industrial arts is derived. The integration of this content with the elementary curriculum must be investigated to determine what is appropriate for each grade level. Since emphasis is placed on the manipulative methods of teaching, the teacher must be able to select the activities which will promote the best learning experiences.

3. *Tool and Material Experience*—This is a most important component for teachers of elementary industrial arts. Experiences with tools and materials will help them develop the necessary skills and level of confidence needed to feel comfortable working with tools and materials. This phase of teacher preparation should also develop an understanding of the broad range of tools and materials so they can determine what children at various stages of development can use safely and successfully.

4. *Environment for Learning*—The environment is very important and should be one in which children can participate freely in formal and informal learning arrangements. Each classroom must provide for the multitude of ways in which children learn and for varying rates of maturation. Teacher preparation should include lessons which deal with room arrangements including modification of existing classrooms and special rooms.

5. *Opportunity to Apply Learning with Children*—Prospective teachers should have the opportunity to work with children in live situations to obtain the insights needed to successfully plan and operate this program. Visits to programs in operation for observation purposes is also helpful. This gives them a chance to see a variety of organizations, plans, teaching methods, and facilities. An opportunity to apply the theory they have learned in a controlled learning environment under the supervision of their instructor or a master teacher assists greatly in assuring their success as an elementary industrial arts program.

6. *Involvement of Resource Persons*—The use of resource persons can enhance the industrial arts teacher education program. Industrialists, psychologists, ecologists, and sociologists are just a few of the resource people who may be used. A pre-service and in-service instructional program should acquaint teachers with the way resource people can be incorporated into their program.

7. *Involvement of Community Resources, Physical and Human*—Since the education of children at the elementary level should extend beyond the confines of the school, teachers should understand how community resources can be utilized effectively in their program. The teacher education program should show how community resources provide effective learning and also strengthen the relationship between the school and the community.

8. *Techniques for Gaining Administrative Involvement*—The elementary industrial arts personnel must possess a background of knowledge and techniques that will enable them to obtain the necessary support from their administrators and board members. Pre-service and in-service education should include instruction that will assist them in informing these people about the purposes, the functions, the content, the contributions, the potential, the problems, and the costs of elementary industrial arts programs.

9. *Program Evaluation*—An essential part of any educational endeavor is an effective evaluation design. Elementary industrial arts personnel should receive instruction in techniques for developing objective evaluative criteria and the procedure for using them in the classroom. Valid evaluation data that shows significant positive results provides a powerful technique in gaining support from the community, administrators, and board members.

Planning Activity Units

The success of an elementary industrial arts program depends greatly upon the planning of the units to be studied. Keeping in mind that industrial arts activities should be incorporated whenever they can make useful and significant contributions to the curriculum. Since the activities should originate from the curriculum and the organization of the general curriculum varies from school to school, it is impossible to prescribe specific activities. The following outline gives one example of how a unit might be planned.

I. Establish objectives to be achieved.
II. Discuss and plan unit with students (should be done in a democratic manner—using students' ideas).
    A. Assist and guide students in this exercise.
    B. Give thought to ability level, length of time, availability of materials, etc.
III. List possible activities to enrich the study.
    A. Construction activities.
    B. Field Trips.
    C. Resource people.
IV. Organization of class.
    A. Establish committees (if needed).
    B. Make individual assignments (when appropriate).
V. Develop Activities Management Plan.
    A. Assign student assistants.
    B. Explain laboratory procedures.
        1. Tools.
        2. Materials.
        3. Schedule.
        4. Clean-up.
        5. Safety.
VI. Plan necessary demonstrations.
    A. Involving use of tools.
    B. Working with materials.
    C. Construction procedures.
VII. Evaluate progress.
    A. To solve problems.
    B. Discuss what has been learned.
    C. Plan next steps.
VIII. Culminating activities.
    A. Discuss some of the problems and how they were solved.
    B. Point out important things learned and tie together all of the experiences involved in the unit.
    C. Arrive at conclusions and generalizations.
    D. Share the culminating activities with other classes.
    E. Display projects for others to see.

As you can see from the above outline, involvement of elementary industrial arts requires extensive group planning and problem-solving. Organizing the class into groups, committees, and individual assignment responsibilities is a part of the teacher's role. The culminating activities suggested in the outline should also be planned and designed by the teacher and students since it pulls all of the learning experiences into a unified report which is shared with all members of the class and, in many instances, with other classes in the school.

After the teacher has guided the initial planning to the extent that the activities have been selected, she can develop through group discussion the reasons for the planned activities and the values to be derived from them. The next step involves detailed planning with the pupils and the ability to solve problems as they occur during the progress of the project.

Pupil-teacher planning skills are a must to prevent frustration for the students and chaos for the teacher. The teacher who can bring about an understanding as to what is to be done and why it is necessary to do it in a particular way, will have a successful and meaningful unit of study.

The teacher must possess enough background of construction knowledge to exercise good judgment so that the activities planned will not be so complex that the children become impatient and lose interest before they get started. Also, she will need to review, to emphasize, and maybe revise before or during each work session.

Since this type program is informal, noisy, and presents some potential hazards, the teacher must establish safe and orderly procedures with the pupils. This includes distribution of tools, securing and handling materials, preparation of the construction area, storage of materials, and cleanup after each session.

The amount of time scheduled for the activity is most important in order to pace the workshop sessions so that sufficient time is allotted to accomplish the values of this method of teaching. A well planned and organized program allows the teacher time to move throughout the group observing, suggesting, and assisting the pupils. The teacher can focus attention on the various problems being dealt with and insure that everyone is participating and each knows what his responsibilities are. An efficient organization with preassigned duties and prearranged signals can assist in accomplishing the cleanup task in a relatively short period of time. Good work habits can be formed through these procedures.

Evaluation of the constructional activities provides an opportunity for valuable learning experiences. The teacher should evaluate each session including the assessment of each individual, committee and group. Since each individual varies greatly in terms of work skills as well as emotional and social adjustment, the evaluation should be in keeping with the concept of individual differences. The evaluation should be based on progress made to date, the significant problems that have been solved, and those problems which remain unsolved. Also, attention should be given to the progress children make as they work together in sharing materials, tools, and assisting each other with the various problem solving tasks.

A successful elementary industrial arts program not only motivates and improves learning but it also provides an excellent way to promote public relations. The children will be your best ambassadors of good will. They will sell their parents, other students, teachers, administrators and anyone else who will listen to their enthusiastic stories. The teacher can promote the program through displays, programs for the PTA and open house, to mention a few.

ROLE OF THE PRINCIPAL

The principal of the elementary school plays a key role in lending guidance and assistance to the teachers who wish to initiate an elementary industrial arts program. His leadership should provide the teachers with encouragement and the necessary assistance needed to make industrial arts experiences an integral part of the curriculum. The principal who understands the value of the program and believes in the importance of the constructional activities as they relate to the units of study takes the responsibility of selling it to his teachers and the community. The deciding factor in the success of the program may be due to the principal's enthusiasm and firm conviction about the values of industrial arts experiences.

The principal has the responsibility of providing the necessary space, budget, and curriculum for the operation of an elementary industrial arts program. He can create an atmosphere conducive to the implementation of the program by planning and setting up a special room for the construction activities. If a special room is not available he can assist the teachers by planning for utilization of space within the classroom. This program requires a budget that will support the activities. Materials, tools, and storage must be easily obtained so that they do not create additional concerns or burdens on the teacher.

The elementary industrial arts program offers a wonderful opportunity for the school to obtain good publicity. Here again, the principal's role should be one of promoting the values of the program and informing the community about the educational contributions.

ROLE OF THE CONSULTANT

The consultant (sometimes called specialist) can serve to increase the effectiveness of the elementary industrial arts program. He may serve as a resource person to the principal and teachers helping to solve problems in study units when they involve his specialty or he may organize and promote experimental classroom activities which lead to new interests or study units. Although the majority of elementary teachers, by necessity, must work either independently or in groups of two or more, it is generally conceded that the special assistance provided by a consultant can greatly encourage and aid the teacher's efforts. He can provide specialized information concerning tools, materials, and processes. The consultant can also conserve the classroom teacher's time by assisting with the planning, organization, and directing the classroom activities.

The industrial arts consultant must have a thorough knowledge of the elementary school curriculum at the various grade levels. He must also have a fundamental knowledge of: (1) how the elementary school is organized; (2) the growth stages of children; and (3) implications for the use of construction activities that lend themselves to each curriculum area. The consultant must also have a background of knowledge about a wide range of careers and how they can be incorporated into the elementary curriculum. He should be able to assist in the designing of activities which will help students relate the work world to knowledge of self, develop an understanding of work roles and gain an understanding of job families.

Special Preparation for the Industrial Arts Major

People interested in becoming elementary industrial arts consultants should take special courses in the fields of industrial arts education and elementary education. Although certification requirements vary from state to state, most states will approve those who are certified in either field of education. To be successful in this role, however, it is generally agreed that preparation of an industrial arts major in this field should include studies concerning the following topics:

I. Elementary curriculum.
   A. How the elementary school is organized.
   B. Appropriate content and methods.
   C. Evaluation process.
II. Developing an understanding of the elementary school child.
   A. Growth stages of the child.
   B. Learning styles.
   C. Knowledge to be learned at various levels.
III. Elementary industrial arts and its role.
   A. Programs that have operated in the past.
   B. New and innovative programs.
   C. Present day philosophy and objectives.
   D. Contributions to elementary education.
   E. Laboratory activities that contribute to program goals.
IV. Laboratory work.
   A. Appropriate tools and their use by various age groups.
   B. Teaching methods.
   C. Appropriate materials and supplies and their use.
   D. Construction methods for elementary children.
   E. Shop safety.
V. Physical requirements.
   A. Study various work area arrangements.
   B. Plan laboratory areas.
      1. Classroom space.
      2. Special room.
      3. Other work areas.
   C. Tools and equipment needed.
   D. Storage.
      1. Tools.
      2. Supplies and materials.
      3. Projects.
   E. Estimate costs.
VI. The role of a specialist/consultant.
   A. Organizing and implementing programs.
   B. Developing and conducting in-service workshops.

C. Working with teachers and administrators.
D. Promoting the program.
E. Evaluating the program.

Personal Characteristics

Personal characteristics of the elementary industrial arts consultant can enhance the success of the program greatly. He should have a desire to work with people and an ability to get along with those with whom he comes in contact. The ability to get along with children and adults is most important because without this attribute the consultant is of little value to the program. The consultant should possess leadership qualities which provide him with the ability to organize and accomplish problem solutions. Imagination, resourcefulness, enthusiasm, patience, and a sense of humor are most important characteristics since the consultant will come in contact with many different types of people and a variety of work situations. Salesmanship ability is one characteristic which will be needed to sell his type of program to those who do not understand its values and are reluctant to accept these methods of instruction.

Coordinating the Program

The consultant is responsible for coordinating the program in a school system. His position is strengthened if the administrators believe in the program and see need for his assistance. The consultant should be alert to the administrator's feelings toward the program and in situations where there seems to be a negative attitude, he may have to develop an informational approach to sell the program.

Assisting the Classroom Teacher

The relationship between the classroom teacher and the consultant should be one that permeates a friendly, cooperative atmosphere. If the consultant is to be effective, he must be viewed as a fellow teacher with something to contribute rather than as a supervisor. A clear definition of the consultant's services should be given to the classroom teachers and they should be encouraged to use these services. The consultant must learn to deal with the individual differences of the teachers with whom he works.

It is important for the consultant to keep the program flexible in order to meet the variety of requests from different grade levels which may be quite different in approach and scope. He must be able to work with the ideas of others and still be resourceful in providing suggested activities appropriate to the curriculum area and grade level involved.

Obviously, the consultant can be of most help to the classroom teacher in the planning stages of a program. His contact with the teachers may be through a group meeting first and then individually as his services are needed. If the school organization permits, the consultant may be scheduled during the regular school day; if not, the meeting may be held before or after school hours. A sign-up schedule on the faculty bulletin board may be helpful. After the planning sessions the consultant can be helpful in securing materials, tools, and developing the processes to be used. In cases where the teacher has little or no previous industrial arts experience, the consultant may provide advanced instruction to the teacher. In some programs, the industrial arts consultant conducts the constructional activities classes for teachers in their districts which is a very effective method of assisting teachers in the development of construction skills and securing related information.

Probably the most important service provided by the consultant is a program of in-service education for the classroom teachers. Through this program the classroom teacher can be taught the values of elementary industrial arts and how it can be utilized to enrich the curriculum areas. Instruction concerned with the development of tool skills, use of materials, and processes can be given which provide classroom teachers with the encouragement and assurance needed to conduct the program. Through the in-service program teachers can be taught shop procedures, laboratory organization, related information, and how to obtain materials and equipment. This program also provides an opportunity for the consultant and the teachers to discuss problems and their solutions in addition to the opportunity to share ideas.

Promoting Elementary Industrial Arts

A successful elementary industrial arts program requires a good public relations program. The consultant in cooperation with the administrators should sponsor films, displays, and meetings to inform the community about the program and its accomplishments. The consultant should become knowledgeable about the community's industry, products produced, and raw materials. He should develop a good rapport with the community leaders and, in particular, the specialists in industrial fields for the purposes of obtaining speakers for programs and providing field trips.

CONCLUSION

The success of an elementary school industrial arts program is truly dependent on many persons. The classroom teacher, administrator, and industrial arts consultant each have a role to play. When each performs his functions cooperatively with the others a successful and relevant program of elementary school industrial arts will emerge.

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CHAPTER VIII

Teacher Education

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The primary mission of this Chapter is to present an analysis of the methodology used by teacher educators to implement the philosophies and educational goals so well presented in other chapters of this Yearbook. Let us first clarify that until the recent formation of the National Conference on Elementary Industrial Arts in 1971, there was no recognized national definition for the term, "Elementary School Industrial Arts." Therefore, almost every state or school system that included industrial arts as one of its curricular offerings utilized a definition that satisfied local needs and very often presented programs that were far removed from the concepts of "technology and its processes."

Teacher educators have in the past presented the type of program that best suited the philosophies of education fostered in their particular geographic area. This dichotomy of trends was in fact one of the primary reasons for forming the National Conference on Elementary School Industrial Arts. A few of the most common basic philosophies are reflected in course titles which have been offered in teacher education institutions. Examples of these are "Practical Arts for the Elementary School," "Industrial Arts for Children," "Arts and Crafts for the Elementary School," "Elementary School Industrial Arts," "Industrial Arts Consultant in the Elementary School," and many others. Reflecting current trends, courses titled "Careers in Technology for Children" and "World of Technology for Children" and similarly titled courses are being offered. An analysis of these and other courses will further explain the dichotomy of definitions that have existed (and still do exist) in industrial arts programs throughout the nation. A review of a survey conducted by the authors will be presented later in this chapter to indicate the current status of programs offered at teacher training institutions.

Who is Served?

There are two basic groups of students who are offered courses in the area of industrial arts for the elementary school. The first are those majoring in industrial arts and the second group consists of those majoring in elementary education, with some of the colleges offering courses to any non-industrial arts major. Some also offer courses for special education majors. Generally speaking, there are very few teacher education institutions of either industrial arts education or industrial education who are opposed to the concepts fostered by Industrial Arts for the Elementary School. In fact, these writers found no educational leaders who are willing to express negative concerns in relation to this area of curricular content. Unfortunately, the vast majority of teacher education institutions have been very negligent in the preparation and offering of courses to its student population who will be expected to provide leadership in the public schools. Program variations as explained in other sections of this Yearbook indicate how the typical pattern of Industrial Arts for the Elementary School has varied from one part of the country to another and from one philosophy to another. Essentially, the kinds of programs presented at the teacher education level have dealt with the following major areas: (1) Arts and Crafts, (2) Elementary Industrial Arts, and (3) Correlated Industrial Arts. The "Arts and Crafts" program has been designed basically to provide industrial arts majors with the variety of craft type experiences that may be related to activities accomplishable by elementary school children. These courses are isolated from children in that they are taught on the campuses of higher education and provide little knowledge of, or contact with the curriculum that exists in the elementary school. They do, however, serve the purpose of providing an excellent background for avocational or recreational use of tools and materials in a creative endeavor. "Elementary Industrial Arts Programs" can be typically defined as those programs for industrial arts majors which explore the elementary processes of technology in utilizing tools and materials to develop activities for children which are geared to their physical and mental capabilities. These courses are basically skill-oriented and do not take into account the curriculum that exists in the elementary school. They are typically designed as separate offerings for industrial arts majors.

The third general type of course falls in the category of "Correlated Industrial Arts" for the elementary school. This program is presented as part of the general orientation of industrial arts majors to the curriculum of the elementary school. Content is developed by utilizing the elementary school curriculum as a basis for generating interest areas, concepts, and activities. Active involvement is the underlying characteristic of the program and capitalizes on children's natural impulse to investigate and work with their hands. This approach is not generally concerned with skill development nor is its primary goal that of avocational or recreational activities. The fundamental goal centers on concept developments which are inherent in the total educational curriculum and can be strengthened and enhanced through a program of elementary school industrial arts correlated and integrated in regular classroom units of instruction.

Courses offered to elementary education majors typically follow the same general patterns as those offered to the industrial arts majors. Perhaps major differences are that the elementary education majors are fully aware of the curriculum content in the elementary school and need a basic knowledge of tools and materials, and their possible utilization in the classroom. Unfortunately, neither the industrial arts nor the elementary education major can operate successfully within the organization of a typical elementary school without each having an understanding of the other's role within the educational system. The industrial arts teacher or consultant must be knowledgeable and fully aware of curricular patterns and expectations before he can be a positive contributor to the overall program for children. Likewise, the classroom teacher must possess a basic understanding of the potential resources, knowledge, skills, and facilities related to technology. There are very few programs in the country today at the teacher education level utilizing a methodology whereby both the industrial arts and the elementary education departments collaborate to present a united program in "Industrial Arts for the Elementary School." Consequently, the graduates of each of these programs have gone their separate ways in the arena of public education and the full potential of industrial arts at the elementary school level has never really been achieved in the vast majority of our nation's schools.

SUGGESTIONS FOR CURRICULUM DEVELOPMENT

Courses for Industrial Arts Majors

The following suggestions should be considered in developing course content for industrial arts majors. Courses should include:

1. A general orientation to the curriculum of the elementary school.
2. A knowledge of individual roles within the elementary school.
3. Background in human growth and development in early childhood.
4. An opportunity to participate actively with classroom teachers and children, preferably in a public school setting.
5. Opportunities to develop units utilizing resources for activities in industrial arts such as area craftsmen, local industry, local government, and any others available to the schools.

Courses for Elementary Education Majors

It is suggested that the following concepts be considered in preparing course content for elementary majors in the area of industrial arts for the elementary school. Courses should include:

1. A general exposure to tools, materials, and processes applicable to elementary school children, their needs, abilities and interests.
2. A clear understanding of the philosophy involved in correlating curriculum and activities.
3. A clear understanding of planning procedures utilizing the services of industrial arts specialists and other available resources for curriculum enrichment.
4. An opportunity to experiment with unit development in an active elementary school setting, involving administrators, teachers, and children.
5. An awareness of the basic vocabulary and understandings associated with our industrial society, its materials, occupations, processes, products, and problems.

TEACHER EDUCATION INSTITUTION SURVEY

In order to ascertain the status of Elementary School Industrial Arts programs being offered in the teacher training institutions in the United States, a questionnaire was sent to all institutions listed in the *1969-70 Industrial Teacher Education Directory,* of the American Council on Industrial Arts Teacher Education. In November 1971, a letter containing a definition of Elementary School Industrial Arts and other information related to completion of the questionnaire, together with several copies of the questionnaire for each course, and a self-addressed envelope, were sent to each of the 209 institutions listed in the *Directory*. Respondents were asked to indicate courses offered that provided experiences and understandings as defined.

Definition of Elementary School Industrial Arts

The definition of Elementary School Industrial Arts as used in the questionnaire was that formulated by the National Conference on Elementary School Industrial Arts.

> Industrial Arts at the elementary school level is an essential part of the education of every child. It deals with ways in which man thinks about and applies scientific theory and principles to change his physical environment to meet his aesthetic and utilitarian needs. It provides opportunities for developing concepts through concrete experiences which include manipulation of materials, tools, and processes, and other methods of discovery. It includes knowledge about technology and its processes, personal development of psychomotor skills, and attitudes and understandings of how technology influences society. (Hoots, 1971, p. 3)

Institutions Offering Courses

Of the 209 institutions receiving the questionnaire, responses were received from 103, a forty-nine percent (49%) return. Of the 103 responding, 80, or seventy-eight percent (78%) indicated that they did offer some type of coursework in Elementary School Industrial Arts as defined. At the eighty institutions indicating coursework in Elementary School Industrial Arts, a total of 125 individual courses was offered. A listing of the various courses did include titles such as Manuscript Writing, Photo Technology, and Industrial Leather. However, the majority of courses included specific reference to the elementary school and/or children in the course title.

Number of Courses Offered

Table 1 shows the number of elementary school industrial arts courses offered in the 103 institutions responding to the questionnaire.

Table 1

NUMBER OF COURSES OFFERED IN COLLEGES AND UNIVERSITIES

	Number of Courses Offered in Elementary School Industrial Arts						
	1	2	3	4	5	6	7
Number (80) and Percentage of Institutions Offering Courses	N=58 72.5%	N=11 13.7%	N=7 8.8%	— —	N=2 2.5%	— —	N=2 2.5%

Institutions Offering One Course

The following data was obtained from the 58 institutions offering one course in elementary school industrial arts.

Table 2

COURSE PATTERNS USED BY INSTITUTIONS OFFERING ONE COURSE IN ELEMENTARY SCHOOL INDUSTRIAL ARTS

	Course Required	Free Elective	Course Required for Ind. Arts Majors	Course Required for Elem. Ed. and Spec. Ed. Majors	Course Required for Ind. Arts, Elem. Ed and Spec. Ed. Majors
Institutions (58)	25	33	6	17	2

In regards to the level at which this course is offered, seventeen (17) institutions offer the course at the freshman or sophomore level, while thirty-seven (37) institutions offer it at the junior or senior level. Four (4) institutions offer the course at the graduate level. These fifty-eight schools offered 231 sections, enrolling 5354 students during the 1970-71 school year.

Institutions Offering Two Courses

The following data was obtained from the 11 institutions offering 2 courses in elementary school industrial arts.

Table 3

COURSE PATTERNS USED BY INSTITUTIONS OFFERING TWO COURSES IN ELEMENTARY SCHOOL INDUSTRIAL ARTS

	Both Courses Required for I.A. Majors	One Course Required for Ele. & Spec. Ed. Majors	Both Courses Elective for Ele. & Spec. Ed. Majors	One Course Offered as an Elective for I.A. Majors
Institutions (11)	1	2	8	6

Four of the total of 22 courses offered by these schools were available to freshmen and sophomores; six only to juniors; three only at the graduate level and the remainder for sophomores and above. The eleven schools providing 22 courses, offered sixty-five (65) sections of these courses and enrolled 1274 students during the 1970-71 school year.

Institutions Offering Three Courses

Seven institutions offered 3 courses in elementary school industrial arts. The status of these 21 courses is described in Table 4.

Table 4

STATUS OF COURSES ASSOCIATED WITH THE 7 INSTITUTIONS OFFERING 3 COURSES EACH

	Required of I.A. Majors	Required of Elementary and Special Ed. Majors	Elective for I.A. Majors	Elective for Ele. & Spec. Ed. Majors
Number of Courses (21)	4	3	10	16

Four of the twenty-one courses are open to freshmen and above, three to sophomores and above, one to seniors and graduate students. Six are available only to graduate students, and the remainder, seven, are open to juniors and seniors. These seven schools, offering 21 courses, enrolled 1387 students in sixty-seven sections during the 1970-71 year.

Institutions Offering Five Courses

Two institutions offered 5 courses in elementary school industrial arts. The status of these 10 courses is described in Table 5.

Table 5

STATUS OF COURSES ASSOCIATED WITH THE 2 INSTITUTIONS OFFERING 5 COURSES EACH

	Required of Special Ed. Majors	Elective for I.A. Majors Only	Elective for Elem., Spec. Ed., or I.A. Majors
Number of Courses (10)	1	2	7

None of the courses is available for freshmen, only one is open to sophomores, three only to graduate students, and the remainder open to juniors and above. Twenty-five sections of the ten courses were offered in the school year 1970-71 enrolling 568 students.

Institutions Offering Seven Courses

Two institutions offered 7 courses in elementary school industrial arts. The status of these 14 courses is described in Table 6.

Table 6

STATUS OF COURSES ASSOCIATED WITH THE 2
INSTITUTIONS OFFERING 7 COURSES EACH

	Required for I.A. Majors	Required for Elem. and Spec. Majors	Elective for I.A. Majors Only	Elective for Ele., Spec. Ed., or I.A. Majors
Number of Courses (14)	1	2	5	6

None of the courses was open to freshmen; three courses open only to graduate students. Eight were available to sophomores and three to juniors and above. Thirty-five sections of these fourteen courses were offered in 1970-71 school year enrolling 739 students.

Enrollments Survey

Table 7 attempts to summarize data concerning course sections offered and students served in elementary school industrial arts during the 1970-71 school year.

Table 7
NUMERICAL DATA CONCERNING NUMBER
OF COURSE SECTIONS AND STUDENT ENROLLMENT

Number of Courses Offered in Elementary School I.A.	Number of Institutions Offering Courses	Number of Sections Offered 1970-71	Number of Students Enrolled
1	58	231	5354
2	11	65	1274
3	7	67	1387
4	—	—	—
5	2	25	568
6	—	—	—
7	2	35	739
TOTALS	80	423	9322

Table 8 shows the scheduling patterns used by the 80 institutions offering elementary school industrial arts during the 1970-71 school year.

