The development of an industrial arts program for the elementary school, K-3

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THE DEVELOPMENT OF AN INDUSTRIAL ARTS PROGRAM
FOR THE ELEMENTARY SCHOOL, K-3.

IOWA STATE UNIVERSITY, PH.D., 1978
The development of an industrial arts program
for the elementary school, K-3

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Denise Helene Keller

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Abstract

The problem of this study was to plan and articulate an industrial arts program for the elementary school, K-3. To do so, two questions were resolved in the study: to identify a base or rationale for developing the program and to identify the content of such a program.

Initially, a rationale for an industrial arts program in the elementary school was developed founded upon the four bases of the curriculum. These included: social forces, the nature of knowledge, the nature of learning and human development. It was found that a study of industrial arts in the elementary school could be substantiated and, furthermore, that the content orientation of such a study must revolve about technology.

Throughout the remainder of the study, Sarapin's Formative Evaluation Procedural Model (1977) was utilized to specify the content of an industrial arts program in the elementary school. Goals, objectives, and instructional materials for the program were first assembled by a four-member Development Committee and then evaluated by a ten-member Expert Review Committee. The instructional materials were then partially field tested in an elementary school.
It was found from this activity that specific goals and objectives for an industrial arts program in the elementary school could be identified. Furthermore, the goals and objectives could be and were utilized to develop materials which were beneficial to the elementary-aged student and which supplemented the existing elementary curriculum.
CHAPTER I. INTRODUCTION

The sharp increase in the growth of knowledge and technology in the past decade serves as a constant reminder that the methods and techniques of the past may no longer be sufficient for the present or the future. Alvin Toffler, author of Future Shock (1970), warns us that the world is in a state of rapidly accelerating change and that individuals need help in coping with this pace of change.

Education, and consequently curriculum planners, has a responsibility to serve the needs of individuals. This would include the need to understand the advancement of technology, the rate and ways in which it encroaches upon individuals within society, and the many benefits technology offers individuals and society as a whole. Technology also has to be understood and controlled for the benefit of humankind.

Industrial arts, often defined as a study of industry and technology, is, by its very nature, well-suited to help the individual interpret and cope with technology. Industrial arts attempts to meet these individual needs by bridging the gap between the individual and the technological society.

Traditionally, industrial arts has been taught at the junior and senior high school levels. Courses such as woodworking,
drafting, and metal working were typical. Originally designed
to reflect the technology of the day, these courses no longer
adequately resemble current industry and technology. As in many
other areas of education, change within the field of industrial
arts is reserved and slow. Nonetheless, there are efforts to
alter industrial arts programs to a point where they do once
again accurately reflect and articulate the industry and tech­
nology of the day.

Industrial arts programs run the gamut from
almost obsolescence to sparkling modernity....
As increased technological knowledge brought
new products and new industrial processes into
everyday living, curriculum planners sought to
incorporate this new information into the shop
classes (Trump and Miller, 1973, pp. 142, 143).

Innovative programs for industrial arts appeared during the
1960's: the Maryland Plan; the Industrial Arts Curriculum
Project (IACP); the Alberta Plan; and the American Industry
Project (Cochran, 1970). These programs, in varying manners,
attempted to interpret industry and technology. Organized
around various clusters or components of technology and
industry, each sought to more accurately help students under­
stand and cope with industry and technology.

Some authors have suggested that the human need for
understanding the technological environment occurs in young
people prior to entering junior high school. Close atten-
tion must be and is paid to children's expanding awarenesses
of self and their relationships with the world at the ele-
mentary school level.

The elementary-school-age child is in the
period of life in which his efforts are direc-
ted toward independence, achievement, production
and mastery of tasks as ways of gaining orienta-
tion to and control of his world (Llewellyn
and Robinson, 1974).

An industrial arts program for the elementary school
can better enable young students to interpret industry and
technology, and to help these students relate the activities
to an expanding environment.

Problem of the Study

The problem of this study was to plan and articulate
an industrial arts program for the elementary school, K-3.

Purpose of the Study

The purposes of this study were to:

1. provide a rationale for implementing an industrial
   arts curriculum for the elementary grades in the
   public schools; and

2. assist elementary school administrators and teachers
   with implementing an industrial arts curriculum for
the elementary school.

Need for the Study

Throughout the last fifty years, advocates have stressed the need to help students understand industry and technology at ages earlier than junior high school. As early as the 1920's Bonser and Mossman established a need for elementary school industrial arts programs. Bonser emphasized a curriculum centered around children and their needs for socialization, activity, and understanding the environment. Bonser purported that industrial arts was a key to meeting these needs of children (McPherson, 1972, p.v). This position can still be supported today as evidenced in contemporary articles.