Table 8

SCHEDULING PATTERNS OF INSTITUTIONS OFFERING ELEMENTARY SCHOOL INDUSTRIAL ARTS COURSES

	Number of Sections Offered 1970-71		
	1-5	6-10	11 or More
Number and Percentage of Institutions Offering Coursework in Elementary School Industrial Arts	N=48 60%	N=15 18.8%	N=17 21.2%

Four institutions: Ball State University, Muncie, Indiana; Northern Illinois University, DeKalb, Illinois; Kent State University, Kent, Ohio; and St. Cloud State College, St. Cloud, Minnesota, each account for over 23 sections and enrollments in excess of 500 students in the 1970-71 school year. Two of these schools, Kent State and St. Cloud, offer only one course at the undergraduate level, while Ball State offered three courses, and Northern Illinois four courses.

Required or Elective

Table 9 and 10 illustrate the degree to which elementary school industrial arts coursework is either required or offered as an elective.

Table 9
INSTITUTIONS REQUIRING ELEMENTARY SCHOOL INDUSTRIAL ARTS COURSEWORK

Coursework in Elementary School I.A.	Number of Institutions Requiring Coursework	Percentage of Institutions Requiring Coursework
Required for I.A. Majors	11	13.7%
Required for Elem. Ed. Majors	15	18.7%
Required for Spec. Ed. Majors	10	12.5%
Required—Major Not Specified	4	5.1%
Totals	40	50 %

Table 10
INSTITUTIONS OFFERING ELEMENTARY SCHOOL INDUSTRIAL ARTS ON AN ELECTIVE BASIS

Coursework in Elementary School Industrial Arts	Number of Institutions Offering Elem. School I.A. as an Elective	Percentage of Institutions Offering Elem. School I.A. as an Elective
Elective for I.A. Majors	45	56.2%
Elective for Elem. Ed. Majors	51	63.7%
Elective for Spec. Ed. Majors	37	46.0%
Elective for Either I.A., Elem., or Spec. Ed. Majors	29	36.2%

Of the institutions offering work in Elementary School Industrial Arts, only five have both required and elective courses for industrial arts majors, while three have both elective and required courses for elementary education majors.

Place in Student's Program

In seventeen schools, 21.3 percent, coursework was offered as a part of a sequence of courses, either as a part of the industrial arts or elementary education curriculum. Sixty-two, or 77.5 percent, indicated that the course was offered as a single course and not as a part of a series of courses in the major. One school did not answer the question.

Level Offered and Availability

Coursework was offered at all levels, freshmen through graduate. In exactly half, 40 schools, coursework was offered only at the undergraduate level. At thirty of these schools the course was offered at the junior, senior level. Four institutions indicated that they offered work only at the graduate level. Thirty-eight schools, 47.5 percent, offer courses each session, some including in-service and off-campus; while sixteen, 20.0 percent, offer work as in-service only, and the same percentage only offer off-campus work. Five schools offer courses only in the summer.

Public School Involvement

Forty-six institutions indicated that they had some involvement with public schools in connection with their Elementary School Industrial Arts coursework. In thirty of the schools, 37.5 percent, the coursework in Elementary School Industrial Arts required direct involvement in the elementary school classroom. Nineteen of these institutions involved elementary school children, teachers and facilities while four schools involved children and teachers only. Seven institutions involved only the classroom teacher while three schools make use of the facilities of the elementary school and involve the classroom teacher, while three other schools only make use of the elementary school facilities for teaching purposes. In only 19 schools is there opportunity for industrial arts majors to have student teaching experiences in the elementary school classroom.

Lecture/Laboratory Ratio, Course Credit

Thirty-two courses, 25.6 percent, schedule equal time for lecture and laboratory work. In only four courses, 3.2 percent, is there more lecture time than laboratory time scheduled. These courses were offered primarily for graduate students. Eighty-nine of the courses, 71.2 percent, scheduled more laboratory time than lecture time. In the vast majority of these courses, the ratio between lecture and laboratory time was between two and five to one. One course scheduled eight laboratory hours for each lecture hour and one course was scheduled on a ten to one ratio. The majority of schools responding, 66.2 percent, operate on the semester basis. These schools offer between 1-3 hours of credit, with three courses at four semester hours of credit. Twenty-seven schools, 33.8 percent, operate on the quarter system, with the majority offering 2-4 quarter hours of credit. Six courses earned five quarter hours of credit.

Course Development

In all institutions offering Elementary School Industrial Arts coursework, the course was developed and was being taught by the industrial arts, industrial education or vocational education department, depending on the administrative structure of the particular institution.

CONCLUSION

Perhaps the most essential concept being developed in this dialogue is "relevance." No teacher education program is worth the paper it is written on unless the student can identify with it a relevant application to the theories being taught. No amount of theoretical classroom development, model building, or project construction can ever come close to the type of learning developed through contact with classroom teachers and children in the unfolding of units as they become meaningful learning experiences for all. Teacher education programs should be designed not only to support the systems in local communities, but to provide research and development of new methodology. They should also be vitally concerned in providing programs with relevant content so that a smooth transition can be achieved from the world of school to the world of people and the world of work. A great deal of interdepartmental dialogue needs to take place to eliminate the artificial barriers developed in education by compartmentalization of subject matter into neat little packages. Realistically, life outside the school in our society is not divided into such segments of activity, but rather a blending of total experiences.

Recently, developments in the area of career education have had an impact on teacher education. Many departments, including industrial arts, are now beginning to communicate with each other in role identification for the various specialties in the total career education program. Admittedly, the total curriculum in industrial arts from K-12 has been work oriented, including "awareness" at the elementary level; "exploratory" at the middle and junior high level, and some "skill development" at the secondary level. Historically, industrial arts has covered the area of technological enterprise that constitutes a great percentage of our work force, namely, manufacturing, communication, construction, and other *technological* aspects of our society. Unfortunately, a review of approximately 30 exemplary programs for career education indicates that over half are utilizing industrial arts activities in grades K-6 as the basis for career education at the "awareness" level. This statement is prefaced by the word "unfortunately" because although industrial arts is a very important phase of career education, it is by no means the total effort in terms of breadth and societal involvement in the world of people and work. Every segment of the elementary school curriculum is a potential source for development of awareness in reference to career education. The responsibility for developing materials cannot and should not be assigned to any particular discipline.

Teacher educators have before them a much wider horizon in the area of Industrial Arts for the Elementary School. Trends for the future indicate that career education will call on all disciplines to contribute vital roles in the development of experiences for children which will culminate in a broad program of awareness of self and others at the elementary school level. Industrial arts teacher educators cannot ignore their responsibilities to provide those unique experiences and understandings associated with elementary school industrial arts that can contribute to the development of a total program which will better meet the needs of youth in the schools of our nation.

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CHAPTER IX

Historical Reflections

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SKILLS IN PRIMITIVE LIFE

The teaching of technology as a part of man's knowledge began when early cave man taught his son to master the skills needed for survival. In that day this learning became necessary at a very early age. Through the periods of history the techniques and materials man needed for productive living evolved into a very complex system. It is the purpose of this chapter to examine some of the underlying purposes and outcomes of the procedures used and more especially to look at the development of the most significant events that took place that influenced the methods used to teach young children.

SKILLS OF EARLY MAN

It is quite evident that man developed skills that were very close to his primary needs to sustain life. Realizing the importance of these skills of hand he must have transmitted this feeling to his offspring by using some form of instruction.

> But even under these circumstances one must think of education in the crafts in terms of present methods of learning. The process of imitation became conscious; but never as common practice did primitive life reveal a rationalized process of instruction (Bennett, 1926, p. 12)

The process of unconscious imitation doubtlessly played a large part in the learning procedures as practiced by early man. It is amazing to examine some of the fine pieces of craftsmanship that were produced by early civilizations, realizing that no organized method of teaching the skills involved was in use at this period in history.

All the arts and crafts and technical abilities of primitives are relative to their environment, but everywhere the excellence with which they perform the activities necessary to supply their economic wants is remarkable. Snares, traps, bows, arrows, spears, and nets, for instance, are needed by hunters and fishermen; gardening implements are needed by gardeners; many household utensils are needed by the women. Primitives are adept in making these tools, but specialization in the arts and crafts is decidedly rare, although a few men and women, in an occasional tribe specialize in a few crafts, and the children pursue the same occupations as their parents. (Thurnwald, 1932, pp. 33-34.)

The effectiveness of the methods that were used in earliest times must have had much that proved to be everlasting. In this field of informal primitive education there operated, in a very real sense, that activity school of which our modern educators speak so frequently and enthusiastically. For those who are interested in teaching technology to children there is in this primitive era the very obvious truth that the activities employed in childrens' play are necessary to foster skill development in later years.

THE VALLEY OF THE NILE

The land protected from invaders by deserts and the sea became the seat of the great Egyptian culture. The skill developed by the followers of Osiris never ceased to amaze those who appreciate fine work. In the exhibition of treasures from the tomb of King Tutankhamun held in the British Museum in 1972 people from all over the world stood in line for hours in order to see the exquisite pieces of work produced by the artificers who fashioned them in 3000 B.C.

The Egyptian method of training may be thought to be the forerunner of the medieval guild system. Fathers taught their sons in a particular craft and standards dictated that a concerted effort in one area was necessary to achieve proficiency in the art. Those who would venture outside a particular specialization would be punished. Skill in technique and the preparation of materials were family traditions that were closely guarded. (Erman, 1894, p. 163)

The development of graphic representation led to the symbolic representation of information. The scribe gained stature and besides his apprenticeship to the master scribe he was required to spend some time engaged in a major written work to gain experience in his craft. (Ogg, 1948, p. 41) The use of papyrus was reserved for the use of the scribes that reached a certain degree of proficiency. (Ogg, 1948, p. 61) The production of written material also made possible the teaching and learning procedure of a more academic nature. Papyrus scrolls were stored in stone jars thus establishing the library. However, in teaching skills involving techniques the "hands on" method of dealing with tools and materials was of major concern. The basic procedure of learning by doing was uppermost. (Woody, 1959, p. 58)

THE BABYLONIANS

A civilization, starting with the Sumerians, flourished between the Tigris and the Euphrates rivers where there was plenty of rich soil and water to nourish the crops. Just as Egypt was the product of the Nile, this land to be developed by the Babylonians was the product of the rivers which flowed on either side of it.

Neither metal nor stone were to be found in this valley and timber did not exist in great amounts. The Babylonians, using available materials, had to turn to the soil and therefore became makers of ceramic building materials. They learned to make bricks, which were baked in the sun. Later they developed primitive furnaces in which they burned the clay to produce a more durable product. (Woody, 1959, pp. 76, 79)

They worshiped many gods and those who were more learned were set apart as their leaders. The museum at the University of Pennsylvania has in its collection tablets of clay that have imprinted upon them writings that were found in this land and were produced in 2200 B.C. Maspero says that "every workman taught his own trade to his children and these in turn would instruct theirs; families which had an hereditary profession, or from generation to generation had gathered bands of workmen about them, formed themselves into various guilds, or, to use the customary term, into tribes, governed by chiefs and followed specified customs. The women of lower-class families who bore the burden of all household labor, must have trained their daughters by an informal apprenticeship to do the physical tasks they were to perform, even as masters trained boys in their shops." (Maspero, 1901, p. 751)

THE ORIENTAL PEOPLE

The orientals have had a very rich development in technological areas about which we have very little knowledge. They evidently have had an efficient means of teaching their children how to master the skill their industries have needed through the years. One of their techniques of teaching a manual skill has been adopted by Americans today, namely the method used to teach young children to play the violin. In this system the parent of the child studies the works with the child in the learning process. This procedure may hold some hidden value in structuring techniques that may be used in teaching any technology. This method does not seem too far removed from other early civilizations that used similar means of transmitting trade skills from father to son. There may be much to learn from the methods used by orientals that present-day scholars may find a means of applying to current educational practice.

GREEKS AND ROMANS

In early Greek culture the craftsman was held in high regard but in later years his position in society was relegated to the position of a slave or was designated as "banausic" (merely mechanical). With this attitude toward hand work little or no provision was made for those youths of the upper classes of society. Socrates (470-399 B.C.) explained the reason for the attitude of contempt toward the mechanical arts when he stated that "in some cities, especially in those that were considered to be strong in war, no citizen is permitted to work at any banausic craft." (Bennett, 1926, p. 15)

With all the stress on physical fitness and preparation for war it is evident that "neither physical fitness or intellectual, aesthetic, and political qualities, cultivated in palestras, gymnasia, and in the school of life, which Pericles so much extolled, were competent to preserve her." (Woody, 1959, p. 467)

The Roman children were taught in much the same way as the Greeks. Major emphasis was on training to supply the needs for their military efforts. The boys were under the supervision of their fathers while the girls were taught spinning, weaving, and other household arts by their mothers. Many games involving physical activity such as running, throwing, juggling, and balancing were a valuable part of child activity.

LEADERS OF SIXTEENTH, SEVENTEENTH, AND EIGHTEENTH CENTURIES

Following the early civilizations the arts and skills of man were propagated by guilds which were associated with monastic movements. Since writing as a means of communication had now spread throughout Europe, many monks were engaged in crafts associated with manuscript production. The production of books was of course the greatest single factor leading to schooling that was eventually to affect the lives of children. In this period any teaching of children about the skills associated with the technology of the age were still carried out within the home of the child's family. (Bennett, 1926, pp. 18-22)

Francis Bacon (1561-1626)

One of the first men to see that worship of the past was a serious hindrance to progress was Francis Bacon. He saw the study of nature as a sense experience and through this process introduced the experimental method of inquiry which has been one of the goals of industrial arts in the elementary school through the years.

John Amos Comenius (1592-1670)

Another leader, born in a Moravian village and educated in Germany, who became a teacher of note was John Amos Comenius. He contributed to education through his writings; especially significant to us is *Orbis Pictus.* In this book he placed pictures of objects with their Latin names. This book, demonstrating the power of graphic representation earned for him the name of the father of audio-visual instruction. This book further demonstrated his philosophy that "the child perceives through the senses; everything in the intellect must come through the senses." (Bennett, 1926, pp. 36-39) Comenius believed in infant schools for young children with a rich program of sensory experiences. Bacon said "knowledge is power" and Comenius added "and thus acquire the power to remedy all the ills of life and society." (Mulhern, 1946, p. 336)

John Locke (1632-1704)

The formation of the Royal Society in London was the beginning of the period of scientific discovery in England. One of the most striking educational products of this period were the writings of John Locke. His publication of *Some Thoughts Concerning Education* was probably the reason for his being made a Fellow of the Royal Society in 1668. (Bennett, 1926, pp. 60-61)

In his writings he stresses the necessity for the development of the physical body, especially in early childhood, which he termed the "hardening process." His work was recognized by the medical students at the time and also influenced those who formulated psychological publications in England. He saw verbal learnings as "learned gibberish" and said that "things are the only reality," and believed that "it is with these objects of sensation that reason works." He also associated morality with the experiences gained from the physical world.

> Man has the power, however, to draw useful inferences from the data of sensation and, using his experience, to achieve a practical morality.— —and use his natural facilities to acquire sufficient knowledge to live well and agreeably with others. (Mulhern, 1946, p. 341).

Jean Jacques Rousseau (1712-1778)

A Frenchman who became familiar with the writings of John Locke, Rousseau had had many unfortunate experiences in his early life. He set about to break down the walls of educational formalism by writing his feelings about the system. Jean Jacques Rousseau in the publication of *Emile* set forth the philosophy that the child should have little to do with books until he had a great deal of experience in a natural environment. Being an exponent of the theory that learning is best accomplished by doing, he thought that one hour of work would be equivalent to a whole day of verbal instruction. He said "a student should be made to work like a peasant and think like a philosopher or he may become as idle as a savage." (Bennett, 1926, p. 80)

Rousseau continued to build upon theories proposed by earlier leaders who saw much value in training of the senses through contact with things and activity in connection with them. His program for children would include the utilization of drawing and music, the manipulation of three-dimensional materials and the use of tools in learning to develop the whole child.

Johann Heinrich Pestalozzi (1746-1827)

Influenced by Comenius and Locke there arose another in Switzerland dedicated to the belief that education could bring about human and social change that would lead to reform the world. Johann Heinrich Pestalozzi, who became known as the father of manual training, made several unsuccessful attempts to establish schools for poor children before he finally gained recognition as a leader. His work grew out of his benevolent spirit to help others. His philosophy stressed the need for learning to follow the practical experience that came from involvement with things. "Doing leads to knowing." "There are two ways of instructing, either we go from words to things or from things to words. Mine is the second method." (Bennett, 1926, p. 119)

Pestalozzi introduced models to be used as aids in instruction when he was unable to have children gain firsthand experience working in fields or workshops. His teaching placed great improtance upon the moral and social lessons that were related to hand work. The schools he established at Neuhof and Burgdorf gained attention because of the social implications that were involved. His schools succeeded largely because of his hard work and dedicated spirit but he found it impossible for poor children to earn their living and become well educated through the hand work.

Friedrich Wilhelm Augustus Froebel (1783-1852)

The direct heir to the ideas of Pestalozzi was Friedrich Wilhelm Augustus Froebel, a German who introduced the doctrine of self-activity. His theory was carried out in an environment which in 1840 was first accepted and called a kindergarten. Children grow and blossom much the same as plants if they are placed in the proper atmosphere. His most important work was done after he had gained a varied experience and published his book *The Education of Man* in 1826. (Bennett, 1926, p. 163) Most significant to us is the importance of the use of many three-dimensional materials that he gave children to use to foster their growth and development. He was one of the first to recognize individual differences and prescribe different materials to meet individual needs. It is also noted in his writings that he felt children should be encouraged to grow creatively, breaking away from theories that prescribed the same for all, and expecting the same from all.

SYSTEMS FROM ABROAD

Hand Work of the Children of England

England has always had a good share of master craftsmen and thus her children have always been taught to respect the effort of the skilled hand. As a part of the curriculum for elementary children it was not given much consideration until recently. Because of the class levels and the thought that existed during the latter half of the nineteenth century that hand work was thought to be only appropriate for the children of the poor. In the schools that they attended a certain amount of time was spent in farm work and gardening for the boys while girls were engaged in cooking, sewing and housework. (Bennett, 1926, p. 233)

The industrial revolution brought with it a decline in the quality and design of man-made products. There arose at this time a movement to improve the design of graphic and home furnishing items and this was championed by William Morris (1832-1896). He was a very versatile person who had studied architecture and was interested in all the decorative arts. Sir Sidney Cockerell said of Morris:

> He is indeed utterly unlike anyone I have encountered. There was nothing petty in his nature. He was self-sufficient, but was not self-centered, though he became utterly absorbed in any work on which he was engaged. His industry was amazing —his output was that of twenty men. And yet he never was too busy to see a friend. (Blunt, 1965, p. 48)

The English craft movement in the schools came about because Morris gained the respect of the educational leaders of his day. There was enough written to have its influence felt in America. The emphasis was on design and craftsmanship, with the stress on developing skill with hand tools. The term crafts is still used to describe shop work in English schools today. The College at West Dean established in 1970 has as its sole purpose the preservation of English arts and crafts.

The primary schools with the new philosophy of "open education" include constructive activities that seem to be a carryover of the type of work British craft classes performed. Teachers as well as children construct models, instruments, and tools that are used to give added meaning to learning experiences. There is much improvising with the simple materials at hand especially those found in the immediate community. These schools have attracted much attention to the extent that teachers and students of elementary education from American campuses have literally flocked to England to see the program in action. (Evans, 1971, p. 265)

The "adventure playgrounds" are another recent innovation that have shown how children can be provided with an atmosphere that encourages creative activity. With a few hand tools children are encouraged to build using discarded materials: boards, boxes, tires, sheet metal, rope, bricks, and a host of other items. These are supervised by trained leaders and are to be found in open areas throughout the large cities of England. (Murrow, 1971, p. 221)

A look at present-day innovative practice in British schools gives one the feeling that we with all our emphasis on technology could well temper our programs with some of the humanistic quality that prompt English teachers to say "children come first."

Technical Education for the Children of France

A change in educational thought accompanied the French Revolution. As in other European countries earlier schools were largely associated with the church and were concerned with the education of the upper classes of society. Schools for the children of the poor were brought about after the revolution. These children were obliged to work as they always did but schooling for part of the day was made available to them by the leaders of the new social order.

A significant observation was made concerning the learning that took place for those who attended schools full time compared to the achievements of children who were compelled to work half of each day:

It has been remarked that children who for half of the day are subject to the discipline of the workshop, pay great attention to their lessons at school, and acquire the instruction they're given about as rapidly as those who go to school the whole day. (Bennett, 1926, p. 275)

After the early guild system which preserved early craftsmanship was broken down it was quite obvious that men of the trades lacked the ability to produce fine work and were unable to design and build as well. As result drawing and technical training were introduced by those who planned the curriculum of elementary schools. There was a part of the curriculum for all children that dealt with creative manipulative work and little concentration for the few who were exceptionally talented. This was the trend that was taking place in all European countries at the time and may be said to be the reason for the change in the quality of craftsmanship that was taking place. The workers that emerged from the French technical schools did not produce the masterpieces that were turned out by the craftsmen who were employed by the royal families.

It is obvious that a change in the method of training had also produced a marked difference in the method and quality of production. The fact mentioned earlier concerning the learning of those that worked in the shops is also significant. Those children who worked part of the day were motivated in some way to apply themselves when the opportunity to attend classes was made available. Children seem to need the change of pace or a variety of activity which work with tools and materials seems to furnish.

Sloyd from Scandinavia

The Sloyd system that came to us from the Scandinavian countries was the result of a much more formal system that was being used in Russia. It consisted of a series of models made from wood. Uno Cygnaes (1810-1888) of Finland modified the Russian system to include the making of objects from wood that would involve tool operation in producing items which were of more practical use. The emphasis was on manual dexterity rather than the production of skill as a craftsman, to develop native capacities and to provide an outlet for children to put native ideas into external form. This method was the result of the earlier teaching of Froebel in his theories of motor expression. The elements of the Sloyd system were first shown in America during the Centennial Exposition in Philadelphia held in 1876. The report of the exposition given by President Runkle of M.I.T. to his board of trustees said the purpose of the work was: "not to fit the pupil for a particular trade, but to develop the bodily and mental powers in harmony with each other." (Mulhern, 1946, p. 480)

This was a revolutionary movement for the schools of America where heretofore education was chiefly a literary and intellectual process. By 1900 the manual training method which was the name applied to the work introduced as Sloyd, was rather widespread especially in the larger cities.

The Influence of John Dewey

The belief that it is essential to keep children busy is probably as old as teaching. This, however, did not necessarily agree with the child's feelings regarding the purpose for life.

Unfortunately, some teachers used manual training activities simply to keep children busy with little regard for the learning that could be associated with hand work. There emerged on the American scene at this time a man by the name of John Dewey (1859-1952), who was destined to give new impetus to the "experience" concept of learning in education. His philosophy is simply stated in the phrase "learning by doing."

> In education, action should hold the primary place. Education is purposeful activity in the solution of problems recognized by pupils as worthwhile, and involving reflection as to means, ends, and consequences of one's actions. The activity must be inspired, not by the teacher, but by the pupil's own feelings of need for a solution of a problem. It must arise freely and spontaneously out of a life situation. (Mulhern, 1946, p. 484)

Two people who were greatly influenced by the teaching of Dewey were Bonser and Mossman of Columbia University who did much to implement his theories through the publishing of the book *Industrial Arts for the Elementary School.*

The book suggested that much learning could be associated with activities related to six areas, namely: food, clothing, shelter, tools, utensils, and records. (Scobey, 1968, p. 5)

The book by Miller and Smalley, *Selected Readings for Industrial Arts,* contains a chapter that outlines Calvin M. Woodward's philosophy and re-evaluates the earlier concepts that were set forth by previous leaders in the field. He held that "It awakens a lively interest in school, and invests dull subjects with new life." (Miller and Smalley, 1963, p. 22) Educators were becoming more conscious of the association between "the cultured mind and the skillful hand." (Miller and Smalley, 1963, p. 29) Woodward concludes his treatise by saying that "intelligent citizenship is one of the fruits of manual training."

For obvious reasons the programs in individual schools differed widely. Resourceful teachers saw the value of including work with tools and materials. Teachers of industrial arts in junior and senior high school gave some help to elementary teachers who sought their assistance but for the most part their lack of understanding in the field of elementary education and child development was a disadvantage in this situation. In some cases school districts employed a person to act as a specialist who would assist elementary teachers to carry on industrial arts work in their classes or in a special laboratory. Many specialists did not know the exact purpose the teacher had in mind and therefore a good correlation associated with the major aims of the learning environment was not realized.

Many will agree that a good course in industrial arts required for all elementary teachers would make great strides toward improving instruction that is sorely needed to educate children to live in this technological society. This being true and with specialists to aid in supplying the extra assistance needed to coordinating the entire facility, much more could be accomplished.

The Council for Elementary School Industrial Arts

For many years prior to 1958 there was no effort made to coordinate the existing programs and administer any evaluative criteria. The American Industrial Arts Association was interested and published articles in their magazine and included programs at their conventions for those working in elementary school industrial arts.

Largely through the efforts of Elizabeth Hunt a group of interested members of the American Industrial Arts Association met at the St. Louis convention in 1962 and became charter members of what was to become the American Council for Elementary School

Industrial Arts. This council became active and has been striving to coordinate their effort to provide leadership for those who teach children industrial arts in the elementary school.

Since its beginning the council has provided direction in the form of publications, convention programs and special meetings with emphasis on industrial arts for young children. Many of the members of the council have become authors of books that have provided much needed help for those who were unable to secure guidance in their areas. One of the major projects of the Council was to publish a bibliography compiled by Arthur Stennard which contains an extensive list of books dealing with Industrial Arts in the Elementary School. It is available from the office of the American Industrial Arts Association in Washington.

Under the leadership of Dr. William Hoots, a number of leaders in the field held three two-day conferences in 1970 at which time an effort was made to evaluate work being done and to formulate a new set of objectives for elementary school I.A. Out of these conferences came the publication: *Industrial Arts in the Elementary School: Education for A Changing Society,* (Hoots, 1971)

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CHAPTER X

Philosophical Positions

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The history of man has never experienced such rapid and dramatic change as that which has been caused by technology. It has invaded man's life, bringing him many advantages which were not even within his realm of conception a few years ago. This fast, dramatic, and forceful change has affected his way of life, his values, and his educational needs.

Change has affected some aspects of man's existence more than others. The most evident result is in the nature of technological products and services; the least apparent is in education and government. Between these two extremes lie social changes in the home, the church, and other social agencies.

Conceived at the beginning of this technological revolution, modern industrial arts for elementary school children has lived through this period of change. As a segment of education, industrial arts has been affected only nominally by the technological revolution; but its subject matter, which is technology itself, has undergone considerable transformation that has had an influence on the various philosophical points of views.

Some scholars trace the beginning of elementary school industrial arts to the early nineteenth century and Froebel's work in the German kindergarten, but the program did not develop as a real definable aspect of the modern school curriculum until the beginning of the twentieth century through the work of such people as James E. Russell and Frederick G. Bonser. The discussion in this chapter will begin with a look at the past philosophical points of view, beginning with the Russell-Bonser era and covering a number of earlier approaches. Following will be a presentation of some present practices of industrial arts programs in the elementary schools; a discussion of the future trends in elementary school industrial arts; and, finally, the formation of some conclusions with regard to the emerging philosophical trends for elementary school industrial arts.

PAST

The work of Dr. James E. Russell and Dr. Frederick Gordon Bonser at Teachers College in the early 1900's did much to establish the first philosophical base for industrial arts in the elementary school. Their "Speyer School Curriculum," published in 1913, was the first published course of study based on the philosophy that industrial arts should be a subject dealing with fundamental industrial processes. This philosophy received further refinement and elaboration by Dr. Bonser and Lois Mossman in their publication, *Industrial Arts for Elementary Schools,* published in 1923. The basic points underlying the Bonser philosophy can be summarized as follows: (Bonser & Mossman, 1924)

1. Industrial arts is a subject matter discipline and has its own unique body of content.
2. Industrial arts derives its content from industry, with emphasis on man's changing of raw materials into useful products, from the life related to these changes, and from the consumer aspect of utilizing these products.
3. Industrial arts is a part of the total school curriculum and has a close relationship to the other subjects within the curriculum.
4. The elementary school classroom teacher must provide industrial arts instruction at the elementary school level.

The Subject Matter of Industrial Arts.

Most who have studied the history of industrial arts, at one time or another, have been required to memorize Bonser's definition of industrial arts. However, it seems appropriate at this point to repeat this definition. (Bonser & Mossman, 1924, p. 5)

> The industrial arts are those occupations by which changes are made in the forms of materials to increase their value for human usage . . . Industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes.

Bonser sees two purposes for studying industrial arts: a vocational purpose and a general education purpose. What he terms the vocational purpose is very similar to that which is today considered vocational education, and what he terms the general education purpose is very similar to that which is now considered industrial arts; it is the general education purpose that will be considered here. Bonser states:

The purposes . . . of the general education studies are realized in the degree in which it helps one become efficient in the selection, care, and use of the products of industry, and to become intelligent and humane in the regulation of control of industrial production . . . it concerns itself with such common daily needs of life as the selection of the use of food, clothing, utensils, household furnishings, and other products of industry; and to such problems of citizenship as call upon us to share in the regulation of industry, so that all employees, employers, and citizens may recieve just and fair treatment. (Bonser & Mossman, 1924, pp. 6-7)

In determining the content of industrial arts at the elementary school level, Bonser delimits the study of industrial arts to that which children could learn about selecting, purchasing, and using products. This study further delimits the content to the study of food, clothing, shelter, utensils, records (books, paper, and allied graphic arts), and the study of tools and machines.

He further indicates a high degree of relationship between industrial arts and other subjects in the curriculum when he states that most subjects are divided into somewhat artificial categories; for examples, teaching math, science, history, and other subjects separately increases the degree of abstractness and fails to show their relationships to each other. Industrial arts, he contends, provides an opportunity to unify and to make other subjects more realistic. He said, "It is possible and desirable to bring much . . . unity of life into the school," and by so doing "school work becomes more nearly a genuine practice of life's activities themselves." (Bonser and Mossman, 1924, p. 75)

Facilities for such a program as proposed by Bonser includes a special room equipped with necessary tools and machines. Bonser indicates, however, that "much of the work can be done in . . . the regular grade room" (Bonser and Mossman, 1924, p. 81) but that it is good to have one specially equipped room to which a class can go when work requires special equipment that cannot be provided in the regular classroom.

The classroom teacher is considered the key to the success of Bonser's elementary school industrial arts program. Since it is the elementary classroom teacher who knows the total curriculum and who knows the children, it is the classroom teacher who logically must conduct instruction in industrial arts. (It was indicated that the book was prepared for elementary school teachers.) It is also true that the sheer number of special teachers needed would make implementation of such a program impossible.

In summary, the Bonser philosophy of elementary school industrial arts provides a definite subject matter drawn from the consumer aspect of the products made by man in his attempt to change raw materials into useful products. This content is infused into the traditional elementary school subjects, thereby making all subjects more meaningful and more relevant to the student.

Arts and Crafts.

Many activities appropriate for the elementary classroom are identified by Bonser and Mossman in their publication *Industrial Arts for the Elementary Schools.* These activities are related to their philosophy of the concepts embodied in the total school program and to the content of industrial arts, the changes made in the forms of materials to increase their value. However, it seems that many of these activities have been lifted out of context and used in a manner that takes on the appearance of arts and crafts. It is probable that the arts and crafts movement grew out of just such a situation.

In all fairness to the arts and crafts movement, it must be pointed out that some of the Bonser concepts are incorporated. Arts and crafts activities provide pupils with the opportunity to manipulate tools and materials; they provide pupils with the opportunity to find satisfaction and enjoyment in the beauty of form and color found in materials and products; and they provide an opportunity for activities that would make abstract concepts of regular academic subjects more realistic. The major aspect of the Bonser philosophy that is omitted is content, the emphasis of the study of the changes made in material form by man and the consumer aspects of these products as they relate to shelter, clothing, food, utensils, and records.

While Gerbracht and Babcock are not usually classified as proponents of the arts and crafts philosophy, their definition in the 1959 edition of *Industrial Arts for Grades K-6* states: "Industrial arts at this level involves material things; it is concrete and it is active; it includes making things, doing things, and using things." (Gerbracht and Babcock, 1951, p. 1) Examples of activities suggested in this publication included such things as making a beanbag game from tin cans; a dressing table, chair, or store from orange crates or other similar types of wood; ring holders, tie racks, bookends, cutting boards, scrapbooks, keyholders, toy transportation vehicles, and other similar items. While they stressed the proper use of tools and materials and the correlation of activities with the total school curriculum, it is again easy to see how elementary school teachers could extract the activities from the reference and end up with a program of arts and crafts.

A most accurate summary might be to say that the arts and crafts movement in elementary school industrial arts has resulted in an attempt, on the part of elementary classroom teachers, to implement the program with concrete manipulative activities that have been identified by leaders in the field of elementary school industrial arts. Communication between the philosophers and implementors has been very inadequate, and therefore these activities have been selected without due consideration to the rationale behind them or the relationships and relevancies to the total curriculum; they have been implemented for their effectiveness in giving children concrete activities and physical involvement to release tensions and also in giving them an activity in which they can find a degree of personal satisfaction.

Industrial Arts as a Method of Teaching.

Industrial arts has long been considered a strong influence on learning in other subjects. Bonser points out that certain segments of industrial arts have definite implications for each of the subjects within the elementary school curriculum, that there is a need to bring these subjects together in order to show their proper relationship, and that "no other phase of school work has such great possibilities for bringing about this unity of school and life experiences as the industrial arts when taught with proper regard to the broad relationships of its problems and its content." Although Bonser sees industrial arts at the elementary school level as being an integral part of the total school curriculum, when this aspect of supporting other subjects is lifted from his philosophy, it is easy to see that one would find supporting evidence for using manipulative activities to teach other subjects within the curriculum. Gerbracht and Babcock also support this approach when they discuss a point of view on when to use industrial arts activities in teaching. The following are principal contributions of industrial arts activities to the learning processes identified by Gerbracht and Babcock: (1959, pp. 7-9)

a) develop adequate meanings by reducing levels of abstraction and enriching the curriculum
b) provide for individual differences
c) provide socializing experiences
d) develop desirable personality characteristics
e) motivate learning

f) establish learning readiness
g) make children like school and schoolwork
h) acquaint children with their cultural heritage
i) teach fundamental skills

As far as this writer can determine, these authors do not enumerate any other objectives, functions, or purposes of industrial arts for this level; it must be assumed that they are suggesting that the main contribution of industrial arts is in the psychological and sociological areas of child development and in the area of cognitive learning in other subject matter disciplines by providing realistic and concrete experiences related to those disciplines.

The traditional elementary classroom teacher is primarily concerned with teaching the traditional elementary school subjects. Those who have been introduced to industrial arts have found that concrete experiences and realistic activities help children better understand abstract ideas. They have found that this method is effective in teaching traditional curriculum and, through this discovery, have again lifted one aspect of elementary school industrial arts from its total concept and used it as a method of teaching. This factor probably contributes, more than anything else, to industrial arts as a method of teaching being one of the most prominent philosophies practiced during the last several decades.

Tools, Materials, and Processes.

A number of programs of elementary school industrial arts throughout the past few decades have resulted in a reflection of what might be termed the tool/material/process concept, the emphasis being placed on learning to use tools and materials properly. Gerbracht and Babcock devote considerable attention to the proper use of tools, the names of the parts of tools, and the differences in kinds and uses of fasteners; their book was written at the time when the prevailing philosophy of the total industrial arts program was centered around the study of tools, materials, and processes, an era when it was hoped that every elementary school industrial arts program could have a specialist at least to assist in industrial arts instruction. Since the background of most of these specialists was from traditional tool- and material-centered collegiate programs, the tendency was to emphasize tools and materials.

In their publication, *Teaching Elementary Industrial Arts,* W. R. Miller and Gardner Boyd discuss the values of industrial arts to the elementary school child and the contributions that it can make in classroom activities. They discuss problem-solving activities and methods of incorporating these into the unit structure of the elementary school curriculum. But their publication, like many others, seems to forget the content of industrial arts and dwells predominantly on the manipulative aspects of the program. Approximately 180 of their 220 pages are devoted to projects and how to make them, with detail on the use of tools and materials. Is it not easy to see how an elementary teacher can pick up a book such as this and skip over the first thirty-six pages of pedagogy and get into implementation—the actual classroom activities—and end up with a tool- and material-centered or arts and crafts centered approach to elementary school industrial arts?

It must be said, in summarizing the philosophical points of view prevalent in the past, that the real beginning of industrial arts took place when Frederick Gordon Bonser identified content for industrial arts as being the changes made in the materials by man. He further identified the elementary school industrial arts curriculum as dealing with those changes that dealt with the consumption of products: clothing, shelter, utensils, records, and tools and machines. Because Bonser presented his ideas in such a manner, it was difficult to separate the manipulative aspects from the total curriculum and to separate the concrete activities of elementary school industrial arts from the study of the total world.

The manner of presentation utilized by Bonser was somewhat difficult to follow and somewhat difficult to implement. Subsequent authors have attempted to simplify this problem and to give the elementary school classroom teachers what they have been asking for: "What can I do in industrial arts in my classroom?" These teachers have been asking for a clear-cut prescription of how to teach industrial arts in the elementary classroom, and in the attempt to give them that educators have gotten away from the real emphasis of content and subject matter of industrial arts and its role in the total education program. These authors cannot be blamed, for they saw no other way of meeting a current need. They gave teachers suggestions and instructions for classroom activities and, at the same time, hoped that each teacher would become aware of the true value of elementary school industrial arts.

PRESENT

One of the most recent statements made to describe the present philosophy of elementary school industrial arts was that embodied in a definition developed by the National Conference for Elementary

School Industrial Arts. This conference, sponsored by the U.S. Office of Education, was composed of twenty-one national leaders in the field who represented many divergent points of view. The conference met on three separate occasions during the 1969-70 school year, and at the third meeting it reached a consensus on the nature of industrial arts in today's elementary school. That definition is as follows:

> Industrial arts at the elementary school level is an essential part of the education of every child. It deals with ways in which man thinks about and applies scientific theory and principles to change his physical environment to meet his aesthetic and utilitarian needs. It provides opportunities for developing concepts through concrete experiences which include manipulation of materials, tools and processes, and other methods of discovery. It includes knowledge about technology and its processes, personal development of psychomotor skills, and attitudes and understandings of how technology influences society. (Hoots, 1971, p. 3)

The National Conference identified six philosophical bases for modern industrial arts. They are: (1) concrete experiences, (2) thought processes, (3) learning processes, (4) personal abilities, (5) self-concepts, and (6) world of work. A highly unique contribution of industrial arts is to provide the child with opportunities to become involved in physical and mental manipulation of materials and sensory interaction with things. The concrete experiences, then, provide opportunities for making abstract concepts realistic.

Thinking processes, which are unique to technology, involve problem solving based upon the manipulation of materials with tools and processes. The more frequently children are allowed to experience problem solving situations, the more fluent they will become in this type of thinking and the more able they will become to interpret and to think through the language of forms and the manipulation of materials.

It has long been believed that the optimal learning situation provides for sensory data input through all sensory channels. The actual manipulative processes—the opportunity to touch, smell, manipulate, taste, and otherwise become intimately acquainted with a material—provide for a full range of sensory stimuli. These help not only to facilitate problem solving but also to provide an opportunity to try out new ideas and test them against reality through nonverbal means. In addition, although there is an attempt to departmentalize public school curriculum and to divide it into so called disciplines, there is always an overlap, and each discipline tends to support the other. This overlap is probably more evident in industrial arts than in any of the other disciplines because through it all areas of knowledge are brought together in a practical application in support of a good and better life. This mutual support causes the study of industrial arts to assist learning in other disciplined areas more relevant to the comprehension level of the child.

Another goal of the total educational program is to develop positive self-concepts within each child. Successful experiences are necessary for the child to develop positive self-concepts, and it is often only through manipulative experiences such as those provided in industrial arts that the child can find this satisfaction and develop positive self-concepts. Knowledge that one can master something outside of himself, that he can take pride in individual accomplishment, and that he can gain recognition from others as a result of this extension of self will contribute significantly to the development of these self-concepts.

The sixth philosophical concept of the National Conference report, the world of work, embodies the idea that industrial arts is indeed a subject matter discipline and has its own body of content that centers around the world of work, industrial processes, insights into manufacturing and production, and exposure to the physical and material world. Through this study, students should attain respect for craftsmanship both in the personal development of skills and in the talents of others. This concept tends to overlap with several other philosophical concepts, especially the idea of the development of self-concepts, but through the study of the world of work, students discover the relationship of it to their own abilities, limitations, ambitions, and aspirations. Through this study of the world of work and through the knowledge of its effect on him, each individual will lay the foundation that will eventually lead to the making of a satisfying and meaningful occupational choice.

The Conference reported a number of different approaches to the implementation of elementary school industrial arts that ranged from very limited programs conducted in the classroom by the classroom teacher to a special curriculum conducted in a special industrial arts laboratory by an industrial arts specialist. The consensus seemed to be that the most practical answer to the problem was that of placing the responsibility of industrial arts instruction on the elementary classroom teacher but that she should be given as much help as possible with an industrial arts specialist.

Another key position taken by the Conference was that the success of any elementary school industrial arts program is dependent upon the philsosphy of the personnel who are charged with organizing and conducting it. Thus, the responsibility of adequate elementary school industrial arts seems to be placed on the teacher educator. He must devise ways by which the subject matter (technological content), tool and material experiences, creation of an environment for learning with the proper tools and facilities, and many other aspects of implementing a program of elementary school industrial arts are unified in such a way that they will not come apart and appear in the classroom as a handicraft or an arts and crafts unit or as only a supplement to language arts or social studies; the various aspects must be held together with a bond that will show elementary school industrial arts in its true value and in its true perspective as it brings the study of our technological environment into the classroom and relates it to all other segments of the curriculum.

Career Education in the Elementary School.

During the past several years, educators at all levels have been talking about career education and the role it should play in the public school curriculum. Many have come to the conclusion that during the middle school years this program should constitute a variety of exploratory experiences with different kinds of occupations. Even more have agreed that, at the senior high school level, career education should take the form of a type of traditional vocational education to prepare pupils with job entry skills. But what of the lower grades? Psychologists say that there are certain developmental processes which children must go through before they are able to make career choices even based on fantasy. Banes and Jencks, in their research, imply that success is more often a matter of a considerable amount of luck and a little bit of knowledge rather than the reverse. The implication seems to be that the pupil should have a broad education, develop expertise in problem solving, and develop skill in the continuation of his own educational process.

There are many schools that boast of career awareness programs for the elementary children. Many of these have programs comprised of a series of activities through which all students are rotated; there is no flexibility for the student. Some teachers, guided by empirical judgment, decided that these are the things the child needs in order to develop career awareness. It is no wonder that citizens in many communities are upset over the type of career education that is being given to their children, and it is high time that responsible educators implement programs of career education and career awareness based on research, that they take a look at the experimental projects, that they study the data for themselves, and that they determine what it is that children really need in order to be able to cope with career problems with which they will be faced fifteen or twenty years hence. Many jobs of today will not even exist then, and many future opportunities are not yet conceived.

Because of the national trend toward career education and the fact that money is being provided for these kinds of programs, this phase of elementary school industrial arts is beginning to receive primary attention. Maybe the acquisition of funds is an answer, but it must not be forgotten that it is the total child who will grow up to be the adult who will be faced with making the career choice, and it is the total child whom we must educate; all facets of elementary school industrial arts must be included in his educational program.

Career education at the elementary school level must lay the foundations for knowledge and for choices that will be made in later years. Basic to the making of these decisions is a knowledge of oneself. It is imperative that every elementary school industrial arts program have as an objective to help the child discover the kinds of things that he likes to do as well as the things that he does not like to do. He must have the opportunity to explore his own talents, limitations, and aspirations to the maximum degree. He must have the opportunity to relate these to as many tangible objects in his environment as possible, but above all else, he must know himself.

FUTURE

The future of industrial arts at the elementary school level seems to lie in the ability of those working within the area to adapt to conceptual changes and to look at the total needs of the child without too much sentimentality toward tradition. One major point of focus that seems apparent includes an elementary school industrial arts curriculum concentrating on technology and the technological influences on the environment in which children live; the other point stresses career education to include the development of attitudes and values toward work, the effect of work on the lives of people, and the effects of technology on work. While there is a considerable similarity between these two points of view and there is a distinct possibility of combining the two, they are different, and they deserve separate discussion.

Industrial Arts as a Study of Technology.

The literature, for many years, has emphasized the fact that the subject matter of industrial arts should be industry and technology. Dr. Mary-Margaret Scobey in her book, *Teaching Children About Technology,* does an excellent job of laying the philosophical groundwork for technology as a base for elementary school industrial arts and of implementing the study of technology in the elementary school curriculum. She says that the major emphasis of education is to provide for young children "knowledge and skills necessary for a life in a technological culture." (Scobey, 1968, p. 7) Dr. Scobey contends that industrial arts must be an integral part of the total school program:

> . . . the study of industrial arts contributes to the study of man's activities in a particular social setting and cultural environment which man created to some extent through the invention of tools and processes. As an integral part of the elementary school curriculum, industrial arts can reinforce almost all subject matter areas of the curriculum as well as contribute its own unique content related to industry. (Scobey, 1968, p. 7)

For a number of years, the New Jersey Technology for Children Project has provided technological experiences for children in many classrooms throughout that state. This is probably one of the most widespread programs in existence. It has provided in-service instruction for many teachers and instructional packets for their use in the classroom. Although this project originated with Ford Foundation funds, the New Jersey Department of Education has taken over complete responsibility and hopes eventually to reach every child in the state.

Another project with a highly futuristic trend is the Technological Exploratorium, K-6, being conducted in the Hudson, Ohio, Elementary Schools. The purpose of the project ". . . is the study of man's development, stimulated by his environment, and his endeavors which are evidenced through his technology." The project staff hopes ". . . to educate children to be better prepared to adapt to and analyze life's evolving challenges, to develop their humanness and their human abilities to deal with challenges of their society." In discussing the basis of the curriculum, the *Rockwell Power Tool Instructor,* Vol. 20, No. 1, quotes Mrs. Norma Heasley, project director:

> We're not adding a study onto the curriculum. . . . We're analyzing the basic skills that the children need to gain at each level and broadening their planning experiences so that they gain these skills as well as a conceptual understanding about man's technology. (Rockwell Power Tool Instructor, 1972-73, p. 1)

Mrs. Heasley summarizes when she says:

> As we are designing curriculum for the elementary child, we are developing a *system* for his learning. . . . We are helping him to build a foundation that will determine his direction for his present and future life. . . . The abilities to *think,* critically analyze, create, make decisions, *evaluate,* solve problems and adjust to changes are crucial in a technological society. (Rockwell Power Tool Instructor, 1972-73, p. 1)

Career Education.

The major force behind career education and its future in the elementary school program is its support through the U.S. Office of Education and federal funding. A major weakness in most local programs has been the lack of monetary assistance, which can provide the thrust that will put programs into the schools. This thrust, powered by federal funds, presents a challenge to educators in that they must carefully study all facets of the problem to develop a program that will meet the needs of the child rather than to act in haste and empirically design a project that will meet cursory approval.

Career education has been defined as that education leading to meaningful and productive activity. In the broadest sense, career education can be seen as the total purpose of the school program. Through this concept of career education, boys and girls at the elementary school level can discover their own talents and limitations, their aspirations, and their weaknesses; they can learn something of the nature of work, what work does for man, and what work does for society; and they can learn something of the technological developments created by man and the effect that these have on work and on the changing nature of work. As boys and girls progress through school, career education can offer them an opportunity to try out and to explore some of the things that are of interest to them; and as they go farther and farther through their educational process, they can continue in their areas of specialization. Career education must begin at the earliest formal stages of education, pre-school or kindergarten, and extend through and beyond all formal education. Career education, if accepted in its total form, can lead to the reorganization of the American education and to the reorganization of that educational program that will make its benefits meaningful and relevant to the life of every child.

These basic concepts of career education, according to Hoyt and others, ". . . will call for major changes in the organizational, methodological, administrative, and fiscal policies of American education. . . . Career education, if it is to succeed, must be adopted as a total concept." (Hoyt et al., 1972, p. 123) These authors suggest that career education will not expect the classroom teacher to add another subject to the already overcrowded curriculum, but it will ask the teacher to change and adapt current teaching procedures to accommodate a career education emphasis. This accommodation will require major changes in daily lesson plans. It will require a tremendous effort on the part of boards of education and administration. The price will be high, and it will be necessary for school boards to make commitments; the accomplishments of such changes will require time for teachers to gain knowledge and to develop personal attitude changes necessary for teaching career education, and it will require the procurement of special materials and supplies.

CONCLUSIONS

The reader can draw many conclusions from the preceding discussion of the varying philosophies of elementary school industrial arts. However, it seems appropriate here to focus on some that seem most important. These include the apparent shift of emphasis in the content of elementary school industrial arts from its earlier forms to its present forms, the trends involving classroom-teacher-taught programs, and the emphasis on careers and the orientation to the world of work.

Shift in Content

The earliest philosophical position reported here indicated that the content of elementary school industrial arts was centered around the consumer aspects of materials produced by man through the changing of materials to increase their value. From this point there was a transition toward an arts and crafts and/or handicrafts approach. It is probable that this approach, as well as the "method of teaching" approach, stemmed from the out-of-context application of the Bonser philosophy. At the present time, however, the pendulum seems to be swinging back to a subject matter content based somewhat similarly to the earlier concepts; but presently, content emphasizes technology and the effects of technology on our lives and our environment. A most recent trend has been on the amplification of the career function of industrial arts and what is becoming commonly called career education.

Staff Trends

Dr. Bonser supported the position that the industrial arts program at the elementary school level would have to be taught as a part of the regular elementary school curriculum and that it would have to be taught by the elementary classroom teacher. Since that time, many attempts have been made to teach elementary school industrial arts by specialists through a variety of methods, but these approaches have resulted, for the most part, in arts and crafts or handicrafts types of programs with little or no relationship to the total curriculum. Too, they have, for the most part, failed to reach many children. In most situations where a large number of children have been reached, the answer has been to utilize the elementary classroom teacher as the teacher of industrial arts. One might say that for a period of approximately forty years elementary industrial arts people tried to prove Bonser wrong on this point, but they were unable to do so. If industrial arts is to reach every elementary school child throughout the United States, this task cannot be accomplished unless it is done through the classroom teacher. Where money is available, a consulting teacher could be of considerable value, but the classroom teacher must remain in charge of the program, the industrial arts specialist serving as a resource person.

Emphasis on Career Education

It has already been pointed out that one of the biggest problems behind the growth and implementation of elementary school industrial arts has been the lack of money. On the other hand, it is predicted that the growth and development of programs of career education at all levels, including the elementary school level, will be possible through availability of federal money. There is practically no difference between good industrial arts and good career education at the elementary school level. The philosophies of both are sound, but it is imperative that educators at all levels take the time to study and to learn from research and those who have laid the foundation. Neither elementary school industrial arts nor career education can afford to accept watered-down versions of secondary school programs.

Industrial arts can be one of the most vital aspects of the elementary school program. Through the concepts embodied in the various philosophies of this area, efforts are made to help children understand themselves, the technological aspects of their world, and the relationship of one to the other. Elementary school industrial

arts can help children understand the relationship of abstract concepts of academic subjects to technology, to the world of work, and to themselves. This combination can help produce a better citizen.