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... (Gilbert, 1974).

Although the need for an industrial arts program in the elementary school exists and has been realized for some time, few programs reflecting technology have been developed. Most of the materials are of an arts and crafts or handiwork orientation. Few programs attempt to help the student interpret the environment.
there is evidence that the apparently aimless search for suitable elementary school activities has been given direction and purpose by changes in our economy, our society, and professional education which belatedly indicates that some of these activities should be industrially oriented, provided in every elementary classroom, and related to the total elementary program. Professional direction is still lacking, but the growing need will doubtless force activity on many fronts (Lux, 1958).

Questions of the Study

1. Can an appropriate base be found to substantiate the development of an industrial arts curriculum for the elementary school?

2. What is to be the content of an industrial arts curriculum for the elementary school, K-3?

Assumptions of the Study

1. A logical and thorough base for an industrial arts program in the elementary school can be found within the literature on social forces, human development, learning theory, and the nature of knowledge.

2. The industrial arts program for the elementary school should be of such a nature to logically integrate with the existing program.
3. An industrial arts program for the elementary school should be such as to reinforce and supplement the other subject areas within the elementary curriculum.

Limitations of the Study

This study was carried out with the following limitations:

1. The guidelines proposed in The Iowa Guide for Curriculum Improvement in Industrial Arts, K-12 (1975) were utilized.

2. The curriculum developers were limited to:
   a. the researcher;
   b. an elementary classroom teacher;
   c. a recognized and knowledgeable person in elementary school industrial arts; and
   d. a recognized and knowledgeable person in industrial arts education.

3. Only select portions of the curriculum were field tested.

4. A single school and a single classroom at each grade level was utilized for field testing.

Procedures of the Study

I. Pre-Development Activities

   A. Establish a rationale for the development of an industrial
arts curriculum for the elementary school.

1. Review selected related literature.

2. Identify supportive information based upon
   social forces, human development, the nature
   of learning, and the nature of knowledge.

3. Prepare a justification for an industrial arts
   program for the elementary school.

B. Identify populations for the development and evalua-
   tion of the curriculum.

1. Identify members of the Development Committee,
   to include:
   a. the researcher;
   b. an elementary classroom teacher;
   c. a recognized and knowledgeable person in
      elementary school industrial arts; and
   d. a recognized and knowledgeable person in
      industrial arts education.

2. Identify members of the Expert Review Committee,
   to include:
   a. four (4) elementary classroom teachers;
   b. four (4) recognized and knowledgeable persons
      in elementary school industrial arts;
   c. an elementary curriculum coordinator; and
   d. a curriculum development specialist.
3. Identify the field test site.

II. The Identification and Ordering of Goals.
   A. Formulation of goals.
      1. Review selected literature.
      2. Disseminate literature to Development Committee.
      3. Identify preliminary goals in conjunction with the Development Committee.
   B. Evaluation of goals.
      1. Disseminate preliminary goals to the Expert Review Committee.
      2. Identify an instrument for the evaluation of developmental goals.
      3. Administer the instrument to the Expert Review Committee.
      4. Rank and order the goals.
      5. Provide feedback to the Expert Review Committee.
      6. Develop revisions as required.

III. The Identification and Operationalization of Objectives.
   A. Development of objectives.
      1. Review selected literature.
      2. Disseminate literature to the Development Committee.
      3. Identify preliminary objectives in conjunction with
the Development Committee.

4. Operationalize objectives in conjunction with the Development Committee.

B. Evaluation of objectives.

1. Disseminate objectives to the Expert Review Committee.

2. Identify an instrument for the evaluation of the objectives.

3. Administer the instrument to the Expert Review Committee.

4. Analyze the data.

5. Provide feedback to the Expert Review Committee.

6. Develop revisions as required.

IV. The Development and Evaluation of Interim Materials.

A. Development of interim materials.

1. Review related materials.

2. Identify clusters or areas for Development Committee to work in.

3. Identify a procedure and format for the development of materials.

4. Develop prototype materials.

5. Edit prototype materials for clarity and continuity.
B. Evaluation of interim materials.

1. Disseminate interim materials to Expert Review Committee.
2. Develop a checklist instrument to facilitate review of the interim materials.
3. Administer the checklist to the Expert Review Committee.
4. Analyze the data from the checklists.
5. Provide feedback to the Expert Review Committee.
6. Develop revisions as required.

V. Field Testing.

A. Selection of products.

2. Review of intrinsic tryout materials.
3. Identification of materials ready to be tested.
4. Selection of materials, based upon readiness and level.