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CHAPTER XI

Research

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INTRODUCTION

The need for and the importance of all types of research as a means of improving instruction in industrial arts has been well stated and adequately substantiated in the Ninth, Tenth, Thirteenth, and Fifteenth *Yearbooks of the American Council on Industrial Arts Teacher Education,* as well as by many other sources. To date, though, there has been no comprehensive study of the need for, the importance of, and the status of research in the area of elementary school industrial arts. It is the purpose of this chapter to reveal the nature and implications of both degree and non-degree research related to this specific area. It is also the hope of the writer that those persons who read the chapter will be motivated to conduct basic research and thus add to the growing volume of data concerning the changing role and function of industrial arts at the elementary school level.

CHARACTERISTICS OF THE SURVEY

The studies reported in this chapter were obtained from six major sources: (1) *Dissertation Abstracts International* (formerly *Dissertation Abstracts*), (2) *Abstracts of the ACIATE-NAITTE Joint Research Committee,* (3) deans, division and/or department chairmen in institutions offering course work in industrial education, (4) directors of funded elementary school industrial arts projects, (5) state supervisors of industrial arts, and (6) the 900+ persons who receive the *ACESIA Newsletter*. Other sources reviewed in the research identification process were the: (1) *ACIATE Yearbooks,* (2) *Education Index,* (3) *Industrial Education Magazine* (formerly *The Industrial Arts and Vocational Education Magazine*), (4) *Journal of Educational Research,* (5) *Journal of Industrial Teacher Education,* (6) Researcher's Index of *Man/Society/Technology Magazine* (formerly *The Journal of Industrial Arts Education*), (7) *Master's Degree Abstracts,* (8) *Phi Delta Kappa Directory of Educational Research Agencies and Studies,* (9) *Phi Delta Kappa Research Studies Index,* (10) *Review of Educational Research,* and (11) *School Shop Magazine.*

A letter of introduction accompanied by three information forms was mailed to four major sources (three through six) alluded to in the previous paragraph. The forms were constructed so as to identify three levels of research: (1) doctoral, (2) master's, and (3) staff studies and other non-degree research that is presently being conducted or that has been completed in the area of elementary school industrial arts. The letters and forms were mailed during the third week of January 1973. A follow-up letter and forms were mailed during the third week of February 1973, to those who had not responded to the original request for information. A second and final follow-up letter and forms were sent during the third week of March 1973. Follow-up letters were not sent to the 900 + persons who receive the *ACESIA Newsletter.*

A search of *Dissertation Abstracts* and *Dissertation Abstracts International* from 1938, the first volume of *Dissertation Abstracts,* to the present revealed numerous doctoral studies related to the area of elementary school industrial arts. The *Abstracts of the ACIATE-NAITTE Joint Research Committee* were used as a cross-check against those doctoral studies reported in *Dissertation Abstracts* and *Dissertation Abstracts International.* This review revealed a few doctoral research studies that had been completed prior to 1938.

The third major source contacted was the deans, division and/or department chairmen who were located in the 226 institutions listed in the *1972-73 Industrial Teacher Education Directory.* Educators from 193 of the 226 institutions listed in the directory (85%) responded to the survey instruments. (Persons from all but two of the institutions that offer course work in elementary school industrial arts (96%) responded to the survey instruments.) Deans, division and/or department chairmen who were not listed in the directory but were located in institutions where doctoral or master's degree research had been conducted in the area of elementary school industrial arts were also contacted. *Dissertation Abstracts* and the *Abstracts of the ACIATE-NAITTE Joint Research Committee* were utilized as resources for this phase of the survey. A 100 percent return was received from this resource.

All of the known directors of local, state, and federally funded elementary school industrial arts projects were contacted, and a 100 percent return was received from this source.

Thirty-eight of the 50 state supervisors of industrial arts responded to the survey instruments for a 76 percent return.

The sixth and final major source contacted was the 900+ persons who receive the *ACESIA Newsletter.* This source was most helpful in obtaining information relative to master's degree research and staff studies and other non-degree related research.

Since this study is intended to reflect a comprehensive survey of research in the area of elementary school industrial arts, each of the six sources contacted was asked to include information on every piece of research that had ever been conducted. You will note that the data presented in this chapter is complete through 1972.

The survey was confined to degree and non-degree related research which had been completed or that was being conducted in North America. Three levels of research were solicited for inclusion in this chapter: (1) doctoral degree research, (2) master's degree research, and (3) staff studies and other non-degree related research.

Each of the three levels of research presented is preceded by a summary of research findings. Abstracts of all doctoral research studies have also been included and are followed by observations related to this level of research study. Tables which allow for a pictorial description and comparison of the data presented are then included at the end of each of the three levels. Research numbers have been assigned to each of the studies which are intended to aid the reader in making effective use of Tables one through nine.

SUMMARY OF DOCTORAL RESEARCH FINDINGS

To the writer's knowledge the first doctoral degree research in the area of elementary school industrial arts was conducted in 1930. During the past four decades, there have been 58 such research studies conducted—21 experimental, 25 descriptive-survey, 4 documentary-historical, and 8 developmental-curriculum. (Refer to Table three for these and other data.) It is encouraging to note the emphasis that has been placed on research in the past decade. Sixty percent of all doctoral-related research in the area of elementary school industrial arts has been conducted during the past 10 years. Of the 21 institutions involved in the research effort, five institutions are responsible for more than 60 percent of the total doctoral degree research effort. These institutions are: The University of Missouri at Columbia, New York University, The Ohio State University, The University of Maryland, and the University of Northern Colorado at Greeley. A further analysis of the data reveals that each of the 21 institutions where doctoral degree research has been conducted tend to specialize in one or two types of research. (Refer to Table four for these and other data.)

Experimental Research

Of the 21 experimental studies conducted between 1930 and the present, 19 have been conducted since 1964. Twice as much of the experimental research at the doctoral level has been devoted to cognitive learning than to the other two domains of learning combined, with the least emphasis having been placed on the affective domain. The difficulty of accurately assessing the domains of learning through the use of paper and pencil test instruments has resulted in a majority of the research having been conducted at the upper elementary school grade levels. These and other data are presented in Table one.

Other Than Experimental Research

There have been thirty-seven studies of this nature conducted between 1939 and the present, with less than half of this research having been conducted during the past decade. Over 70 percent of these studies have been of a descriptive-survey nature followed by the developmental-curriculum category with the documentary-historical proving to be the least popular. The primary purpose of these studies has been to determine the status, need, nature and scope of elementary school industrial arts courses offered by institutions of higher education, to report on the methods utilized by elementary school teachers who had developed and were conducting successful industrial arts courses offered by institutions of higher education and to report on the methods utilized by elementary school teachers who had developed and were conducting successful industrial arts activity programs integrated with the existing elementary school curriculum. Several research studies have also been devoted to the development of elementary school industrial arts resource materials to be integrated with existing elementary school curricular units of instruction. These and other data are presented in Table two.

DOCTORAL DEGREE RESEARCH STUDIES
(Completed)

Research #: 1

Author: Baugrud, Kim J.

Title: **Industrial Education for the Visually Limited: The Teacher and His Approaches to Instruction in the Residential School.**

Institution: University of Missouri-Columbia

Date: 1968

Purpose of Study: To (1) ascertain the personal characteristics, background experiences, and professional preparation of industrial education teachers of the visually limited, (2) identify prevailing instructional approaches used to provide instruction to children with visual impairments enrolled in industrial subjects, and (3) ascertain the nature and extent of agreement existing between industrial education teachers and a group of specialists regarding instructional approaches.

Findings and/or Conclusions:

1. There is evidence of teacher stability and satisfaction with their teaching positions.
2. It would appear that the professional preparation of the industrial education teacher in the area of the visually limited is inadequate.
3. The industrial education teachers, as a group, were interested in their own professional growth; however, the teachers were not interested in extending their professional growth to include the AAIB teacher rating.
4. The industrial education teachers and a recognized group of specialists were in general agreement regarding the instructional approaches which were being utilized and those instructional approaches considered "most important" in the presentation of content to children who have visual impairments.
5. Since the instructional approaches which are being utilized by the industrial education teachers are now known, teacher education programs of a preparatory or in-service nature can be developed more effectively.
6. There is a need to clarify the type of courses which are offered in conjunction with the residential schools.

Research #: 2

Author: Bender, Michael

Title: **An Experiment Using a Visual Method of Instruction Followed by Imitation to Teach Selected Industrial Education Psychomotor Tasks to Severely Mentally Retarded Males**

Institution: University of Maryland

Date: 1971

Purpose of Study: The purpose of this study was to (1) analyze the changes of behavior of severely mentally retarded children as an effect of using a visual-imitative instructional method incorporated to teach industrial education psychomotor tasks, (2) provide additional research evidence relevant to observational learning and its use with severely mentally retarded children, and (3) generate information relevant to procedures helpful to curriculum planners for organizing industrial education programs, sheltered work environments, and special programs for the severely mentally retarded.

Findings and/or Conclusions:

1. Statistically significant differences were found between total performance test scores obtained on pretest-posttest, posttest-retention test, and pretest-retention test scores.
2. The visual-imitative program was found to be effective for teaching industrial education psychomotor tasks to severely mentally retarded male children.
3. Although the visual-imitative program was tested with severely mentally retarded children, there was no reason why it would not be successful with children of normal functioning abilities, especially children enrolled in nursery or kindergarten classes.
4. A visual-imitative program eliminates much of the verbalization encountered in such training and allows the participant to observe the demonstration and immediately imitate it.

Research #: 3

Author: Benson, Kenneth R.

Title: **A Manual of Craft Activities for Summer Playground Leaders and Camp Counselors**

Institution: New York University

Date: 1956

Purpose of Study: The purpose of the investigation was to develop a manual of craft activities to be used by summer playground leaders and camp counselors.

Findings and/or Conclusions:

Based on the criteria for selecting projects, the seventy-five projects selected from the literature and the twenty-five projects developed by the investigators were considered for possible inclusion in the manual. Selected projects were tested by camp leaders and counselors and a manual consisting of forty craft projects was developed.

1. Evidence indicates that crafts are part of the total activity programs conducted in camps and on playgrounds. The leaders conducting these programs have had little formal or informal training in the crafts, these leaders are principally college students in the fields of education and liberal arts.
2. The crafts manual constitutes the major results of this study. The emphasis in the manual is on the forty craft projects that are suitable for use in camps and on playgrounds outside of craft shops.

Research #: 4

Author: Bicknell, William C.

Title: **Constructional Activities in the Elementary Schools—Their Development and Use**

Institution: University of Missouri-Columbia

Date: 1942

Purpose of Study: A study concerning the European and American background, use, types, purposes, organization, methods of presentation, and administration of constructional activities in the elementary school.

Findings and/or Conclusions:

1. The use of constructional activities in the elementary schools of the United States may be traced to Europe.
2. Over 57 percent of the 178 schools reporting indicated that the purposes: to satisfy natural impulses of children, to furnish activities around which various subject matter experience may be developed, to develop desirable habits, attitudes and ideas, and to provide an opportunity to express ideas through other media than words, functioned in all six grades.
3. Constructional activities carried on in all schools were described as: The representation of landscapes, direct participation in out-of-school activities, and the completion of useful articles.
4. Seventy percent of 256 schools surveyed indicated that industrial arts was a separate subject in grade VI and two percent of the schools indicated industrial arts was carried on in grade I.
5. The mean number of minutes per week devoted to industrial arts and handwork as separate subjects respectively was approximately 100 minutes and 80 minutes.
6. Fifty-two percent of the schools surveyed indicated constructional activities were used in teaching other subjects in all grades.
7. Most of the schools reporting indicated that emphasis was placed upon creativeness rather than skills in the types of organizations of constructional activities.

Research #: **5**

Author: Bjorkquist, David Carl

Title: **Discrimination Transfer from Scale Models and Pictorial Drawings in Learning Orthographic Projection**

Institution: University of Minnesota

Date: 1965

Purpose of Study: The primary purpose of this study was to determine the relative effectiveness of scale models and pictorial drawings in helping beginning mechanical drawing students to learn some principles of orthographic projection. In addition the effect of learning task difficulty on performance on a succeeding transfer task was studied.

Findings and/or Conclusions:

1. It was concluded that pictorial drawings were more effective than scale models or no aids in helping beginning students to learn some principles of orthographic projection.
2. Also, the treatment group having the easier learning task did perform best on the difficult transfer task.

Research #: **6**

Author: Bonde, Robert

Title: **An Evaluation of Elementary School Industrial Arts Tools (Grade I)**

Institution: University of Northern Colorado-Greeley

Date: 1964

Purpose of Study: The purpose of the study was to evaluate selected industrial arts tools in order to determine the specific sizes, kinds, and weights that are most suitable for first grade children of various physical builds and sexes to use in construction activities.

Findings and/or Conclusions:

1. Difficulty was experienced in the use of the hand drills and planes; therefore, it appears that the utilization of these two tools should be limited at the first grade level.
2. Of the tools selected for the experiment, the seven, ten, and thirteen-ounce claw hammers; the sixteen, eighteen, and twenty-inch panel saws; the wire and rigid frame coping saws; the eight, ten, and twelve-inch bit braces; and the fourteen, sixteen, and eighteen-inch sawhorse workbenches were within the capabilities of the children.
3. It is recommended on the basis of trends that developed during the study that for purposes of greater efficiency, economy, and utilization that the thirteen-ounce hammer, the twenty-inch panel saw, the rigid frame coping saw, the ten-inch bit brace, and the sixteen-inch sawhorse workbench be utilized for first grade educational construction activities.

Research #: 7

Author: Brown, Robert D.

Title: **Industrial Arts Competencies Needed by Elementary Teachers**

Institution: University of Minnesota

Date: 1955

Purpose of Study: To ascertain as accurately as possible the industrial arts competencies which are needed by elementary teachers.

Findings and/or Conclusions:

1. Elementary teachers should develop specific competencies within each of three broad industrial arts areas. The areas are: woodwork, the graphic arts, and the crafts.
2. Each elementary teacher should possess a great deal of general industrial arts knowledge. She should know the objectives of elementary industrial arts, the ways in which the program can best be carried on, how industrial arts activities can be integrated with the work of the teaching unit, and how to demonstrate manipulative skills in such a way that learning is facilitated.
3. Each elementary teacher should be familiar with a wide variety of industrial arts activities which can be profitably carried on at the elementary level, and she should know about numerous specific activities included within each general type.

Research #: 8

Author: Bruce, Phillip L.

Title: **Status, Content, and Appraisal of Industrial Arts Courses for Elementary Teacher Education in Public High Educational Institutions**

Institution: University of Missouri-Columbia

Date: 1964

Purpose of Study: To ascertain the status and content of industrial arts courses for elementary teachers in public colleges and universities throughout the United States, and to appraise the adequacy of the content reported.

Findings and/or Conclusions:

1. Ninety-four of the 165 industrial education departments reporting were currently offering 143 industrial arts courses for elementary teachers.
2. A majority of the courses offered were junior, senior, or graduate level courses.
3. These courses were generally taught by industrial education staff with no special training in this area.
4. Classes are generally wood or metal oriented laboratory/lecture classes with student-teacher planned individual projects.
5. Closer communication should be fostered between the elementary education and industrial education departments.
6. In view of these classes being primarily elective, it appears that educators generally do not consider them essential to the preparation of elementary teachers.

Research #: 9

Author: Brudzynski, Alfred J.

Title: **A Comparative Study of Two Methods for Teaching Electricity and Magnetism with Fifth and Sixth Grade Children**

Institution: Boston University School of Education

Date: 1966

Purpose of Study: To determine whether or not fifth and sixth grade children achieve and retain both the factual materials and their applications better when a unit in electricity and magnetism is taught by the inductive method than when it is taught by the lecture-demonstration technique.

Findings and/or Conclusions:

1. The groups were similar insofar as errors of prediction were concerned for both the achievement and retention analyses.
2. The pupils of the lecture-demonstration group with average and below-average intelligence scored slightly higher in the achievement test than comparable pupils in the inductive group.
3. The pupils utilizing the inductive method, who were above-average in intelligence, scored higher than their counterparts in the lecture-demonstration group.
4. The retention differences followed a similar pattern to that of the achievement differences except the reverse was found with respect to intelligence.
5. In the sub-group analyses, the boys and girls of the sixth grade, and girls of the fifth and sixth grades tended to achieve the factual materials and their application better when they were instructed by the lecture-demonstration method. In retention superiority, the statistical analyses showed no significant differences.

Research #: 10

Author: Chamberlain, Duane G.

Title: **Factors Relating to Teaching of Practical Arts Activities in the Elementary Schools of Michigan**

Institution: The University of Michigan

Date: 1954

Purpose of Study: To isolate and investigate factors relating to teaching of practical arts activities in self-contained classrooms of the elementary schools of Michigan; to assist classroom teachers, administrators, and teacher trainers; to locate and eliminate or alleviate factors which inhibit utilization of practical arts work in the elementary grades, and to locate and promote factors which contribute to effective use of practical arts in the elementary grades.

Findings and/or Conclusions:
1. Industrial arts in the elementary school is usually taught by classroom teachers who have more general professional and industrial arts college training.
2. Personal characteristics, teaching load, a rigid daily program of studies, and classroom size do not appear to affect the role of industrial arts in the elementary grades.
3. Attitudes of superiors, parents, press, noise from work, and classroom acoustics play a role influencing the inclusion or exclusion of industrial arts.
4. Teachers using these activities usually receive higher salaries.
5. Costs of instructional supplies are greater when industrial arts is included.

Research #: 11

Author: Champion, George

Title: **The Interrelationship of Industrial Arts With Science in the Elementary School**

Institution: University of Maryland

Date: 1965

Purpose of Study: (1) Assess the value of industrial arts from the point of view that it might be included in the elementary school curriculum through integration with other subjects, (2) develop certain techniques for implementing industrial arts in the curriculum so that it might enhance existing subjects, offer new experiences, and not infringe upon the time now devoted to other subjects, (3) establish the significance of integration procedures, (4) discover possible implications for college courses for elementary school teachers who might implement industrial arts by the proposed procedures, (5) determine whether within a reasonable amount of preparation time, in-service teachers could utilize industrial arts in elementary schools.

Findings and/or Conclusions:
1. Industrial arts can be implemented in the elementary school curriculum through integration with other subjects.
2. Industrial arts provides an effective means for demonstrating the value of other subjects.
3. Industrial arts stimulates interest in learning.

Research #: 12

Author: Charlesworth, Kenneth B.

Title: **Safety Programs for Industrial Arts Education in the State of New Jersey**

Institution: Columbia University Teachers College

Date: 1968

Purpose of Study: This study focuses on the need for safety programs in industrial arts education programs in the State of New Jersey and presents a positive approach in dealing with accident prevention.

Findings and/or Conclusions:
1. Safety education does not solely consist of placing restrictions on the use of the various types of machinery and equipment. Rather it consists of teaching the student to take every precaution, to foresee and forestall danger in the use of school shop-lab materials and equipment.
2. The safety program must not be passive and permissive, it should be a vigorous, consistent and continuous program which aims to do everything in the safest possible manner.
3. Accident prevention programs generally tend to be measured negatively. Statistics should be used to point out the lives saved and the number of injuries prevented through present day safety methods rather than to count the number of accidents that occur.
4. There is convincing evidence that numerous accidents are being prevented by modern safety methods; shattered goggles, crushed safety shoe guards, and other damaged personal protective devices are striking examples of many serious injuries which have been avoided.

Research #: 13

Author: Doane, Raymond C.

Title: **Industrial Education in Selected State Schools for the Deaf**

Institution: University of Missouri-Columbia

Date: 1956

Purpose of Study: To ascertain the status and need for industrial education at State schools for the deaf of the upper Mississippi Valley region.

Findings and/or Conclusions:
1. The occupational success of graduates of schools for the deaf, in the trade for which they were trained, compares favorably with hearing employees who have been employed on similar jobs for approximately the same length of time.
2. Teachers and administrators should seek arrangements to provide for on-the-job training.
3. An organized placement service should be provided by these schools.
4. A more functional in-service teacher education program should be promoted.
5. Approximate budgetary policies need to be established to provide for greater salaries of industrial education teachers and for up-to-date facilities.
6. On the basis of the occupational success of graduates of schools for the deaf, in occupations for which they were trained, it seems that employers need not be reluctant to employ other graduates who have had sufficient training.
7. Employers should understand that the individual has more to do with what he will do on the job than his handicap prevents him from doing.

Research #: 14

Author: Doutt, Richard F.

Title: **An Evaluation of Selected Elementary School Industrial Arts Hand Tools—Grades II, III, and IV**

Institution: University of Northern Colorado-Greeley

Date: 1965

Purpose of Study: To evaluate selected industrial arts hand tools and one piece of equipment, the sawhorse workbench, in relation to body build and sex of second, third, and fourth-grade students in order to determine those tools most suited to elementary school construction activities.

Findings and/or Conclusions:

1. For all three levels the 13-ounce hammer, the rigid frame coping saw, the 8-inch bit brace, the 3/8-inch hand drill, and the 18-inch crosscut saw were the most suitable.
2. For the second grade, the block plane and the 18-inch sawhorse were the most suitable.
3. The smooth plane and the 16-inch sawhorse were the most suitable for the third grade.
4. The fourth grade were the most suited for the 10-inch bit brace, the Jr. jack plane and the 18-inch sawhorse.

Research #: 15

Author: Downs, William A.

Title: **The Effect of Constructional Activities Upon Achievement in the Areas of Science and Mathematics at the Fifth Grade Level**

Institution: University of Missouri-Columbia

Date: 1968

Purpose of Study: To ascertain the relative effect of selected constructional activities upon the achievement of high and low ability male and female students in fifth grade science as well as concomitant outcomes in the area of mathematics.

Findings and/or Conclusions:

1. Regardless of ability level, achievement scores of students in Group A, who constructed aids directly related to the unit under study, were significantly higher than Groups B and C, those students who constructed aids indirectly related to the unit under study or who did not have a constructional experience as a part of the unit under study. Therefore, the constructional activities approach to teaching science at fifth grade level is more effective than the traditional approach.
2. Constructional activities provide high ability students an opportunity for increased achievement in science as was proven by Groups A and B, students who had directly and indirectly related constructional experiences, since they made significantly higher gains in achievement of selected science content than did those students who had no constructional experiences.
3. There was no significant difference in the achievement and retention scores of male and female students, regardless of the treatment utilized.
4. A directly related constructional experience is judged to be a more effective method of teaching science content in the elementary school than indirectly related constructional experiences or no constructional experience at all.

Research #: 16

Author: Duncan, Glenn S.

Title: **Practical Arts Activities in Elementary Teacher Education**

Institution: Unviersity of Missouri-Columbia

Date: 1950

Purpose of Study: To discover what is being done with practical arts activities in the elementary school by superior teachers; to ascertain what practical arts experiences superior teachers and other competent authorities think are needed in teacher education; and to suggest some implications of the above for elementary teacher education.

Findings and/or Conclusions:

1. Teachers who had college work beyond a master's degree were the most consistent users of practical arts activites. Those with less than five semester hours of practical arts subjects did little or nothing in utilizing them, and they had the least desirable room set-up for conducting their activities, while those with the most special training used the activities the most frequently in providing the preferred physical arrangements and obtaining budgetary allowances for materials.
2. As the grade level increased there was a tendency for more practical arts activities to be used.
3. Certain criteria which respondents have repeatedly urged to be kept in mind in using practical arts activities in the elementary program are:
   (a) Practical arts activities must not be ends in themselves, but support the teaching unit;
   (b) construction must be simple and not involve intricate skills; constructions must be representative of whatever is being portrayed and not something distantly removed;
   (c) constructions must be successful to give the learner the necessary motivating satisfactions.
4. Methods of directing practical arts activities that were preferred by 50 percent or more of the respondents were:
   (a) Cooperative planning by teacher and pupils;
   (b) construction of separate group projects;
   (c) construction of central group projects, such as a farm, stage set, etc.:
   (d) construction of different individual projects;
   (e) working sketches and procedures prepared jointly by teacher and pupils.

Research #: 17

Author: Fagan, Raymond E.

Title: **College Preparation for Teaching Manipulative Activities in the Elementary School**

Institution: Oregon State University

Date: 1954

Purpose of Study: To ascertain the nature and extent of the preparation in manipulative activities offered by elementary teacher education institutions.

Findings and/or Conclusions:

1. Practices concerning time spent, credit, requirements, courses designed for elementary teachers, and textbooks seem to be generally adequate.
2. Possibilities of relationships made with elementary school subjects and the variety of experience areas used in courses seem to be entirely inadequate.
3. The majority of courses are divided about equally between education and art departments.
4. Industrial arts and home economics departments are responsible for relatively few courses.
5. Two courses are recommended:
   (a) One for familiarization with tools and materials,
   (b) methods of use of tools and materials.

Research #: 18

Author: Genevro, George William

Title: **A History of Industrial Arts in the Long Beach City Schools**

Institution: University of California-Los Angeles

Date: 1966

Purpose of Study: This study is concerned with the inception, growth and development of industrial arts education in the Long Beach City Schools in the period from 1905 until 1940. In addition to the factual material which appears in the study, consideration was given to the forces both within and outside of the school system that affected the evolution of the industrial arts program.

Findings and/or Conclusions:

1. The industrial arts programs in the junior high schools developed rapidly and in some cases became somewhat vocationally oriented.
2. The elementary industrial arts program was reduced in scope after the junior high schools were well established and eventually was integrated with other curriculum areas such as the physical and social sciences.
3. The industrial education program was affected by the presence of a large number of grade-oriented teachers and by a diversity of viewpoints on matters such as curriculum construction and supervisory practices, among others.

Research #: 19

Author: Gerne, Jr., Timothy A.

Title: **A Comparative Study of Two Types of Science Teaching on the Competence of Sixth-Grade Students to Understand Selected Topics in Electricity and Magnetism**

Institution: New York University

Date: 1967

Purpose of Study: The purpose of this study was to compare and evaluate in grade six the relative effectiveness of a special electrical board method for teaching electricity and magnetism against the traditional method. The evaluation also included an analysis of the attitudes of both the students and the participating teachers toward the Essex Electrical Board.

Findings and/or Conclusions:

1. There was statistically significant growth in achievement by the entire group as measured by the difference between the adjusted mean pre-test and post-test scores.
2. There were no statistically significant differences between the entire experimental and control groups in reference to growth in achievement as measured by the adjusted means of the post-test scores.
3. Chi square calculations indicated pupils' attitudes were statistically favorable to the electrical board.
4. The teachers liked the professional stimulation that the board provided and the increased demonstration technique it made possible.
5. For teaching electricity and magnetism in grade six, the Essex Electrical Board is a practical alternative.

Research #: 20

Author: Gilbert, Harold G.

Title: **An Industrial Arts Teacher Education Program for Elementary Schools**

Institution: The Ohio State University

Date: 1955

Purpose of Study: To ascertain (1) the need for elementary classroom teachers with industrial arts training and the responsibility of industrial arts consultants, (2) the teacher-education experiences that might best qualify industrial arts specialists for elementary school training, and (3) the teacher-education experiences that might best qualify elementary teachers to use industrial arts experiences.

Findings and/or Conclusions:
1. The basic industrial arts program to prepare a consultant should include the scientific study of children as well as the organization of elementary schools and methods of initiating and enriching classroom activities.
2. Work in manufacturing, construction, power, transportation, communication, and management as well as development of physical settings.
3. Provisions for a full-time student teaching experience under the direction of a consultant should be made.
4. Problems to be included in the elementary education program to prepare industrial arts specialists include the above plus the definition of industrial arts

Research #: 21

Author: Goff, William Harry

Title: **Vocational Guidance in Elementary Schools**

Institution: The Ohio State University

Date: 1967

Purpose of Study: An experimental program of vocational guidance in the elementary school was designed and activated to determine if measurable increments in occupational knowledge, vocational aspiration and realism in occupational choice could be achieved in predetermined situations in two different elementary schools.

Findings and/or Conclusions:
1. It was concluded that measurable increments in vocational knowledge, level of occupational aspiration and realism of occupational choice could be attained following a planned vocational guidance program.
2. The "best" approach to the instruction and counseling in such a program was undetermined by statistical comparisons of the techniques used.
3. Level of occupational aspiration, as measured by the Occupational Aspiration Checklist, was positively and significantly related to school ability and school achievement.
4. Teacher and parent response to a vocational guidance program at the elementary school level was generally positive and supportive. This was particularly true of the school in an economically disadvantaged area.

Research #: 22

Author: Griffin, Raymond V.

Title: **An Analysis of Selected Science Concepts to Determine Industrial Arts**

Related Experiences Suitable for an Integrated Elementary Industrial Arts Program at the Intermediate Grade Levels

Institution: University of Northern Colorado-Greeley

Date: 1965

Purpose of Study: The problem of this study was to identify specific industrial arts related experiences which contribute to the understanding of the concepts found in the most common science textbooks on the intermediate grade levels of four and six.

Findings and/or Conclusions:

1. Selected industrial arts related experiences can make a contribution to the understanding of the science concepts included in this study.
2. The elementary teachers and elementary industrial arts coordinators had presented numerous industrial arts related experiences in their science programs.
3. There are specific industrial arts related experiences which contribute to the understandings of selected science concepts for Grades IV, V, and VI.
4. The teacher education institutions attended by the members of the American Council for Elementary School Industrial Arts had provided the necessary education for presenting the industrial arts related experiences included in this study.
5. Industrial arts experiences were related more to the physical science concepts than to the biological science concepts.
6. There was agreement upon the desirability or non-desirability of the specific industrial arts related experiences: (1) among the participating college teachers, (2) among the secondary industrial arts participants, (3) between the elementary school teachers and the elementary industrial arts coordinators, and (4) between the college teachers and elementary school industrial arts teachers.

Research #: 23

Author: Gunther, Theresa C.

Title: **The Manipulative Participation in the Study of Elementary Industrial Arts**

Institution: Columbia University Teachers College

Date: 1931

Purpose of Study: Compare the value of the conventional method of studying the facts from books with the manipulative participation method. It includes pupils studying industrial arts in the elementary grades. Two units of subject matter were studied in each of thirteen classes, selected from grades three to six.

Findings and/or Conclusions:

No information available.

Research #: 24

Author: Hansen, Russell G.

Title: **An Evaluation of Selected Elementary School Industrial Arts Hand Tools—Grades V and VI**

Institution: University of Northern Colorado-Greeley

Date: 1964

Purpose of Study: To evaluate six selected industrial arts hand tools and one piece of equipment, the sawhorse workbench, in relation to the body build and sex of fifth and sixth grade pupils to find if there were any significant differences between the child's body build and the success he achieved using nineteen various size and weight industrial arts hand tools. The objective was to determine the hand tools most suited for fifth and sixth-grade boys and girls in elementary construction activities.

Findings and/or Conclusions:

1. Comparing the size and weight of tool best suited for fifth and sixth-grade boys and girls to use, it was found that there were some highly significant differences in the use of the coping saws, hand drills, and bit braces.

Research #: 25

Author: Haws, Robert W.

Title: **The Emerging Role of Industrial Arts in the Experience Curriculum of the Elementary School**

Institution: The Ohio State University

Date: 1947

Purpose of Study: To determine what use former elementary education students are making of industrial arts experiences, to find the problems and analyze them and offer a tentative solution.

Findings and/or Conclusions:

1. The majority of the group studied have sufficient skills and understanding in industrial arts to carry on an effective program.
2. There are hindrances of time, space, materials, tools, and equipment.
3. A sympathetic administration can help remove obstacles which block a program.
4. Visual aids were not used sufficiently.
5. The use of trips to industry was not employed enough.

Research #: 26

Author: Herrick, Irving W.

Title: **The Knowledge of Basic Industrial Technology Possessed by Sixth Grade Inner City and Suburban Boys**

Institution: University of Maryland

Date: 1969

Purpose of Study: To discover whether or not there existed a differential in knowledge of basic industrial terminology between inner city and suburban boys.

Findings and/or Conclusions:

1. Subjects from the suburban environment did display more knowledge of verbal symbols for selected common tools, for appropriate uses of those tools, and for the fact that each tool was representative of a category of tools than did their urban counterparts.
2. The mean scores attained by the suburban sample were found to be significantly higher than those attained by the inner city sample on each interview subpart and on total score.

Research #: 27

Author: Hornbake, R. Lee

Title: **Industrial Arts in the Elementary School: A Study of Contributions with Emphasis Upon a Specific Program**

Institution: The Ohio State University

Date: 1939

Purpose of Study: To establish a basis for industrial arts in elementary school programs. The formulation and projection of an industrial arts program in an elementary school.

Findings and/or Conclusions:

1. Industrial arts in elementary school provides children with opportunities to express themselves in tangible media, to develop wholesome personalities, to formulate understanding of social import, to think in planning and executing their tasks.
2. The major part of the industrial arts work should be related in some way to ongoing classroom enterprises. Also some time should be set aside for children to work on something they want in a laboratory situation.

Research #: 28

Author: Hurley, Carl E.

Title: **The Effects of Feedback on Psychomotor Performance of Fourth and Sixth Grade Students**

Institution: University of Missouri-Columbia

Date: 1971

Purpose of Study: It was the primary pupose of this study to ascertain whether or not there is a significantly different level of psychomotor performance among students who experience the following feedback treatments: viewing a videotape recording of their own performance; rating their own performance with the aid of a check sheet while viewing their own actions by means of videotape recording; rating their own performance with the aid of a check sheet alone; or receiving none of the experimental treatments (control group).

A secondary purpose was to ascertain whether or not grade level is related to the learning of psychomotor performance.

Findings and/or Conclusions:

1. It was concluded that when a student rates his own performance of layout operations with the aid of a check sheet while viewing a videotape replay of his own performance, a higher level of performance does result.
2. A higher level of performance of cutting operations does result when the student views his own performance on videotape; rates his own performance with a check sheet; or rates his own performance with a check sheet while viewing a videotape recording of his own performance.
3. A higher level of performance of assembling operations does result when the student rates his own performance with a check sheet or when he rates his own performance with a check sheet while viewing a videotape recording of his own performance.
4. For holding operations, the feedback treatments do not appear to raise the level of performance.

Research #: 29

Author: Inaba, Lawrence A.

Title: **The Development of a Framework for and a Model Teaching-Learning**

System in Electronics Technology for the Elementary School

Institution: The Ohio State University

Date: 1970

Purpose of Study: The purpose of the study was twofold: (1) To develop a rationale and a structure of knowledge that may serve as the basis for an elementary school instructional system in electronics technology within a broader framework of technology, and (2) To design and develop an instructional packaged system in electronics technology that may be used as a model to encourage the development of other similar packaged systems.

Findings and/or Conclusions:

1. The construction of the instructional system included: a teacher's guide, a textbook, a student workbook, transparencies, a vocabulary list, and resource guides.
2. Although a framework of the total instructional packaged system in electronics technology for grades one through six was structured and developed, the prototype of the instructional system included in this study represents the total teaching-learning system geared for only the sixth grade level.

Research #: 30

Author: Ingram, Franklyn Charles

Title: **The Effect of Elementary School Industrial Arts on Pupils' Social Studies Achievement**

Institution: The Pennsylvania State University

Date: 1966

Purpose of Study: To determine whether the introduction of elementary school industrial arts activities into regular social studies units in grades four through six, would have an effect on social studies unit concept learnings.

Findings and/or Conclusions:

1. The incorporation of elementary school industrial arts activities into four and six-week social studies units in grades four, five, and six, did not prevent, as measured by social studies unit concept tests, significant learning in social studies.
2. All experimental groups studying the social studies units incorporating elementary school industrial arts activities improved their silent reading comprehension and work study skills during the period of the study although silent reading and work study skills were not a direct part of the unit.
3. Students studying the social studies units incorporating elementary school industrial arts indicated that they "Learned a lot" and "Had lots of fun." There was a highly significant difference favoring the experimental unit incorporating elementary school industrial arts activities.
4. This study indicated that learning can be fun, in the view of the learners, at no expense to achievement in unit concepts and in silent reading comprehension and work study skills when elementary school industrial arts activities are a part of the social studies unit.

Research #: 31

Author: Johnson, Raymond Carl

Title: **A Proposed Industrial Arts Program for Langston University**

Institution: North Texas State University

Date: 1971

Purpose of Study: The purpose of the study was to provide a high quality plan for enhancing the industrial arts program at Langston University.

Findings and/or Conclusions:

1. Relatively small industrial arts programs cannot satisfy all of the demands of industry since the programs are limited in the number and kind of course offerings.
2. The demands and requirements from industry of an industrial arts major should be used in developing industrial arts programs.
3. The industrial arts program at Langston University is in need of revision and upgrading, especially with regard to course offerings, equipment, and special counseling services for industrial arts majors.
4. The present trend is to provide a great deal of flexibility in the industrial arts program that will permit the implementation of change commensurate with the need (implications for elementary school industrial arts).
5. If Langston University's industrial arts program is to survive and if it is to play a significant role in this highly competitive and technological world, it must meet the challenge with a curriculum revision that will meet the needs and requirements of its students.
6. Since Langston University is located near other colleges, it is important that its curriculum offerings be unique and not parallel those of nearby institutions.
7. There is a great deal of flexibility built around a sound industrial arts program, one that will permit the implementation of changes commensurate with the need.

Research #: 32

Author: Kirkwood, James John

Title: **A Comparative Study of Advance Organizers in a Classroom Presentation in Industrial Arts**

Institution: Purdue University

Date: 1970

Purpose of Study: The study attempted to determine the effect of different types of written introductions on the learning of content from oral lectures on mass production concepts.

Findings and/or Conclusions:

1. The three experimental groups exposed to advanced organizers or general overviews, "typical" or motivational introductions, and placebo or unrelated introductions and then receiving three consecutive lectures did not differ significantly on the criterion instrument.
2. The three treated groups performed significantly better on the criterion instrument than did the non-equivalent control group.
3. Three comparison groups which read the three types of introductions but did not receive further instruction did not differ significantly as measured by the criterion instrument.
4. Experimental groups were divided into ability groups based on SAT Verbal scores. The high ability groups performed at significantly higher levels than did the lower ability groups. No interaction between ability and treatment was found.

Research #: 33

Author: Kohler, Richard C.

Title: **Arts Activities Integrated with the Teaching of Reading, Science, and Arithmetic in the Elementary School**

Institution: University of Missouri-Columbia

Date: 1951

Purpose of Study: To ascertain and analyze the arts activities textbook writers recommend using on an integrated basis in the teaching of reading, science, and arithmetic at the various grade levels of the elementary school, and to present and interpret findings in a way helpful to persons interested in the preparation and advancement of elementary teachers.

Findings and/or Conclusions:

1. Teacher's guidebooks in reading, science, and arithmetic recommended thirty-seven different types of art activities for integration with the teaching of these subjects in the elementary school. Thirty-four types of arts activities appeared in the teacher's reading guidebooks; twenty-five types appeared in the teachers' science guidebooks; and fourteen types appeared in the teacher's arithmetic guidebooks.
2. The distribution of two and three-dimensional arts activites remained relatively constant through the grades for all areas of the curriculum analyzed.
3. The frequency of appearance of the arts activities decreased as the grades in school progressed.
4. Many types of arts activities are common to and can be integrated with the teaching in each grade of the elementary school.
5. Many types of arts activities are and can be integrated with more than one area of the curriculum.

Research #: 34

Author: Kroh, Damon K.

Title: **Relationships of Industrial Arts to the Modern Elementary School Curriculum: Recommendations for Improvements in Elementary Industrial Arts Undergraduate Teacher Education Programs in New York State Colleges**

Institution: New York University

Date: 1957

Purpose of Study: Although a license to teach industrial arts in New York State Public Schools is valid for use in kindergarten through grade twelve, colleges with industrial arts specializations have geared their curricula to the training of junior-senior high school shop teachers. Graduates experience difficulties in adapting their training to elementary school (K-6) situations.

It was believed that elementary school administrators and shop teachers could offer recommendations to serve as guides for revision of existing curricula so that candidates would be better trained for elementary school positions.

Findings and/or Conclusions:

1. That the New York State Education department and the colleges with industrial arts specializations re-evaluate their requirements for certification of industrial

arts teachers and establish a curriculum for training teachers to serve at any level of public school education.
2. The Bureau of Industrial Arts Education should operate under the control of the Assistant Commissioner for General Education rather than the Assistant Commissioner for Vocational Education.
3. The present undergraduate curriculum at each college should be rebuilt upon the emphasis on the qualitative aspects of teaching as a profession rather than upon the present emphasis on technical skills as the vehicle for becoming a successful shop teacher.
4. Industrial arts should be treated as a method in education. The technical skills of the curriculum should be taught as the means for interpretation and enrichment of the public school general education program.
5. A new curriculum should be devised for the four-year undergraduate work in industrial arts education.

Research #: 35

Author: Krumbiegel, Walter Otto

Title: **A History of Recent Developments in the Activity Movement in the United States 1900-1950**

Institution: New York University

Date: 1955

Purpose of Study: To record developments in the activity movement in elementary education in the United States and to relate developments to the social developments of the twentieth century.

Findings and/or Conclusions:
1. The activity movement represented an attempt to replace the traditional subject matter curriculum of the elementary school with a curriculum consisting of activities, units, experiences, themes, or centers of interest.
2. Evidence indicated that activity education could be traced to primitive cultures. The activity movement of the twentieth century in the United States, however, stemmed from William H. Kilpatrick's project method.
3. The data supported the view that the activity movement reflected the social developments of the twentieth century to some degree.
4. Although educators seemed to agree on the value of including activities in the curriculum, they disagreed on the use of those activities. Some educators held that activities should be employed to teach subject matter while others contended that subject matter should be taught as called for by the activity.
5. Experimental evidence favored the activity curriculum over the traditional curriculum.
6. The status of the activity movement at mid-century was not clear.

Research #: 36

Author: Ljostad, Rodney A.

Title: **Industrial Arts Activities in the Enrichment of Science Experiences for Elementary Schools (with) Part II: The Guide, Illustrations by Betty E. Ljostad**

Institution: New York University

Date: 1965

Purpose of Study: To construct a guide for teachers suggesting industrial arts activities to enrich the teaching of science in the elementary schools. Part I dealt with research; Part II dealt with producing the guide.

Findings and/or Conclusions:

1. The guide consists of thirty carefully selected projects which integrate industrial arts with the content of elementary school science.
2. The guide is organized from simple to complex projects which are appropriate for use with individuals, small groups or whole classes.
3. While a test of effectiveness for the guide was beyond the scope of this study, it was concluded that the guide did represent an attempt to enrich the content of industrial arts by integrating basic concepts of science.

Research #: 37

Author: Lloyd, Clifford J.

Title: **Utilization of Constructional Activities in the Elementary Classroom by Graduates of the University of Missouri—Columbia**

Institution: University of Missouri-Columbia

Date: 1968

Purpose of Study: To (1) ascertain the background experiences and status of those elementary and special education teachers who graduated from the University of Missouri-Columbia from January, 1963, to August, 1966, (2) ascertain the extent to which responding teachers utilized constructional programs under their directions, (3) ascertain the extent to which responding teachers who had experienced differing patterns of preparation utilized constructional activities in the instructional programs under their direction, and (4) to provide an information base from which school authorities may alter educational programs to utilize constructional activities more effectively in the elementary schools.

Findings and/or Conclusions:

1. Elementary and special education teachers are inadequately prepared to implement certain phases of a constructional activity program. Therefore, prospective teachers must have experiences at the undergraduate level which will lead to increased capabilities to perform manipulative activities with tools and equipment and increased knowledge of content related to tools and equipment.
2. Inasmuch as the respondents who had not experienced specialized preparation or indirect course experiences performed less manipulative activities and utilized fewer materials in their program of constructional activities, it appears that a preparation pattern providing both specialized preparation and indirect experiences would result in the utilization of an increased number of manipulative activities and materials in a constructional activity program by future graduates.
3. Respondents at all levels indicated a lack or inadequate supply of most tools and equipment which limits the use of constructional activities by graduates.
4. Respondents who experienced both specialized preparation and indirect experiences were more adequately prepared in the application of constructional activities than those who were not prepared in both of these areas.

Research #: 38

Author: Loats, Henry A.

Title: **A Program of Industrial Arts for the Preparation of Elementary Teachers,**

Ball State Teachers College, Muncie, Indiana

Institution: The Ohio State University

Date: 1950

Purpose of Study: To determine what course offerings would best serve Ball State Teachers College in preparation of elementary teachers in so far as the industrial arts background was concerned.

Findings and/or Conclusions:
1. The medium that most elementary school teachers worked with was paper.
2. Group activity units involving the construction of sand table scenes are stressed most while group activities involving the use of industrial processes are stressed least.
3. A lack of supplies and materials and a lack of classroom space are the hindrances encountered most.
4. Using a wider variety of materials is needed.
5. Workshops are the types of industrial arts in-service training needed most.

Research #: 39

Author: Low, Fred G.

Title: **A Study of Industrial Arts Skills and Teaching Techniques as Appraised by Elementary Teachers, Compared to Those Taught by California Colleges.**

Institution: University of Northern Colorado-Greeley

Date: 1963

Purpose of Study: To determine whether industrial arts skills and teaching techniques desired by elementary classroom teachers employed in California were comparable to industrial arts skills and teaching techniques taught by California state colleges in classes for elementary teachers in training.

Findings and/or Conclusions:
1. Teachers in training should have an opportunity for experience in industrial arts activities so as to gain a familiarity through personal use.
2. Teachers in training should have an opportunity to observe an elementary class engaged in an industrial arts activity being taught by an experienced teacher.
3. Teachers in training should be required to take a minimum of one industrial arts class designed especially for elementary credential candidates.

Research #: 40

Author: Mosley, Samuel N.

Title: **The Goals of the Industrial Arts Curriculum in the Middle Schools as Perceived by Selected Florida Educators**

Institution: The Florida State University

Date: 1970

Purpose of Study: This study compared the Q-sort responses of industrial arts teachers, supervisors of industrial arts, principals, and counselors in the middle schools of Florida to determine if there was agreement as to the role of industrial arts in the general education of boys and girls in the middle schools.

The sorting of the four occupational area groups was analyzed and further studied for areas of agreement in the following four categories: (1) years of experience, (2) degree(s) held, (3) industrial arts courses in secondary school education, and (4) sex.

Findings and/or Conclusions:
1. A majority of the participants ranked as most important those statements which dealt with safe practices, skillfull use of tools and materials, and work related to projects. This may indicate that while there is wide acceptance of industrial arts as an important part of the middle school curriculum, those working with the middle schools in Florida remain oriented toward the traditional industrial arts curriculum.
2. Significant agreement existed on the orderings of objectives: (1) among all of the groups, (2) between industrial arts teachers and supervisors of industrial arts, and (3) between industrial arts teachers and principals.
3. The ordering of objectives by industrial arts teachers and counselors displayed no agreement.

Research #: 41

Author: Oaks, Merrill M.

Title: **An Evaluation of the Effectiveness of a Developmental Sequence for Teaching an Industrial Education Psychomotor Task to Severely Mentally Retarded Students**

Institution: University of Maryland

Date: 1970

Purpose of Study: The purpose of this study was to provide research evidence concerning the effectiveness of a sequential program of instruction in the development and performance of industrial education skills by severely mentally retarded students.

Findings and/or Conclusions:
1. The findings of this study revealed that the sequential method utilized was effective for teaching a scribing-sawing psychomotor task to severely retarded young boys. The method was also responsible for significant retention of learned material.
2. A similar sequential technique could be applied to the teaching of other industrial education activities and academic subjects. This method could also be used to teach children of higher ability levels than the severely retarded. Another implication of the use of the sequential technique was that this method could be utilized by the regular classroom teacher to instruct specialized subjects such as industrial education.

Research #: 42

Author: Paine, Olive

Title: **An Experimental Study of Two Methods of Teaching Manual Arts in the First Grade.**

Institution: Yale University

Date: 1930

Purpose of Study: No information available.

Findings and/or Conclusions: No information available.

Research #: 43

Author: Palow, William Paul

Title: **A Study of the Ability of Public School Students to Visualize Particular**

Perspectives of Selected Solid Figures

Institution: University of Florida

Date: 1969

Purpose of Study: This study is an extension of an experiment reported by Piaget and Inhelder in *The Child's Conception of Space.* In their ninth chapter, they ask children to imagine sections of solid figures when planes (represented by a knife) cut the appropriate figures parallel, perpendicular and oblique to their various axes. Success on this test indicates the beginning of the ability to visualize in Euclidean Space, the third of Piaget's mathematical representational spaces. Piaget asserts that the task may be formulated from the view of the second of his representational spaces, projective space.

Findings and/or Conclusions:

1. A significant difference was found between ages, grades, sexes, and I.Q. levels. None of the interaction terms tested were significant.
2. The results of the study support Piaget's position that children acquire Euclidean abilities about the age twelve or at about the seventh grade.
3. The data analyses also indicated that boys do better than girls, that higher ability students do better than average ability students, and that socio-economic level makes no difference in the ability tested by the instrument.

Research #: 44

Author: Peel, Nancy Dale

Title: **An Analysis of the Mathematics Taught in Grades One Through Eight as Applied to Selected Industrial Occupations**

Institution: Indiana University

Date: 1967

Purpose of Study: The study had four major purposes: (1) To determine semi-skilled industrial employees' perception of mathematics used in their work, (2) to determine industrial management's perception of mathematics used in the work of semi-skilled employees, (3) to analyze elementary and junior high school mathematics curriculum for the purpose of determining topics offered and degree of emphasis given the teaching of each topic, (4) to compare rankings indicative of degree of use in industrial work assigned each mathematics topic by employees and employer with rankings in the school mathematics program which indicate degree of emphasis given each mathematics topic in the school program.

Findings and/or Conclusions:

1. The respondents in this sample appear to be representative of all factory workers employed on third shift operations in the manufacturing industry.
2. Employees' perception of the mathematics used in their work included to a considerable degree a knowledge of the four fundamental operations of addition, subtraction, multiplication and division, and perception of the mathematics used in their work differed from the employers' perception of the mathematics used in the work of the employees.
3. Employees' perception of mathematics topics of greatest use in their work differed from the mathematics topics given greatest emphasis in the school mathematics program.
4. Employers' perception of mathematics of greatest use in work situations coincided

with the mathematics given greatest emphasis in the school mathematics program.
5. The school mathematics program gives a high percentage of time to the teaching of the four operations of addition, subtraction, multiplication and division, and a much lower percentage of time to compound operations.

Research #: 45

Author: Pershern, Frank R.

Title: **The Effect of Industrial Arts Activities on Science Achievement and Attitudes in the Upper Elementary Grades**

Institution: Texas A & M University

Date: 1967

Purpose of Study: To determine the effectiveness of integrating industrial arts activities with the teaching of science in the fourth, fifth and sixth grades. Specific attention was directed to student achievement in two areas of science, namely, electricity and machines. Lesson plans and a list of related industrial arts activities were developed to provide direction toward stated objectives.

Findings and/or Conclusions:

1. All groups made achievement gains as the result of the instructional programs.
2. The fourth and fifth grade experimental groups for the unit of instruction in electricity made significant gains in achievement.
3. There was no significant difference in student gain at the sixth grade level in the unit of instruction in electricity as a result of the two methods of instruction.
4. The null hypothesis of no difference between methods was accepted for the machines unit at all three grade levels.
5. In general, students apparently favored that unit of instruction that was taught by the experimental method, as reflected by response to questionnaire items.
6. Students, in response to the questionnaire, generally thought that the unit most difficult to understand was that unit taught by the traditional method.
7. The unit which made science more enjoyable for the students was the unit taught by the experimental method, as revealed by response to the questionnaires.
8. All participating teachers were in agreement in their responses to the questionnaires that integration of related industrial arts activities, as utilized in this experiment, can result in the following: (a) Industrial arts activities can enrich the elementary science program. (b) Construction activities clarify or help to visualize science concepts. (c) The teaching of elementary science can be more effectively accomplished with the integration of industrial arts.
9. From the findings of the experiment, it may be concluded that the integration of related industrial arts activities adds an important dimension to successful instruction in science at the elementary school level.

Research #: 46

Author: Power, Andrew T.

Title: **A Suggested Guide for Use of the Related Arts in an Integrated Curriculum at the Elementary Level in Bloomfield, New Jersey, Public Schools**

Institution: New York University

Date: 1955

Purpose of Study: To develop a suggested guide for administrators, supervisors and teachers to aid in establishing and operating a program of related arts which can be integrated with and used to enrich the general educational program of the elementary schools of Bloomfield, New Jersey.

Findings and/or Conclusions:

1. Authorities are essentially in agreement that learning by doing is a basic educational concept.
2. There is a limited body of literature to supplement this viewpoint.
3. Isolated cases exist in which imaginative teachers, even without a guide, carry on a limited integrated related arts program. Instead of isolated examples of an integrated related arts program, however, American schools should rather consistently show integrated related arts programs as concrete evidence of their verbal expressions of a democratic philosophy of education.

Research #: 47

Author: Richards, Kenvyn B.

Title: **A Comparison of the Effects of Verbal and Verbal-Manipulative Forms of Programmed Instruction in Teaching Measurement Skills to Sixth Grade Pupils**

Institution: University of Maryland

Date: 1970

Purpose of Study: The purpose of this study was to investigate the efficacy of including manipulative experiences in a program of instruction.

Findings and/or Conclusions:

1. There were no significant differences between the experimental groups on the learning task.
2. There was a significant difference between experimental groups in the amount of time needed to complete the treatment.
3. Pupils using the verbal program of instruction required less time to complete the treatment than did the pupils using the verbal-manipulation program of instruction.

Research #: 48

Author: Robbins, Evelyn G.

Title: **The Handicrafts: A Manual for Teachers and Prospective Teachers of Art**

Institution: New York University

Date: 1949

Purpose of Study: To provide the teachers of art with materials for the extension of their field to include the crafts.

Findings and/or Conclusions:

Twenty-four craft activities were finally selected as being necessary for consideration and these in turn were listed under 10 headings or classifications. Each activity under these headings is treated by:

1. Brief explanation and history of the activity.
2. Technical information given as to the processing or manufacture of the materials used in each activity.
3. Examples are given of simple devices that have proved invaluable to teachers as

teaching aids and that may be constructed in the classroom.
4. Pictures, samples and diagrams together with job analyses are given for finishing a project in each craft or activity.
5. Techniques and advice from experience liberally given.
6. The bibliography lists books and reference materials for the complete range of activities considered.
7. The appendix lists supply houses for materials.

Research #: 49

Author: Robinson, Frank E.

Title: **Background of Prospective Elementary Teachers in Selected Industrial Arts Activities**

Institution: University of Missouri-Columbia

Date: 1955

Purpose of Study: To determine the experience and background of elementary industrial arts teachers in Missouri schools on the basis of activities believed desirable by specialists in the field.

Findings and/or Conclusions:
1. There was no significant difference in the background of men and women.
2. Sixteen persons reported no experience in their areas.
3. A very small fraction of each group evaluated themselves as having no skill.
4. Half of the group expressed an attitude of liking to work in other areas.
5. Informational background was somewhat limited.

Research #: 50

Author: Scobey, Mary-Margaret

Title: **Industrial Arts for Elementary Teachers**

Institution: Stanford University

Date: 1952

Purpose of Study: To ascertain the industrial arts education of elementary school teachers.

Findings and/or Conclusions:
1. Course offerings and objectives vary between institutions and do not coincide with the industrial arts objectives as commonly known.
2. Elementary teachers need to understand and apply the principle that industrial arts is the "vehicle" used to provide motivation for content.
3. Teacher training candidates were vague in their understanding of industrial arts and what, why, and how to use this process in the elementary grades.
4. Many teacher training experiences are listed which would provide a broader basis of manipulative experiences and understanding.

Research #: 51

Author: Simmons, Darrell DeWitt

Title: **A Theoretical Basis for Industrial Arts in the Public Schools**

Institution: University of Tennessee

Date: 1958

Purpose of Study: To clarify and, in some degree, reduce the confusion that appeared to exist in the area of industrial arts by investigating the theoretical basis for industrial arts in the public schools. Investigation was made into the following topics in arriving at a theoretical basis: (1) History and trends of industrial arts; (2) Nature of man from the standpoint of biological man, philosophy, and the theory of learning; and (3) Modern culture from the standpoint of traditions, machines, institutions, science, and the concept of democracy.

Findings and/or Conclusions:

1. Reduction of departmentalization and the unit shop concept.
2. Acceptance of the idea that the industrial arts program is an educational program rather than a training program.
3. Belief in the idea that the student who experiences great difficulty is a slow learner rather than a "dumbbell."
4. Make project selection and development compatible with real problems of the student.
5. Integration of learning activities with the activities of other subject areas.
6. Increased understanding and use of appropriate guidance principles.

Research #: 52

Author: Squibb, Albert R.

Title: **A Descriptive and Comparative Study of Industrial Arts in Selected Public Elementary Schools in Ohio**

Institution: The Pennsylvania State University

Date: 1967

Purpose of Study: The study described and compared present practices and teacher opinions relating to industrial arts-type construction activities as employed in selected Ohio elementary education programs. The data that were collected were analyzed and specific suggestions were made to indicate how industrial arts could be included in the child's elementary education.

Findings and/or Conclusions:

1. The responding teachers reported that construction activities contributed positively to the education of the typical elementary school pupil.
2. The majority of the teachers reported that they integrated the construction activities with other phases of the curriculum.
3. A statistically significant number of elementary teachers believed that some industrial arts education should be required at the college level.
4. More than 70 percent of the responding teachers stated that they utilize construction activities to some degree to help with their teaching.
5. Less than one-half of the responding teachers had received any industrial arts education at the college level.
6. Nearly one-half of the elementary teachers had some person available for technical help when using construction activities.
7. The responding teachers overwhelmingly recommended that facilities for construction activities should be provided in all new elementary schools.
8. The school board usually furnished money for construction activity supplies. Money for equipment purchases was generally more difficult to obtain.
9. One-third of the teachers reported that about one to three hours was given to construction activities per typical week.

10. Most of the teachers who utilized construction activities had been doing so for fewer than 10 years.
11. There was little difference in the use teachers made of construction activities when one grade level was compared to another or when different types of school districts were compared.

Research #: 53

Author: Swerdlow, Robert M.

Title: **Toys, Games, and Hobby Materials Available for Use as Instruction Materials in Programs of Industrial Arts Education at the Elementary School Level: A Compendium Including Educational Applications and Suggested Techniques for Teacher Utilization**

Institution: New York University

Date: 1969

Purpose of Study: The compendium developed in this study provides the classroom teacher with a systematized descriptive listing of toys, games, and hobby materials presently fabricated and marketed by American manufacturers that have potential application as instructional materials for use in programs of industrial arts education at the elementary school level. In addition, educational applications for each of the toys, games, and hobby materials are defined and techniques for teacher utilization of these play materials are suggested.

Findings and/or Conclusions:

1. Available, commercially, for use in programs of industrial arts education at the elementary level, are a number of relatively inexpensive play materials capable of accurately reflecting the tools, materials, equipment, processes, products, and organization of American industry.
2. On the basis of a preliminary investigation conducted by the investigator approximately one year prior to this survey, it was concluded that toys, games, and hobby materials appropriate for use as instructional materials in programs of industrial arts education at the elementary school level differ slightly as to type and availability from year to year.

Research #: 54

Author: Thieme, Eberhard

Title: **Pupil Achievement and Retention in Selected Area of Grade Five Using Elementary Industrial Arts Activities Integrated with Classroom Units of Work**

Institution: The Pennsylvania State University

Date: 1965

Purpose of Study: To evaluate elementary industrial arts activities when integrated with classroom units of instruction in selected area of work in the fifth grade.

Findings and/or Conclusions:

1. Pupils utilizing three-dimensional elementary industrial arts construction activities integrated with their units of study did as well as those pupils taught by traditional methods in the areas tested.
2. No significant differences, however, were found in construction activity and

traditional classes in the areas of work study skills, map reading, general map knowledge, and specific map knowledge.
3. Re-testing of pupils after the summer vacation indicated no significant difference in their retention in the areas tested between the activity pupils and the traditional pupils.
4. It was found that the best way to identify classroom teachers who used three-dimensional construction activities as a method of teaching was by observation and visual survey.
5. There were some significant differences of opinion between classroom teachers and elementary industrial arts teachers on the utilization of construction activities.
6. Classroom teachers felt that scheduled industrial arts classes are more important than construction activities in the classroom.
7. Classroom teachers also felt that adequate storage facilities were necessary before construction activities could be utilized.
8. Hammering and sawing activities were not to be encouraged in the classroom, according to the teachers.

Research #: 55

Author: Thomas, Kenneth Russell

Title: **A History of Industrial Arts in the City of Pasadena**

Institution: University of California

Date: 1967

Purpose of Study: To write a history of the industrial arts program of the Pasadena City Schools, Pasadena, California.

Findings and/or Conclusions:
1. Throop Polytechnic Institute offered the first manual training program in the city of Pasadena. Initiating this program in 1892, the institute was soon known as "The Best Equipped Manual Training School for Both Sexes West of the Mississippi."
2. A sloyd school and normal department were added in 1895 as the institution continued to grow in stature.
3. A reorganizational program was initiated soon after the turn of the century, and by the close of the 1910-1911 school year all of the manual training programs had been phased out of the institution.
4. The Pasadena City Schools added sloyd to the lower grammar grades in 1900 and manual training to the upper grammar grades in 1905.
5. The success of these programs, together with the increasing enrollments in the district, led to the establishment of manual training for the senior high school youth in 1911.
6. A junior high school program was initiated in 1913 on an experimental basis, and was adopted district-wide in 1923.

Research #: 56

Author: Trapanese, Menna Gerard

Title: **A Study of Facilities for the Crafts Programs Conducted in Selected Elementary Schools in the State of New Jersey**

Institution: New York University

Date: 1964

Purpose of Study: The principal purpose of this study was to access the facilities for conducting crafts programs in selected elementary schools in the state of New Jersey. A secondary purpose of the study was to develop a manual that could be used by educational administrators and by school architects in planning and designing crafts laboratories in new school construction.

Findings and/or Conclusions:

1. Too few teaching specialists are employed for the elementary school.
2. Facilities, for the most part, are inadequate to meet the instructional needs of the program. Attempts are, however, being made to provide better facilities.
3. Handwork equipment, for this level of instruction, that is available from manufacturers, is at a minimum and appears not to be too well designed.
4. Funds for the elementary school crafts program are not adequate in relation to the current prices of materials.

Research #: 57

Author: VanHerck, Don V.

Title: **Constructional Activities: Their Status and Factors Relating to Their Utilization by Public Elementary School Teachers of Missouri**

Institution: University of Missouri-Columbia

Date: 1966

Purpose of Study: To ascertain the constructional activities used in selected elementary schools of Missouri and determine why these activities are utilized.

Findings and/or Conclusions:

1. The most frequently fulfilled educational outcomes are attitudes, appreciations, creativity, reinforcement, and self-expression.
2. Professional training in this area was shown to be a worthwhile investment.
3. Eighty percent of the teachers surveyed were including constructional activities in their pupils' educational experiences.
4. A large portion of the constructional activities were conducted in the regular classroom with a limited number of tools and equipment with soft materials being most frequently utilized.
5. In view of the value placed upon workshops for the instructional activities, higher educational institutions should make an effort to provide this type of workshop.

Research #: 58

Author: Williams III, Walter R.

Title: **A Study of The Judgements of Experts and Practitioners Concerning Superior Practices in Elementary School Industrial Arts**

Institution: University of Maryland

Date: 1963

Purpose of Study: The purpose of this study was to: (a) identify significant trends in the elementary school industrial arts offerings which were considered superior by elementary industrial arts specialists, (b) develop better understandings of superior elementary school industrial arts activities, (c) determine practices thought to be superior in elementary school industrial arts, (d) assist in the improvement of elementary school industrial arts programs through a study of current school practices that would affect the program, (e) identify elementary school industrial arts procedures which might indicate promising practices that would benefit all programs.

Findings and/or Conclusions:

Over one-half of the participants indicated that they were conducting superior elementary school industrial arts experiences based on:

1. Meeting emotional needs of children.
2. Meeting objectives of industrial arts as related to the personal needs of pupils.
3. Meeting safety requirements as related to the physical needs of pupils.
4. Developing informative and planning skills within the pupils.
5. Developing manipulative skills within the pupils.
6. Using introductory procedures for industrial arts activities.
7. Using individual instructional procedures.
8. Using materials for construction.

DOCTORAL DEGREE RESEARCH STUDIES
(To Be Completed)

Name	Title-Degree-Year	Institution
Andrews, John	Ontogeny of Psychomotor Aptitude: Ph.D. Degree; 1974.	University of Connecticut
Blezek, Allen	The Extent to Which Teacher Educators are Incorporating Career Education Concepts into School Curricula: Ph.D. Degree; 1973.	University of Nebraska-Lincoln
Cadoff, Joel	A Program for the Preparation of Elementary School Industrial Arts Teachers for an Urban Area; Ed.D. Degree; 1974.	Columbia University Teachers College
Darrow, Donald	A Rationale for and Structure of the Technology of the Man-Made World: A Proposal for Elementary School Curriculum; Ph.D. Degree; 1973.	Ohio State University
Hunt, Elizabeth E.	The Open Classroom and the Activity Choices Children Make; Ed.D. Degree; 1973.	University of Maryland
Logan, Noah	The Effect of Constructional Activities Upon Achievement at the Third Grade Level; Ph.D. Degree; 1973.	University of Missouri-Columbia
Moore, John Paul	Attitudes of Elementary Staffs Toward Selected Aspects of Career Awareness Education in Texas; Ed.D. Degree; 1973.	Texas A & M University
Yadon, James N.	A Study to Determine Attitude Change Toward Selected Occupational Fields by Construction Students in Florida; Ph.D. Degree; 1973.	Florida State University

OBSERVATIONS RELATED TO DOCTORAL RESEARCH

The purpose of this section is to provide the reader with a composite of the major findings and conclusions that have been made by those who conducted the research.

Experimental Research

The findings of the experimental research studies conducted to date indicate that students who have experienced the elementary school industrial arts approach to cognitive, affective, and psychomotor learning have either made significantly higher gains or were equal to students who had studied by a more traditional approach, regardless of the elementary school curricular area in which the research was conducted. Based on these and other data, several researchers have stated that elementary school industrial arts activities can be effectively implemented through integration with the regular elementary school subjects of mathematics, science and social studies. Research has also revealed that certain unit concepts in these curricular areas lend themselves to an elementary school industrial arts approach, whereas other unit concepts do not. This seems to imply that an analysis of the abstractness of the concept that is to be presented needs to be made prior to presenting the concept utilizing a hands-on experience approach. There is evidence, though, which implies that elementary school industrial arts activities which are directly related to the unit under study are more effective with respect to achievement and retention than are indirectly related activities or no activities at all.

Research indicates that the lecture-demonstration approach tends to be more effective with the student who is average to below average in intelligence, whereas the inductive approach seems to be more effective with those students who are above average in intelligence when compared on achievement tests.

All of the research studies conducted to date reveal that both teachers and students have a more favorable attitude toward the elementary school industrial arts approach to instruction than to the more traditional approach. Teachers and parents have also revealed a very positive attitude toward occupationally oriented guidance programs in the elementary school, especially teachers and parents who teach and live in economically disadvantaged areas.

Several research studies revealed that an elementary school industrial arts approach not only takes less overall class time to present curricular concepts to elementary students due to the reduction of verbalization by the teacher, but it also stimulates interest in learning concepts that are presented in the elementary school curriculum. This is evidenced by such concomitant outcomes as improved: (1) retention of mathematics concepts, (2) silent reading comprehension, and (3) work study skills.

One research study revealed that suburban male elementary school students have a better knowledge of verbal symbols for selected common tools and know how to appropriately use these tools than do their urban counterparts. There have also been tool utilization studies conducted in the elementary school at various grade levels which reveal the appropriate size, kind and weight of tools to use with elementary school youngsters according to their sex and physical build.

A number of the experimental researches revealed that high ability students comprehend and retain curricular content more effectively than do their low ability counterparts, regardless of the treatment utilized. It has also been found that regardless of the treatment used, male students could not be expected to achieve and retain elementary school curricular content more effectively than their female counterparts.

Other Than Experimental Research

There is a growing body of evidence which indicates that the activity movement can be traced to primitive cultures. This movement in North America, which has a strong European influence, represented an attempt to replace the traditional subject matter curriculum of the elementary school with a curriculum consisting of activities, units, experiences, themes and/or centers of interest. This concept stemmed largely from the work of William H. Kilpatrick's project method of instruction. Early elementary school industrial arts programs, which grew out of the activity movement, were of a separate subject matter basis but were reduced in scope with the advent of the junior high school movement. This latter movement led to the concept of integrating industrial arts experiences with the traditional elementary school curriculum.

Although educators seem to agree on the value of including activities in the elementary school curriculum, they disagree on the use of those activities. Some feel that activities should be employed to teach subject matter while others contend that subject matter should be taught as called for by the activity. There is much stronger support for the philosophy which advocates the integration of industrial arts experiences with the traditional elementary school curricular units of instruction, though, than the separate subject concept. Regardless of the philosophical stand taken, elementary school teachers strongly favor the activity curriculum over the traditional elementary school approach to curriculum. This has led authorities to agree that learning by doing is a basic educational concept even though there remains a limited body of literature to support this viewpoint.

Numerous research studies indicate that the purposes for elementary school industrial arts activities should be to: (1) satisfy the natural impulses of children, (2) furnish activities around which subject matter experiences may be developed, (3) develop desirable habits, attitudes and personalities, (4) provide an opportunity to express ideas through tangible media, (5) formulate understanding of social import, (6) meet the physical and emotional needs of children, and (7) aid students in planning and executing their tasks.

Elementary school industrial arts activities are usually taught by the regular classroom teacher in the regular elementary school classroom. There is more emphasis being placed on creativeness by the elementary school teacher than on skill development, and a majority of the experiences that are provided for elementary school children are related more to the physical than to the biological science concepts. Paper was the most frequently used medium at the turn of the century, but several research studies imply that elementary classroom teachers are now beginning to use a wider variety of materials then they have in the past, although the materials utilized are generally of a soft nature.

Research indicates that as the grade level increases there is a tendency to provide more elementary school industrial arts activities; but the frequency of appearance of two- and three-dimensional activities in reading, science and arithmetic teacher's resource books decreases with an increase in grade level. Personal characteristics, teaching load, a rigid daily program of studies, and classroom size do not appear to affect the role of industrial arts activities in the elementary grades; but the attitudes of superiors, parents, the press, as well as noise from the activity, and classroom acoustics play a very important role influencing the inclusion or exclusion of elementary school industrial arts activities in the elementary school curriculum. Facilities for the most part are inadequate to meet the instructional needs of the elementary school industrial arts program, and those elementary classroom teachers who have been surveyed overwhelmingly recommend that facilities for elementary school industrial arts activities should be provided in all new elementary schools. Handwork equipment for this level of instruction, that is available from manufacturers, is at a minimum and appears not to be well designed. Elementary school industrial arts programs continue to suffer from the hindrances of time, space, materials, tools, equipment, and funding.

More than half of the industrial teacher education departments of the nation offered an elementary school industrial arts course or courses one decade ago, and a majority of these were junior, senior or graduate level courses which were generally taught by industrial education staffs who had received no specific training in the area. The courses were offered and continue to be offered in colleges and universities primarily on an elective basis and generally were a wood or metal-oriented laboratory/lecture class. The possibilities of relationships made with elementary school subjects and the variety of experience areas used in college and university courses seem to be entirely inadequate. This calls for the fostering of closer communication between elementary education and industrial arts departments located in our institutions of higher education.

Elementary school teachers who had not experienced an elementary school industrial arts program during their undergraduate college or university preparation were vague in their understanding of industrial arts and what, why and how to use this process in the elementary grades. They felt that such courses should be offered at the college and university level and felt that industrial arts experiences would contribute positively to the education of typical elementary school students. Respondents who had experienced both specialized preparation and indirect experiences were more adequately prepared than the previously mentioned group in the application of elementary school industrial arts activities, and research reveals that an overwhelming portion of these teachers were utilizing these activities in their teaching but were inadequately prepared to implement certain phases of an elementary school industrial arts program. An increased capacity to perform manipulative activities with tools and equipment, and increased knowledge of content related to tools and equipment is needed. Teachers who had college or university work beyond a master's degree were the most consistent users of elementary school industrial arts activities.

Several research studies indicated that the pre-service preparation of elementary school teachers should include: (1) an elementary school industrial arts course devoted to a familiarization with tools and materials through personal use, followed by a second course devoted to methods of effectively utilizing tools and materials in the elementary school program, (2) an opportunity to observe elementary school students engaged in an industrial arts activity being taught by an experienced elementary school classroom teacher, and (3) a knowledge of the objectives of an elementary school industrial arts program and how activities can be integrated with the existing elementary school program.

Teacher education preparation programs designed to prepare consultants should include a study of (1) child growth and development, (2) content dealing with the organizational structure of elementary schools, (3) methods used to integrate and enrich classroom activities, and (4) provisions of a full time student-teaching experience under the direction of a successful consultant. Two research studies also indicated a need for the preparation of teachers of the deaf and the visually limited who can effectively direct elementary school industrial arts activities.

One research indicated that a model teaching-learning instructional system for use with elementary school students should include: a teacher's guide, textbooks, student workbooks, transparencies, a vocabulary list, and resource guides. Several resource guides have been developed for classroom use which advocate the integration of industrial arts with content of the elementary school curricular areas of science, arts and crafts. Available, commercially, for use in elementary school industrial arts programs, are a number of relatively inexpensive play materials capable of accurately reflecting the tools, materials, equipment, processes, products and organizational structure of American industry.

41	Oaks, Merrill M.	1970		X	X	X	X			X												X								X
42	Paine, Olive	1930	X		X			X			X											X								
43	Palow, William P.	1969		X	X	X	X	X					X	X	X	X									X					
45	Pershern, Frank R.	1967		X	X	X	X	X	X					X	X	X		X						X						
47	Richards, Kenvyn B.	1970		X	X	X	X			X						X	X													
54	Thieme, Eberhard	1965		X	X	X	X	X							X				X					X						
	TOTALS		7	14	20	19	19	14	3	7	2	2	3	7	8	12	2	4	2	1	1	6	1	9	1	1	1	4	1	2

Table 1

COMPARISON OF DOCTORAL STUDIES: EXPERIMENTAL RESEARCH

Research #	Name of Researcher	Year of Graduation	Degree Symbol		Research Categories																										
					Resource Location			Domains			Grade Level(s)						Elem. School Curric. Areas			Other Curric. Areas		Other Categorical Data									
			Ph.D. Degree	Ed.D. Degree	Joint Research Summaries—ACIATE—AIAA—NAITTE	Microfilm	Dissertation Abstracts	Cognitive	Affective	Psychomotor	First (1st)	Second (2nd)	Third (3rd)	Fourth (4th)	Fifth (5th)	Sixth (6th)	Mathematics	Science	Social Studies	Drafting	Electricity	Philosophy & Methodology	Teacher Ed. Prog. Dev. & Util.	Elem. Sch. Prog. Dev. & Util.	Space Relationships	Silent Reading Comprehension	Work Study Skills	Tools & Their Utilization	Guidance	Mental Retardation
2	Bender, Michael	1971		X		X	X			X												X		X						X
5	Bjorkquist, David D.	1965	X		X	X	X	X								X				X				X						
6	Bonde, Robert	1964		X	X	X	X			X	X																	X		
9	Brudzynski, Alfred J.	1966		X	X	X	X	X							X	X					X									
11	Champion, George	1965	X		X	X	X	X										X				X								
14	Doutt, Richard F.	1965		X	X	X	X			X		X	X	X										X				X		
15	Downs, William A.	1968		X	X	X	X	X							X		X	X						X						
19	Gerne, Jr., Timothy A.	1967	X		X	X	X	X	X							X		X						X						
21	Goff, William H.	1967	X		X	X	X	X				X		X		X													X	
23	Gunther, Theresa	1931	X		X			X					X	X	X	X								X						
24	Hansen, Russell G.	1964		X	X	X	X			X					X	X												X		
26	Herrick, Irving W.	1969		X	X	X	X	X								X												X		
28	Hurley, Carl E.	1971		X	X	X	X			X				X		X						X								
30	Ingram, Franklyn C.	1966		X	X	X	X	X	X					X	X	X			X					X		X	X			
32	Kirkwood, James J.	1970	X		X	X	X	X														X	X							

29	Inaba, Lawrence A.	1970	X		X	X	X			X						X							X				
31	Johnson, Raymond C.	1971		X	X	X	X	X											X								
33	Kohler, Richard C.	1951		X	X	X	X	X			X	X	X	X						X							
34	Kroh, Damon K.	1957	X			X	X	X											X								
35	Krumbiegel, Walter O.	1955	X		X	X	X		X								X										
36	Ljostad, Rodney A.	1965	X		X	X	X			X				X									X				
37	Lloyd, Clifford J.	1968		X	X	X	X	X											X								
38	Loats, Henry A.	1950	X		X	X	X			X									X								
39	Low, Fred G.	1963		X	X	X	X	X											X								
40	Mosley, Samuel N.	1970	X		X	X	X	X										X									
44	Peel, Nancy D.	1967		X	X	X	X	X					X							X							
46	Power, Andrew T.	1955	X		X	X	X			X													X				
48	Robbins, Evelyn G.	1949	X		X		X			X					X								X				
49	Robinson, Frank E.	1955		X	X	X	X	X											X								
50	Scobey, Mary-Margaret	1952		X	X	X	X	X											X								
51	Simmons, Darrell D.	1958		X		X	X	X									X										
52	Squibb, Albert R.	1967		X	X	X	X	X												X	X						
53	Swerdlow, Robert M.	1969	X		X	X	X			X													X				
55	Thomas, Kenneth R.	1967		X	X	X	X		X																		
56	Trapanese, Menna G.	1964	X		X	X	X	X							X									X			
57	VanHerck, Don V.	1966		X	X	X	X	X												X	X						
58	Williams III, Walter R.	1963		X	X	X	X	X									X			X							
	TOTALS		17	20	35	33	37	26	4	7	1	1	2	3	2,	1	4	1	11	9	5	2	6	1	1	1	1

Table 2

COMPARISON OF DOCTORAL STUDIES: OTHER THAN EXPERIMENTAL RESEARCH

			Degree Symbol		Resource Location			Research Categories: Type of Study			Research Categories: Elem. School Curric. Area				Research Categories: Other Curric. Areas		Research Categories: Other Categorical Data									
Research #	Name of Researcher	Year of Graduation	Ph.D. Degree	Ed.D. Degree	Joint Research Summaries—ACIATE—AIAA—NAITTE	Microfilm	Dissertation Abstracts	Descriptive-Survey	Documentary-Historical	Developmental-Curriculum	Art	Language Arts	Mathematics	Science	Crafts	Electronics Technology	Philosophy & Methodology	Goals & Objectives	Teacher Ed. Prog. Dev. & Util.	Elem. Sch. Prog. Dev. & Util.	Status & Need of Elem. I. A. Prog.	Teacher Competencies	Resource Material & Act. Dev.	Facilities & Equipment	Safety Program	Visually Limited	Deaf
1	Baugrud, Kim J.	1968		X	X	X	X	X																		X	
3	Benson, Kenneth R.	1956	X		X	X	X			X													X				
4	Bicknell, William C.	1942		X	X		X	X												X							
7	Brown, Robert D.	1955	X		X	X	X	X									X					X					
8	Bruce, Phillip L.	1964		X	X	X	X	X											X		X						
10	Chamberlain, Duane G.	1953	X		X	X	X	X													X						
12	Charlesworth, Kenneth B.	1968		X	X	X	X		X																X		
13	Doane, Raymond C.	1956		X	X	X	X	X																			X
16	Duncan, Glenn S.	1950		X	X	X	X	X											X								
17	Fagan, Raymond E.	1954		X	X	X	X	X											X								
18	Genevro, George W.	1966		X	X	X	X		X																		
20	Gilbert, Harold G.	1955	X		X	X	X	X											X								
22	Griffin, Raymond V.	1965	X		X	X	X	X						X						X							
25	Haws, Robert W.	1947	X		X		X	X												X	X	X					
27	Hornbake, R. Lee	1939	X		X		X	X												X							

Table 3

COMPARISON OF DOCTORAL STUDIES—YEAR/TYPE

	Type of Study by Research #								
	Experimental		Descriptive-Survey		Documentary—Historical		Developmental—Curriculum		
Year	Research #	Experimental Total/Yr.	Research #	Descriptive-Survey Total/Yr.	Research #	Documentary-Historical Total/Yr.	Research #	Developmental-Curriculum Total/Yr.	Grand Total Research/Yr.
1930	42	1							1
1931	23	1							1
1939			27	1					1
1942			4	1					1
1947			25	1					1
1949							48	1	1
1950			16	1			38	1	2
1951			33	1					1
1952			50	1					1
1953			10	1					1
1954			17	1					1
1955			7, 49	2	35	1	20, 46	2	5
1956			13	1			3	1	2
1957			34	1					1
1958			51	1					1
1963			39, 58	2					2
1964	6, 24	2	8, 56	2					4
1965	5, 11, 14, 54	4	22	1			36	1	6
1966	9, 30	2	57	1	18	1			4
1967	19, 21, 45	3	44, 52	2	55	1			6
1968	15	1	1, 37	2	12	1			4
1969	26, 43	2					53	1	3
1970	32, 41, 47	3	40	1			29	1	5
1971	2, 28	2	31	1					3
	Grand Total/Type	21		25		4		8	58

Table 4

**COMPARISON OF DOCTORAL STUDIES—
INSTITUTION/RESEARCHER/TYPE**

Degree Granting Institution	Type of Study/Research #				
	Experimental	Descriptive-Survey	Documentary-Historical	Developmental-Curriculum	Grand Total/ Institution
Boston University	9				1
Florida State Univ.		40			1
Indiana University		44			1
New York University	19	34,56	35	3, 36, 46, 48, 53	9
North Texas State U.		31			1
Ohio State Univ.	21	25,27		20, 29, 38	6
Oregon State Univ.		17			1
Penn State Univ.	30, 54	52			3
Purdue University	32				1
Stanford University		50			1
Teachers College-Columbia University	23		12		2
Texas A&M University	45				1
Univ. of California—Los Angeles			18, 55		2
Univ. of Florida	43				1
Univ. of Maryland	2, 11, 26, 41, 47	58			6
Univ. of Michigan		10			1
Univ. of Minnesota	5	24			2
Univ. of Missouri-Columbia	15, 28	1, 4, 8, 13, 16, 33, 37, 49, 57			11
Univ of N. Colorado-Greeley	6, 14, 24	22, 29			5
Univ. of Tennessee		51			1
Yale University	42				1
Grand Total/Type	21	25	4	8	58

SUMMARY OF MASTER'S DEGREE RESEARCH FINDINGS

More than half of the master's degree research studies conducted in the area of elementary school industrial arts have been conducted during the past five years. Thirty-eight of the 66 studies which have been conducted during the past three and one-half decades have been of a descriptive-survey nature followed by 18 developmental-curriculum, 7 experimental, and 3 documentary-historical studies. This reveals that considerably more developmental-curriculum research studies have been conducted at the master's degree level than at the doctoral level. Like doctoral research, more than 60 percent of the total master's degree research effort has been completed within the past 10 years. (Refer to Table four for these and other data.)

There have been 26 institutions involved in the elementary school industrial arts research effort at the master's degree level with 8 institutions responsible for more than 60 percent of the total research effort. These institutions are: The University of Wisconsin at Stout; The State University College at Buffalo, New York; The State University College at Oswego, New York; Utah State University; The University of Wisconsin at Platteville; Pennsylvania State Unviersity; The University of Minnesota; and Central Missouri State University. It is interesting to note that none of the institutions where a majority of the master's degree research has been conducted in the area of elementary school industrial arts are the same institutions where a majority of the doctoral degree research has been conducted. As was the case with doctoral degree research studies, each of the 66 institutions where master's degree research has been conducted have tended to specialize in one or two types of research. (Refer to Table seven for these and other data.)

MASTER'S DEGREE RESEARCH STUDIES
(Completed)

Name	Title-Degree-Year	Institution
Albrecht, William G.	The Effect of a General Industrial Arts Course on the Attitudes of 7th Graders Concerning Tools & Their Uses; MS Degree; 1972.	University of Wisconsin-Stout

Name	Title-Degree-Year	Institution
Almeida, Thomas C.	Industrial Arts Education in the Elementary Grades (K-6) of the Public Schools in Orange County, California; MA Degree; 1972.	California State University-Long Beach
Anderson, Roger F.	Industrial Arts for the Sixth Grade in the Middle School; MS Degree; 1971.	University of Wisconsin-Stout
Anderson, W. Carlisle	Industrial Arts in Elementary Schools; Purposes; Offerings; Content; Practices; and Related Materials. Chief Attention to Sources and Authorities; MA Degree; 1942.	University of Minnesota
Avakian, Marion	Industrial Arts in the Los Angeles City Schools Prior to 1900; MA Degree; 1955.	University of California-Los Angeles
Baggs, Andrew C.	A Correlated Elementary Industrial Arts Program; M.I.E. Degree; 1964.	Utah State University
Bailey, Lorna A.	A Study of the Need for Industrial Arts in the Elementary School; M.Ed. Degree; 1971.	Millersville State College
Brown, Thomas Wyatt	A Study of Two Methods of Instruction Employed in Teaching at the Elementary Level; MS Degree; 1972.	Oklahoma State University
Brunson, Daniel	A Plan for the Development of Industrial Arts in the Elementary Schools of East Aurora, N.Y.; MS Degree; 1970.	State University College at Buffalo
Burns, Raymond C.	A Proposed Integrated Industrial Arts Program for the Elementary School; MS Ed. Degree; 1968.	Central Missouri State University
Campbell, Roy C.	A Study of Ways to Adapt the Industrial Arts Program to Meet the Needs of the Elementary School Child; M.Ed. Degree; 1963.	Pennsylvania State University
Cowan, James P. (& Richard J. Dahl)	Industrial Arts in Elementary Education: A Preliminary Curriculum with Implications of an Interdisciplinary Approach; MA Degree; 1972.	California State University-San Francisco

Name	Title-Degree-Year	Institution
Dahl, Richard J. (& James P. Cowan)	Industrial Arts in Elementary Education: A Preliminary Curriculum with Implications of an Interdisciplinary Approach: MA Degree; 1972.	California State University-San Francisco
Davidheiser, Gerald A.	Elementary School Industrial Arts: Activities in Selected Pennsylvania Schools: M.Ed. Degree; 1967.	Pennsylvania State University
Farkas, David	A Comparison of the Change in Work Related Attitudes of Elementary School Pupils Who Are Exposed to an Industrial Arts Experence with Those Who Are Not; M.S.Ed. Degree; 1973.	University of New York-City College
Glavan, William J.	Science in Industrial Arts; MS Degree; 1963.	University of Wisconsin-Stout
Godfrey, Blaine	A Proposal for an Industrial Arts Program in the Elementary School of School District #93; M.I.E. Degree; 1964.	Utah State University
Hamari, Roy M.	A Teaching Guide and Instructional Materials for a College Course in Integrated Handwork for Elementary Schools; MA Degree; 1958.	University of Minnesota
Hanna, Robert L.	The Role of Industrial Arts in the Elementary School; MS Degree; 1960.	University of Wisconsin-Stout
Harnack, Richard	Implementation of the Technology for Children Project as of December 1968; M.Ed. Degree; 1968.	Trenton State College
Hawkes, Charles M.	A Study to Determine the Content of an Industrial Arts Program in the Elementary Schools of Box Elder County; MS Degree; 1954.	Utah State University
Heiner, Carl W.	A Model of An Elementary School Industrial and Technological Program; MS Degree; 1971.	State University College at Buffalo
Hofland, Ruth E.	A Research Study and Handbook on the Development of Career Awareness in the Elementary School; MS Degree; 1971.	University of Wisconsin-Stout

Name	Title-Degree-Year	Institution
Hollway, Miriam R.	A Proposed Course of Study in Art for the Elementary Grades I-VI; MA Degree; 1948.	University of Michigan
Holm, Douglas A.	To Determine the Need for Industrial Arts in the Elementary Schools in the Grand Forks School System; MS Degree; 1973.	University of North Dakota
Iverson, Betty L.	Industrial Arts Activities Which Could be Used to Enrich the Social Studies Program of Grades Four, Five, and Six; MS Degree; 1970.	University of Wisconsin-Platteville
Jay, DeWayne D.	A Measurement of Attitudes of Elementary School Teachers Toward a Program of Industrial Arts in the Elementary School; MS Degree; 1952.	Utah State University
Jeffrey, Thomas J.	Psychomotor Development in Industrial Arts at the Elementary School Level; MS Degree; 1971.	Mankato State College
Jones, Homer	Elementary School Industrial Arts Survey; MA Degree; 1971.	California State University-Chico
Koble, Ronald L.	The Development of Concepts Concerning the Function of Industrial Arts for the Elementary School in the United States; M.Ed. Degree; 1961.	Pennsylvania State University
Korver, Edward J., Jr.	Industrial Arts for the Elementary School-A Study to Show the Need for Industrial Arts, with Implications for the Establishment of Programs at the Elementary School Level; MS Degree; 1966.	State University College at Oswego
Larson, William A.	An Investigation Into the Occupational Choice of Sixth and Ninth Grade Boys; MA Degree; 1970.	University of Minnesota
Laux, Robert B. Jr.	A Course of Study for Elementary School Industrial Arts K-6 in New York State; MS Degree; 1970.	State University College at Buffalo
Lee, Janice J.	Industrial Arts Activities Which Can Be Used to Enrich the Social Studies Program in the Primary Grades; MS Degree; 1970.	University of Wisconsin-Platteville

Name	Title-Degree-Year	Institution
Means, J.W.	A Survey of the Facilities, Organizational Patterns, and Activities Used in Elementary Practical Arts; MS Ed. Degree; 1965.	Central Missouri State University
Miller, Duane L.	An Annotated Bibliography of Selected Sources for Occupational Information Suitable for Use in the Elementary, Junior, and Senior High Schools; MS Degree; 1968.	University of Wisconsin-Stout
Moscinski, David J.	Future Occupational Interests of Elementary School Children; MS Degree; 1972.	University of Wisconsin-Stout
Nicholls, Geoffrey T.	A Description and Comparison of Selected Contemporary Elementary School Industrial Arts Programs in the United States of America; M.Ed. Degree; 1972.	University of Alberta, Canada
Niedermeyer, Frederick B.	Industrial Arts Activity Guide for Children K-3; MS Degree; 1971.	State University College at Buffalo
Nightingale, Abel	Development of Programs in I.A. for Preparation of Elementary Teachers at Hamilton Teachers College; MS Degree; 1964.	State University College at Buffalo
Novak, Edward C.	Elementary School Industrial Arts—A Study of the Physical Characteristics of Elementary School Students and the Effect of These Characteristics on Student Uses of the Basic Tools of the Elementary Industrial Arts Program; MS Degree; 1969.	State University College at Oswego
Nurnberger, Errich P. Jr.	What Is The Significance of Industrial Arts in the Elementary School?; MA Degree; 1967.	Trenton State College
Ohrenberg, Robert	Utilization of Practical Arts Activities by Selected Elementary Teachers Certificated by CMSC; 1961-1965; MS Degree; 1969.	Central Missouri State University
Pace, Vito R.	A Study to Ascertain the Duties, Functions, and Qualifications of the Industrial Arts Consultant in the Elementary School; MS Degree; 1955.	State University College at Oswego
Peterson, Clifford P.	Some Indications Pointing to the Need of Industrial Arts From the Fourth Through the Sixth Grade; MS Degree; 1938.	University of Wisconsin-Stout

Name	Title-Degree-Year	Institution
Pinelli, Thomas E.	The Current Status of Elementary School Industrial Arts in the United States; M.Ed. Degree; 1972.	Clemson University
Ralphs, Lee W.	An Evaluation of Necessary Elements for Desirable Industrial Arts Instruction in the Elementary Schools of Utah; MS Degree; 1951.	Utah State University
Randall, Allan F.	Industrial Arts in The Elementary School; MS Degree; 1971.	University of Maine
Richardson, Susan K.	The Role of the Industrial Arts Consultant in the Elementary School; MS Degree; 1970.	University of Wisconsin-Platteville
Riederer, Nancy	A Proposed Vocational Orientation Program for Sixth Grade Academically Talented Students at Schulte Elementary School in Racine, Wisconsin; MS Degree; 1970.	University of Wisconsin-Stout
Rowland, Fred K.	A National Survey of Industrial Arts in the Elementary Schools; MS Degree; 1954.	Utah State University
Salvagin, Carlton	I.A. in Child Development; MS Degree; 1968.	State University College at Buffalo
Scherer, Ralph	Correlation of Science and Math in Industrial Arts in the Sputnik Era; MS Degree; 1959.	University of Wisconsin-Stout
Scheve, Karen S.	Proposed Units in Vocational and Occupational Guidance to be Used in Grade One to Three; MS Degree; 1969.	University of Wisconsin-Stout
Schilling, Karen Johnson	Industrial Arts Activities Recommended for Unit Integration in Science in the Primary Elementary Grades, Kindergarten Through Grade Three; MS Degree; 1970.	University of Wisconsin-Platteville
Self, Merlin R.	Industrial Arts Activities Recommended for Integration in the Mathematics Program for Grade Four, Five and Six; MS Degree; 1969.	University of Wisconsin-Platteville
Strong, Eddie	Status of High School Industrial Arts Departments in the Separate School in Oklahoma; MS Degree; 1958.	Kansas State Teachers College-Emporia

Name	Title-Degree-Year	Institution
Thrower, Robert G.	The Design of a Portable Elementary Industrial Arts Workbench and its Effectiveness in Aiding an Integrated Program of Handwork in an Elementary School; M.I.A. Degree; 1956.	North Carolina State University
Van Arsdale, Richard H.	A Pilot Program of Industrial Arts for the Sanquiot Valley Elementary School; MS Degree; 1961.	State University College at Oswego
Viskupic, Roy F.	The Relationship Between Industrial Arts and Social Studies in the Elementary School—A Study to Determine How Industrial Arts and Social Studies Can Be Integrated Through Purposeful Activities; MS Degree; 1970.	State University College at Oswego
West, Thomas B.	Elementary School Industrial Arts With Special Relevance to Schools in Kentucky; MA Degree; 1964.	Eastern Kentucky State University
Williams, Arthur E.	Industrial Arts for the Middle School—An Investigation into the Various Content Areas with Specific Recommendations for the Rutland, Vermont School Development; MS Degree; 1966.	State University College at Oswego
Wilson, Kenneth E.	A Comparison of Methods Used to Teach Industrial Related Materials in the Elementary School; MA Degree; 1971.	Northeast Missouri State University
Zabel, Selvin M.	Industrial Arts in the Elementary School: A Study of Industrial Arts Activities in the Elementary School and the Manner in Which the Industrial Arts Teacher Can Aid with the Industrial Arts Activity Program; MA Degree; 1954.	University of Minnesota
Zubel, Stanley	Elementary Ceramics—A Guide for Teachers; MA Degree; 1951.	University of Michigan
Zwiener, Henry	An Analysis of Elementary Industrial Arts Type Activities in Relation to Years Teaching Experience and Grade Level; M.Ed. Degree; 1963.	Pennsylvania State University

MASTER'S DEGREE RESEARCH STUDIES (To Be Completed)

Name	Title-Degree-Year	Institution
Ferreira, Charles	The Effects of Activity Versus Verbal Learning on the Career Development Behavior of First Grade School Children; M.Ed. Degree; 1973.	Bowling Green State University
Johnson, Bruce A.	A Proposed Integration of Industrial Arts into the Elementary Classroom; MS Degree; 1973.	University of Wisconsin-Stout
Leeper, Howard Terry	Teacher Education in the State of Pennsylvania for Industrial Arts in the Elementary Grades: Identification of Competencies; M.Ed. Degree; 1973.	California State College, Pennsylvania
Sahly, Donald R.	The Organization and Administration of Industrial Arts for Seventh-Day-Adventists Church School; MA Degree; 1973.	Andrews University
Schultz, Larry	Effects of a Career Education Orientation Program on the Attitudes of Elementary Education Majors; M.Ed. Degree; 1973.	Bowling Green State University
Sopko, John H.	The Effects of a Career Awareness Instructional Unit on the Career Development and Attitudes of Kindergarten Children; M.Ed. Degree; 1973.	Bowling Green State University

OBSERVATIONS RELATED TO MASTER'S DEGREE RESEARCH

An examination of Table five reveals that the primary emphasis of master's degree research has been devoted to elementary school industrial arts program development. Other areas receiving a strong research emphasis have been studies dealing with the: status of, need for, and comparison of elementary school industrial arts programs. The development of resource materials and activities for utilization in programs of elementary school industrial arts have also received a strong research emphasis. There have also been a few master's degree research studies dealing with philosophy and methodology, career and occupational awareness, and facilities and equipment utilization. These represent but a few of the many categories of research undertaken by those conducting research at the master's degree level.

18	Hamari, Roy M.	1958		X							X													X							
19	Hanna, Robert L.	1960	X						X										X												
20	Harnack, Richard	1968				X			X													X									
21	Hawkes, Charles M.	1954	X						X												X										
22	Heiner, Carl W.	1971	X								X										X										
23	Hofland, Ruth E.	1971	X								X																			X	
24	Hollway, Miriam R.	1948		X							X				X						X										
25	Holm, Douglas A.	1973	X						X														X								
26	Iverson, Betty L.	1970	X						X									X							X						
27	Jay, DeWayne D.	1952	X						X				X								X										
28	Jeffrey, Thomas J.	1971	X					X						X							X										
29	Jones, Homer	1971		X					X														X								
30	Koble, Ronald L.	1961				X			X				X						X												
31	Korver, Jr., Ed. J.	1966	X						X														X								
32	Larson, William A.	1970		X					X																					X	
33	Laux, Jr., Robert B.	1970	X								X										X										
34	Lee, Janice J.	1970	X						X									X							X						
35	Means, J. M.	1965				X			X																X	X					
36	Miller, Duane L.	1968	X								X														X					X	
37	Moscinski, David J.	1972	X						X																					X	
38	Nicholls, Geoffrey T.	1972				X			X														X								
39	Niedermeyer, Frederick	1971	X								X														X						
40	Nightingale, Abel	1964	X								X			X						X											
41	Novak, Edward C.	1969	X					X																		X					X
42	Nurnberger, Jr., Errich	1967		X					X														X								
43	Ohrenberg, Robert	1969	X						X																X						
44	Pace, Vito R.	1955	X						X															X							
45	Peterson, Clifford P.	1938	X						X														X								
46	Pinelli, Thomas E.	1972				X			X														X								
47	Ralphs, Lee W.	1951	X						X												X										
48	Randall, Allan F.	1971	X						X												X										
49	Richardson, Susan K.	1970	X						X															X							

Table 5
COMPARISON OF MASTERS RESEARCH STUDIES

Research #	Name of Researcher	Year of Graduation	Research Categories: Degree Symbol					Type of Study				Domains			Elem. School Curric. Areas				Other Categorical Data												
			M.S. Degree	M.A. Degree	M.I.E. Degree	M.Ed. Degree	M.S.Ed. Degree	Experimental	Descriptive-Survey	Documentary-Historical	Developmental-Curriculum	Cognitive	Affective	Psychomotor	Art	Mathematics	Science	Social Studies	Philosophy & Methodology	Tchr. Ed. Prog. Dev. & Util.	Elem. Sch. Prog. Dev.	Elem. Sch. Prog. Util.	Status, Need & Comparison of Elem. I.A.	Elem. I.A. Consultant	Resource Mat'l. & Act. Dev.	Facilities & Equipment	Relationship of Work to Elem. I.A.	Guidance	Ceramics	Career & Occupat. Awareness	Child Growth & Dev.
1	Albrecht, William G.	1972	X					X					X													X					
2	Almeida, Thomas C.	1972		X						X												X									
3	Anderson, Roger F.	1971	X						X												X										
4	Anderson, W. Carlisle	1942		X							X								X												
5	Avakian, Marion	1955		X						X												X									
6	Baggs, Andrew C.	1964			X				X												X										
7	Bailey, Lorna A.	1971				X			X														X								
8	Brown, Thomas W.	1972	X					X				X							X												
9	Brunson, Daniel P.	1970	X								X										X										
10	Burns, Raymond C.	1958					X				X										X										
11	Campbell, Roy C.	1963				X			X														X								
12	Cowan, James P.	1972		X				X				X									X										
13	Dahl, Richard J.	1972		X				X				X									X										
14	Davidheiser, Gerald A.	1967				X			X																X						
15	Farkas, David	1973					X	X					X														X				
16	Glavan, William J.	1963	X						X								X				X										
17	Godfrey, Blaine	1964			X						X										X										

Table 5—Continued

COMPARISON OF MASTERS RESEARCH STUDIES

Research #	Name of Researcher	Year of Graduation	Research Categories: Degree Symbol					Type of Study				Domains			Elem. School Curric. Areas				Other Categorical Data												
			M.S. Degree	M.A. Degree	M.I.E. Degree	M.Ed. Degree	M.S.Ed. Degree	Experimental	Descriptive-Survey	Documentary-Historical	Developmental-Curriculum	Cognitive	Affective	Psychomotor	Art	Mathematics	Science	Social Studies	Philosophy & Methodology	Tchr. Ed. Prog. Dev. & Util.	Elem. Sch. Prog. Dev.	Elem. Sch. Prog. Util.	Status, Need & Comparison of Elem. I.A.	Elem. I.A. Consultant	Resource Mat'l. & Act. Dev.	Facilities & Equipment	Relationship of Work to Elem. I.A.	Guidance	Ceramics	Career & Occupat. Awareness	Child Growth & Dev.
50	Riederer, Nancy	1970	X								X																			X	
51	Rowland, Fred K.	1951	X						X														X								
52	Salvagin, Carlton	1968	X						X																						X
53	Scherer, Ralph	1959	X						X							X	X				X										
54	Scheve, Karen S.	1969	X								X										X				X			X		X	
55	Schilling, Karen J.	1970	X						X								X				X				X						
56	Self, Merlin R.	1969	X						X							X					X										
57	Strong, Eddie	1958	X						X														X								
58	Thrower, Robert G.	1956			X						X															X					
59	VanArsdale, Richard H.	1961	X								X										X										
60	Viskupic, Roy F.	1970	X						X									X			X										
61	West, Thomas B.	1964		X					X												X										
62	Williams, Arthur E.	1966	X						X														X								
63	Wilson, Kenneth E.	1971		X						X									X		X										
64	Zabel, Selvin M.	1954		X							X													X							
65	Zubel, Stanley	1951		X							X														X				X		
66	Zwiener, Henry	1963				X			X																X						
	Grand Total		38	14	3	9	2	7	38	3	18	3	4	2	1	2	3	3	5	1	24	3	12	3	12	4	1	1	1	6	2

Table 6
COMPARISON OF MASTERS STUDIES—YEAR/TYPE

Year	Type of Study by Research #								
	Experimental		Descriptive-Survey		Documentary-Historical		Developmental-Curriculum		
	Research #	Experimental Total/Yr.	Research #	Descriptive-Survey Total/Yr.	Research #	Documentary-Historical Total/Yr.	Research #	Developmental-Curriculum Total/Yr.	Grand Total/Research/Yr.
1938			45	1					1
1942							4	1	1
1948							24	1	1
1951			47	1			65	1	2
1952			27	1					1
1954			21,51	2			64	1	3
1955			44	1	5	1			2
1956							58	1	1
1958			57	1			10,18	2	3
1959			53	1					1
1960			19	1					1
1961			30	1			59	1	2
1963			11,16,66	3					3
1964			6,61	2			17,40	2	4
1965			35	1					1
1966			31,62	2					2
1967			14,42	2					2
1968			20,52	2			36	1	3
1969	41	1	43, 56	2			54	1	4
1970			26, 32, 34, 49, 55, 60	6			9,33,50	3	9
1971	28	1	3, 7, 29, 48	4	63	1	22,23,39	3	9
1972	1,8,12,13	4	37,38,46	3	2	1			8
1973*	15	1	25	1					2
Grand Total/Type		7		38		3		18	66

*Not a complete year

Table 7

COMPARISON OF MASTERS STUDIES—INSTITUTION/RESEARCHER/TYPE

Degree Granting Institution	Type of Study/Research #: Experimental	Descriptive-Survey	Documentary-Historical	Developmental-Curriculum	Grand Total/Institution
Calif. State Univ.-Chico		29			1
Calif. State Univ. Long Beach			2		1
Calif. State Univ.- Los Angeles			5		1
Calif. State Univ.- San Francisco	12,13				2
Central Missouri State University		35,43		10	3
Clemson University		46			1
Eastern Kentucky State University		61			1
Kansas State Teachers College-Emporia		57			1
Mankato State College	28				1
Millersville State Col.		7			1
North Carolina State Univ.				58	1
Northeast Missouri State University			63		1
Oklahoma State Univ.	8				1
Pennsylvania State Univ.		11,14,30,66			4
State Univ. College at Buffalo, NY		52		9,22,33, 39,40	6
State Univ. College at Oswego, NY	41	31,44,60,62		59	6
Trenton State College		20,42			2
Univ. of Alberta, Can.		38			1
Univ. of Maine- Portland-Gorham		48			1
University of Michigan				24,65	2
Univ. of Minnesota		32		4,18,64	4
University of New York- City College	15				1
Univ. of North Dakota		25			1
Univ. of Wisconsin- Platteville		26,34,49 55,56			5
Univ. of Wisconsin- Stout	1	3,16,19,37, 45,53		23,36, 50,54	11
Utah State University		6,21,27,47,51		17	6
Grand Total/Type	7	38	3	18	66

SUMMARY OF STAFF STUDIES AND OTHER NON-DEGREE RESEARCH

The survey of staff studies and other non-degree research conducted as a part of this study revealed that investigations of this nature have been conducted since 1962. Sixty percent of the 34 studies have been conducted over the past three years with equal emphasis being devoted to experimental, descriptive-survey, and developmental-curriculum studies. Little emphasis has been placed on the documentary-historical type of research. (Refer to Table nine for these and other data.)

These studies have been conducted over a wide geographic area in numerous public schools, colleges and universities. Three-fourths of the studies have received funding of some type. (Refer to Table eight for these and other data.)

STAFF STUDIES & OTHER NON-DEGREE RESEARCH (Completed)

Director	Title-Date	Institution
Blatsos, Michael, J.	**Implementing an Industrial Arts Program in Grades 5-6; 1972.**	Lynn Public Schools
Buckley, Anne-Marie	**Elementary Industrial Arts/Career Development Program; 1970-1973.**	Longfields Elementary School
Cadoff, Joel	**Industrial Arts in the Elementary School and New York City's Mobile Learning Center; 1972.**	Teachers College Columbia University
Cadoff, Joel	**The Vacation Day Camp and Its Craft Activities—District II, New York City; 1972.**	Teachers College Columbia University
Calder, Clarence R. Jr.	**A Comparison of Four Methods of Teaching Psychomotor Activities to Elementary School Children from Varying Socioeconomic Levels; 1969.**	University of Connecticut
Chamberlain, Duane G.	**Projects and Problems in Elementary School Industrial Arts; 1962.**	Eastern Michigan University
Deaver, Sylvia J. (& Anne Southerland & Lee Henson)	**Our Creative Environment-A Study in Art, Homemaking and Industrial Arts; 1970 & 1971.**	Fort Worth Public Schools at McLean Middle School

Director	Title-Date	Institution
Downs, William A.	Status of Elementary School Industrial Arts Courses in the Higher Education Institutions of Missouri; 1971.	Central Missouri State University
Edwards, Leonard D.	Elementary School Industrial Arts; 1962.	Northern State College
Ginther, Richard E. (& Stephan A. Kelly)	A Proposed Educational Program in Elementary Industrial Arts for the Ohio Soldiers and Sailors' Orphans Home, Xenia, Ohio: 1972.	The Ohio Soldiers and Sailors' Orphans Home Xenia, Ohio
Hammond, James J.	Ch. XII Frontiers of Industrial Arts in Elementary Education, *Frontiers in Elementary Education;* Date Unknown.	Fitchburg State College
Hansen, Jack	Third Grade Mass Production; 1971.	University of Northern Iowa
Harnack, Richard	Technology for Children; 1968.	Trenton State College
Henson, Lee (& Sylvia Deaver & Ann Southerland)	Our Creative Environment-A Study in Art, Homemaking and Industrial Arts; 1970 & 1971.	Fort Worth Public School at McLean Middle School
Hoffman, Victor	NDEA Institute for Advanced Study in Elementary Industrial Arts "Guides in Construction and Manufacturing for Elementary School Industrial Arts"; 1968.	Ohio State University
Hoots, William R. Jr.	The Development of a Course of Study for Industrial Arts Education at the Elementary School Level; 1968.	East Carolina University
Ivey, Larry T.	ESEA, Title III, Elementary Industrial Arts, Bertie County Schools, Windsor, N.C.; 1971.	Bertie County Schools Windsor, N.C.
Johnson, Conrad (& Robert Weber)	Training Elementary and Special Education Teachers in the Use of Tools and Materials with Children; 1972.	Trenton State College
Kelly, Stephan A. (& Richard E. Ginther)	A Proposed Educational Program in Elementary Industrial Arts for the Ohio Soldiers and Sailors' Orphans Home, Xenia, Ohio; 1972.	The Ohio Soldiers and Sailors' Orphans Home Xenia, Ohio

Director	Title-Date	Institution
Lavender, John	Project Occupational Versatility "The Role of the Student in an Industrial Arts Environment;" 1973.	Seattle, Washington
Miller, W.R.	Contemporary Programs of Industrial Arts in Elementary Schools; 1973.	University of Missouri-Columbia
Mitchell, E.R. (& R.J. Vasek & N.E. Wallace)	A Comprehensive Orientation to the World of Work Through Industrial Arts and Vocational Education; 1970.	Mississippi State University
Morse, Robert L.	Career Education Through an Industrial Arts Approach; 1964.	State Department of Education-Vermont
Mosier, Bert	Some Career Education Concepts for Grades K-1; 1972.	Abilene Christian College
Peterson, Charles (& Glenn Thatcher)	Mass Production with Elementary Age Children; 1972.	Newark State College
Pollock, John M.	Framework for Industrial Arts K-6; 1970.	University of Georgia
Southerland, Ann (& Sylvia Deaver & Lee Henson)	Our Creative Environment—A Study in Art, Homemaking and Industrial Arts; 1971 & 1972.	Fort Worth Public Schools
Stunard, E. Arthur	Books Annotated by American Council for Elementary School Industrial Arts; 1971.	National College of Education-Chicago
Thomas, Edwin P.	Dalton's Valley—A Model City; 1972.	West Virginia University
Vasek, R.J. (& E.F. Mitchell & N.E. Wallace)	A Comprehensive Orientation to the World of Work Through Industrial Arts and Vocational Education; 1970.	Mississippi State University
Wallace, N.E. (& R.J. Vasek & E.F. Mitchell)	A Comprehensive Orientation to the World of Work Through Industrial Arts and Vocational Education; 1970.	Mississippi State University

Director	Title-Date	Institution
Wargo, William	Industrial Arts for the Visually Handicapped; 1971.	Florida State University
Weber, Robert D. (& Conrad Johnson)	Training Elementary and Special Education Teachers in the Use of Tools and Materials with Children; 1972.	Trenton State College

STAFF STUDIES & OTHER NON-DEGREE RESEARCH (To Be Completed)

Director	Title-Date	Institution
Anderson, Lowell D.	Effects of Instructor Behavior on Interns Taught Teaching Methods Using Micro-Multi modeling Strategies as Compared to those Taught Using Micro-Multi modeling by Learning Activity Packages; 1974.	University of Maryland
Anderson, Lowell D.	Development of Curriculum for Industrial Arts in the Middle School; On-going.	University of Maryland
Bailey, Larry J.	Career Development for Children Project; 1973.	Southern Illinois University-Carbondale
Bedwell, Norman W.	Industrial Arts Emphasis in a Basic Social Program; 1973.	University of Alabama
Cadoff, Joel	Elementary School Industrial Arts in the New York Metropolitan Area; 1973.	Teachers College, Columbia University
Campbell, C.E.	Mass Production as per "Common Body of Knowledge"; On-going.	Brady Middle School, Cleveland, Ohio
Christoffel, Frederick (& Vance Snyder & Glenn Thatcher)	Technology for Children—The Development of a Pre-service Experience for Early Childhood and Elementary Teachers; 1974.	Newark State College
Cowan, James P.	A Research Development in the Area of Interdisciplinary Industrial Arts Learning Activities Related to the Elementary Schools; 1975.	California State University

Director	Title-Date	Institution
Darley, Hugh E.	Selected Readings in Elementary School Industrial Arts; 1973.	Georgia Southern College
Donahue, Ward C.	Industrial Arts Articulation K-12; 1976.	City School District Rochester, New York
Dyson, Ralph	Survey of Present Innovative Elementary I.A. Programs with Implication to Elementary Teacher Preparation; On-going.	Michigan State University
Eickhoff, Luvern R.	Differentiated Student Teaching for Majors in Industrial Technology; 1973.	University of North Dakota
Geil, John J.	LOOM (Learner-Oriented Occupational Materials); 1974.	Florida State University
Gettle, Karl E.	An Investigation into the Career Education Needs of Elementary School Children; 1973.	University of Maryland
Gettle, Karl E.	Evaluation of a Proposed Elementary School Industrial Arts Program; 1973.	University of Maryland
Gilbert, Harold G.	To Develop Four Teaching Resource Kits That K-6 Classroom Teachers Can Use for Children to Study the Leather Industry; 1974.	Northern Illinois University
Glismann, Leonard W.	Pilot IA Programs in Elementary Schools K-6; 1977.	Salt Lake City Schools, Utah
Green, Theodis	A Comprehensive Survey of Traditional Disciplines Versus New Semi-Professional Emerging Technologies; 1973.	Oklahoma State University
Haynes, Clayton	Basic Skills Through Practical Arts Covington City Schools, Covington, Tenn. 38109; 1974.	Frazier Elementary & Covington Grammar Schools, Tennessee
Heasley, Norma	A Technological Exploratorium, K-6; 1973.	Summit County Board of Education, Akron, Ohio
Henry, Wilber E.	QUEST; On-going.	State University College Coatland, New York

Director	Title-Date	Institution
Hilton, Ross C.	Developing a Program of Preparing a Teacher to Teach "Career Education" at the Elementary Level; 1975.	Soutern Utah State College
Kuwik, Paul	Learning Experiences in Technology Project; 1974.	Eastern Michigan University
Lickteig, David L. (& C.B. MacLean)	Survey of Present Innovative Elementary I.A. Programs with Implications to Elementary Teacher Preparation; On-going.	Michigan State University
Lucas, Samuel (& Richard Swanson)	Career Exploration for Children; 1975.	Perrysburg, Ohio School District & Bowling Green State University
MacLean, C.B. (& David Leo Lickteig)	Survey of Present Innovative Elementary I.A. Programs with Implication to Elementary Teacher Preparation; On-going.	Michigan State University
Meers, Gary	The Use and Application of Constructional Activities in the Wyoming Elementary Classroom; 1973.	University of Wyoming
Megow, Robert S.	A Comprehensive Vocational Education Program for Career Development in Grades K-12; 1974.	Orange County, Fla. & the Florida State Office of Education
Nannay, Robert	Career Education Unit of Study K-6; 1974.	University of Maine-Portland-Gorham
Palumbo, Audrey	The ICC Plan—Industrial Technology, Career Awareness, Consumer Knowledge; 1973.	Glenwood School, Toledo, Ohio
Perkins, George W.	Follow Through; On-going.	Huntsville City Schools, Alabama
Polk, Harold J.	A Project Designed to Define the Role of Industrial Arts in Career Education in Oklahoma; 1973.	Oklahoma State University
Polm, Eugene	Career Education Project (K-12); On-going.	Anne Arundel County Board of Education, Maryland
Ressler, Ralph	Elementary Career Awareness: The Career Center; 1974.	Dade County Public Schools, Florida

Director	Title-Date	Institution
Reynolds, James O.	Elementary Industrial Arts and Career Motivation; 1973.	Dayton City Schools, Ohio
Siegner, C. V.	Making Elementary School I.A. Projects with Scrap Materials; 1973.	Peru State College
Snyder, Vance (& Frederick Christoffel & Glenn Thatcher	Technology for Children—The Development of a Pre-service Experience for Early Childhood and Elementary Teachers; 1974.	Newark State College
Stevenson, Donald	Mutually Aided Learning Program; Ongoing.	Jefferson County Public Schools, Colorado
Stuart, Wil (& Richard Ford Associates)	Industrial Arts Mobile Learning Center; 1973.	Community School District # 18 Brooklyn, New York
Swanson, Richard (& Samuel Lucas)	Career Exploration for Children; 1975.	Perrysburg, Ohio School District & Bowling Green State University
Taylor, Steve	Industrial Arts for Teachers in Elementary Education; 1975.	Southern Utah State College
Thatcher, Glenn (& Vance Snyder & Frederick Christoffel)	Technology for Children—The Development of a Pre-service Experience for Early Childhood and Elementary Teachers; 1974.	Newark State College
Todd, Ronald D.	Elementary School Career Education Project; 1974.	New York University
Todd, Ronald D.	The Design of Children Oriented Tools for the Elementary Classroom; 1974.	New York University
West, William E.	Status of Industrial Arts in South Carolina; 1973.	Clemson University

OBSERVATIONS RELATED TO STAFF STUDIES & OTHER NON-DEGREE RESEARCH

Equal emphasis has been devoted to experimental, descriptive-survey, and developmental-curriculum studies of this nature. A majority of the staff studies and non-degree researches have been conducted at the college and university level. Elementary school program development and the development of resource materials and activities for utilization in programs of elementary school industrial arts have received a strong research emphasis. Numerous other categories of research undertaken by those conducting staff studies and other non-degree research are presented in Table eight.

One of the most positive aspects of this study is the large number of staff studies and non-degree research studies that are now in progress. There are forty-five studies in progress which, when completed, will more than double the number of studies already completed. An examination of the studies in progress reveals a heavy emphasis being placed on basic curriculum research in the area of elementary school industrial arts. Many of these studies also emphasize career education, career development and career awareness. Several of these projects have received considerable funding, and the findings of their research should prove quite interesting to those persons who are involved in programs of elementary school industrial arts.

Table 8 appears on pages 304 and 305. It should be reviewed prior to Table 9, page 303.

Table 9
COMPARISON OF STAFF STUDIES & OTHER NON-DEGREE RESEARCH—YEAR/TYPE

Year	Experimental: Research #	Experimental Total/Yr.	Descriptive-Survey: Research #	Descriptive-Survey Total/Yr.	Documentary-Historical: Research #	Documentary-Historical Total/Yr.	Developmental-Curriculum: Research #	Developmental-Curriculum Curriculum Total/Yr.	Grand Total Research/Yr.
Unknown					11	1			1
1962					9	1	6	1	2
1964	23	1							1
1968							13, 15, 16	3	3
1969	5	1							1
1970			22, 26, 31, 32,	4					4
1971	12, 17, 33	3	3, 7, 14, 27, 8	5			28	1	9
1972	1, 24, 25, 29	4	4	1			10, 18, 19 30, 34	5	10
1973*	2, 20	2	21	1					3
Grand Total/Type		11		11		2		10	34

*not a complete year

Table 8—Continued

COMPARISON OF STAFF STUDIES & OTHER NON-DEGREE RESEARCH

Research #	Name of Director or Researcher	Year Completed	Type of Study: Experimental	Type of Study: Descriptive-Survey	Type of Study: Documentary-Historical	Type of Study: Developmental-Curriculum	Domain: Cognitive	Domain: Affective	Domain: Psychomotor	Funding: No Funds Requested	Funding: Local Funds	Funding: State Funds	Funding: Federal Funds	Location Conducted: Public Schools	Location Conducted: College-University	Philosophy & Methodology	Elem. Schl. Prog. Dev.	Elem. Schl. Prog. Impl. & Util.	Status, Need & Comparison of Elem. I.A. Programs	Resource Mat'ls. & Activities	Facil. & Equip. for Util.	Relationship of Work to Elem. I.A.	Career Ed. & Development	Art Activities	Crafts Activities	Homemaking Activities	Visually Limited
18	Johnson, Conrad	1972				X						X			X						X						
19	Kelly, Stephen A.	1972				X							X	X													
20	Lavender, John	1973	X										X	X			X										
21	Miller, W.R.	1973		X							X				X			X									
22	Mitchell, E.F.	1970		X									X		X							X					
23	Morse, Robert L.	1964	X				X					X			X								X				
24	Mosier, Bert	1972	X				X				X				X								X				
25	Peterson, Charles	1972	X						X		X				X					X							
26	Pollock, John M.	1970		X						X					X	X											
27	Southerland, Ann	1971		X							X			X			X							X		X	
28	Stunard, E. Arthur	1971				X					X				X					X							
29	Thatcher, Glenn	1972	X						X		X				X					X							
30	Thomas, Edwin P.	1972				X					X				X		X										
31	Vasek, R.J.	1970		X									X		X							X					
32	Wallace, N.E.	1970		X									X		X							X					
33	Wargo, William	1971	X										X		X												X
34	Weber, Robert D.	1972				X						X			X						X						
	TOTALS		11	11	2	10	4	0	4	8	11	5	11	9	25	3	9	2	1	8	3	3	3	3	1	3	1

Table 8
COMPARISON OF STAFF STUDIES & OTHER NON-DEGREE RESEARCH

			Research Categories																								
			Type of Study				Domain			Funding				Location Conducted													
Research #	Name of Director or Researcher	Year Completed	Experimental	Descriptive-Survey	Documentary-Historical	Developmental-Curriculum	Cognitive	Affective	Psychomotor	No Funds Requested	Local Funds	State Funds	Federal Funds	Public Schools	College-University	Philosophy & Methodology	Elem. Schl. Prog. Dev.	Elem. Schl. Prog. Impl. & Util.	Status, Need & Comparison of Elem. I.A. Programs	Resource Mat'ls. & Activities	Facil. & Equip. for Util.	Relationship of Work to Elem. I.A.	Career Ed. & Development	Art Activities	Crafts Activities	Homemaking Activities	Visually Limited
1	Blatsos, Michael J.	1972	X				X						X	X				X									
2	Buckley, Anne-Marie	1973	X				X				X	X		X									X				
3	Cadoff, Joel	1971		X						X					X						X						
4	Cadoff, Joel	1972		X						X					X										X		
5	Calder, Clarence R.	1969	X						X		X				X	X											
6	Chamberlain, Duane G.	1962				X				X					X					X							
7	Deaver, Sylvia J.	1971		X							X			X			X							X		X	
8	Downs, William A.	1971		X						X					X				X								
9	Edwards, Leonard D.	1962			X					X					X	X											
10	Ginther, Richard E.	1972			X	X							X	X			X										
11	Hammond, James J.	----								X					X					X							
12	Jansen, Jack	1971	X						X	X					X					X							
13	Harnack, Richard	1968				X						X			X		X							X		X	
14	Henson, Lee	1971		X							X			X			X										
15	Hoffman, Victor	1968				X							X		X					X							
16	Hoots, William R.	1968				X							X		X					X							
17	Ivey, Larry	1971	X										X	X			X										

NEEDED ELEMENTARY SCHOOL INDUSTRIAL ARTS RESEARCH

There has been and always will be a need for fundamental research in the development and testing of theories in the area of elementary school industrial arts. It is the opinion of this writer that many problems or topics will need to be studied by: (1) graduate students pursuing advanced degrees, (2) elementary school teachers, consultants and specialists who are interested in the area of elementary school industrial arts, and (3) personnel from the public school/college and university cooperative research programs —plus many others. Based on the findings of this nationwide survey of elementary school industrial arts, readings associated with this area and the opinions of professionals practicing in the field of elementary school industrial arts, and the following topics are recommended for possible research:

1. Define and describe the changing theoretical structure and role of industrial arts activities at the elementary school level.
2. Research the effect of the elementary school industrial arts activities approach upon the various domains of learning in elementary school curricular areas other than mathematics, science and social studies.
3. Research the effect of elementary school industrial arts activities on initial achievement and retention of information when the elementary school industrial arts activities approach is incorporated as a separate unit of study in the elementary school curriculum.
4. Design appropriate inexpensive demonstration equipment and materials, based on child growth and development, for use in an elementary school industrial arts program.
5. Develop effective and efficient instruments to assess the effects of cognitive, affective and psychomotor learning for use in an elementary school industrial arts program.
6. Study the relationship between a child's mental capacity and his ability or inability to select and properly utilize basic hand and power tools.
7. Develop valid and reliable instruments to assess the multiple psychological factors which indicate a readiness on the part of the child for hands-on experiences.
8. The value of in-service programs designed to increase the proficiency of the elementary school teacher in the use of elementary school industrial arts activities needs to be studied.

9. A study of existing public school systems utilizing the elementary school industrial arts activities approach extensively in their instructional programs should be made to ascertain what types and kinds of activities are utilized predominantly in the programs and what pre-service or in-service instruction supervisors and directors of elementary school industrial arts consider necessary for elementary teachers.
10. Longitudinal research studies designed to assess the permanency of learning (retention) need to be undertaken.
11. The effect that elementary school industrial arts activities have upon the ability of a student to reason or deduce the unknown from the known should be researched.
12. Research should continue on developing instruments for use in measuring both student and teacher attitudes toward curricular content presented by an elementary school industrial arts approach.
13. Studies devoted to establishing the role of an industrial arts consultant accompanied by a list of the functions of such an individual would prove valuable.
14. A study devoted to establishing and clarifying the psychological and anthropological bases for the use of elementary school industrial arts activities in the elementary school curriculum would add greatly to the development of a sound philosophical base for elementary school industrial arts.
15. Concomitant outcomes that an elementary school industrial arts program contributes to the total elementary school curriculum need to be further researched.
16. Studies dealing with the effect that an elementary school industrial arts approach has for the learning of the exceptional child are greatly needed.
17. Develop valid and reliable instruments to measure the effectiveness of such motivational factors as the project, aids to instruction, methods of instruction, mass production, and experimentation in the elementary school classroom as they relate to the three domains of learning.
18. Elementary school industrial arts innovative curricular structures and concepts that may more adequately meet the needs of elementary children need to be developed.
19. Research in pre-service elementary school teacher education to determine what type of content, the number and kinds of experiences, and the variety of materials that are economical in view of the preparation needed.

20. Study of the effect that an elementary school industrial arts activities approach has on an elementary student's attitude toward and utilization of independent study and self-reliance should be undertaken.
21. A comparative study of current purposes and objectives of courses designed to prepare elementary school teaching majors to direct elementary school industrial arts activities would be desirable and useful to the profession.
22. A study to ascertain the specific processes, methods, procedures, and practices performed in elementary school industrial arts activities with various materials at the elementary school level should be undertaken.
23. There is a need to assess the effect, if any, that elementary school industrial arts had upon student group problem-solving abilities.
24. Determine by experimental research those elementary school curricular concepts that can best be presented utilizing an elementary school industrial arts approach.
25. The development of valid and reliable instruments to assess the three domains of learning at the lower elementary school grade levels is greatly needed.
26. Research the role that elementary school industrial arts can play in fulfilling the objectives of career education.
27. Research the extent to which elementary school industrial arts can play a supportive role to the basic elementary school curriculum while at the same time making a contribution as an academic discipline.
28. A study to determine if industry and technology should be made a part of the experiences of elementary school children should be undertaken.
29. Research into the feasibility and desirability of utilizing an elementary school industrial arts program for pre-vocational objectives would prove helpful from a philosophical base.
30. Ascertain specific units of elementary school curricular areas in which elementary school industrial arts activities are more frequently integrated and identify the most optimum way of integrating the activities with those units.
31. Research the effects that the elementary school industrial arts activities approach has upon an elementary child's ability to visualize spatial relationships.

CHAPTER XII

Selected Bibliography

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In addition to the many references listed at the end of each chapter, and the extensive research studies annotated in Chapter XI, this chapter lists some additional readings and resource materials for the serious student of elementary school industrial arts.

FILMS

"Converting the Elementary Classroom into a Laboratory." 16mm, 15 minutes, Color, Sound, Washington, D.C.: The American Industrial Arts Association.

"Educated Hands." 16mm, 11 minutes, Color, Sound, Morgantown, West Virginia: Audio Visual Center, University of West Virginia.

"Elementary School Industrial Arts." 16mm 25 minutes, Color, Sound, Kent, Ohio: Audio Visual Center, Kent State University.

"How to Construct Miniature Scenery." 16mm, 15 minutes, Color, Sound, Washington, D.C.: The American Industrial Arts Association.

"How to Initiate Construction in the Elementary Schools." 16mm, 15 minutes, Color, Sound, Washington, D.C.: The American Industrial Arts Association.

"Woodworking in the Kindergarten." Ft. Lauderdale, Florida: Wilber Marshall, Supervisor of Curriculum Materials, 1320 Southwest 4th Street.

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