B. Evaluation of products.

1. Develop checklists for teachers to use throughout field testing, covering:
   a. student progress and learning; and
   b. development and effectiveness of materials.
2. Organize and facilitate pay-off tryout.
3. Analyze the data.
4. Provide feedback to the teachers and students.

VI. Assessment of the Industrial Arts Curriculum.
   A. Identify strengths and weaknesses.
   B. Identify strategies for implementation.

Definitions of Terms

Curriculum: All the experiences which are offered to learners under the auspices or direction of the school (Doll, 1964, p. 15).

Industrial Arts: Industrial arts, as a curriculum area, are those phases of general education which deal with technology -- its evolution, utilization, and significance; with industry -- its organization, materials, occupations, processes, and products; and the problems and benefits resulting from the technological and industrial nature of society (Maley, 1973, p. 3).
CHAPTER II: REVIEW OF THE LITERATURE

An attempt was made, throughout the review of the literature, to investigate articles and research related to industrial arts, and more particularly industrial arts for the elementary school, and curriculum development. This review of the literature was undertaken to score the importance and need for this research. The review was documented in three sections: industrial arts for the elementary school, its history; industrial arts for the elementary school, curriculum projects; and curriculum development.

Industrial Arts for the Elementary School

This section of the review of the literature presents research and writings relative to industrial arts for the elementary school. This information is presented as a historical review.

Historical Review

Industrial arts for the elementary school had its beginnings in the United States under the auspices of manual training. Manual training began to flourish as an educational program during the 19th century. These programs were influenced by the writings of such educators as Pestalozzi, Herbart, and Froebel.

Miller and Miller (1975) documented the role these educators
played in the beginning of industrial arts in the elementary school.

The activity-centered program of industrial arts in the elementary school can be readily traced to the European educational experiments of Pestalozzi and Froebel during the latter part of the 18th and early part of the 19th century (p. 255).

Scobey (1968) further substantiated this notion:

These men advocated learning through the manipulation of materials and tools so that all the senses would be used in learning. Their ideas set the stage for industrial arts (p. 4).

The innovative philosophies of the European educators were not readily transferred to the United States. In fact, their work was not utilized until the late 19th century. Miller and Miller (1975) elaborated:

...the work of...pioneer educators in Europe was not recognized in the United States until the latter part of the 19th century when elementary educators began to look to the European accomplishments...as a means of revitalizing the elementary school programs (p. 255).

John Dewey's emergence as an educational leader at the turn of the century supported and stimulated educational reform in the elementary schools. Dewey (1916) proposed industrial arts as both content and teaching method:

When we turn to the school, we find that one of the most striking tendencies at present is toward the introduction of so-called manual training, shop-work...

This has not been done "on purpose," with a full consciousness that the school must now supply that factor of training formerly taken care of in the home, but rather by instinct, by experimenting and finding that such work takes vital hold of pupils and gives
them something which was not to be got in any other way. We must conceive of work in wood and metal...as methods of living and learning, not as distinct studies.

We must conceive of them in their social significance, as types of the processes by which society keeps itself going...; in short, as instrumentalities through which the school itself shall be made a genuine form of active community life, instead of a place set apart in which to learn lessons (pp. 10-11).

Dewey's belief and theories were extolled by Frederick G. Bonser in the early part of the 20th century. Bonser's book, Industrial Arts for the Elementary Schools (1923), co-authored by L.C. Mossman, applied Dewey's social and educational theories to the elementary school utilizing industrial arts (Miller and Miller, 1975, p. 255). Bonser and Mossman suggested that six areas could be associated with learning: food, clothing, shelter, tools, utensils, and records (Hostetter, 1974, pp. 218-219).

Bonser has been credited as the 'father' of industrial arts in the elementary school. "His educational goal was to provide a child with the ability to live and function effectively within an industrial society (Luetkemeyer and McPherson, 1975, p. 262)." Scobey (1968) further scored Bonser's crucial role in the development of industrial arts in the elementary school:

Probably the most influential basis for the present emerging concept of industrial arts was the work of Bonser and Mossman who were undoubtedly influenced by the workings of John Dewey. In 1923 they presented principles for the organization and teaching of industrial arts in the elementary school derived from earlier thinking but modified to emphasize the study of the processes of manufacturing (p. 5).
McPherson (1976 (b)) also stressed Bonser's early role in establishing industrial arts programs in the elementary schools:

Bonser is...recognized for his three major contributions to industrial arts education. One was his widely publicized definition of industrial arts.... A second was the role he played in organizing the first...general shop.... The third was the "Russell-Bonser Plan" and/or "The Industrial Social Theory" of industrial arts education. This theory was considered the basis for the development of industrial arts in the elementary school (p. 350).

Based on Dewey's and Bonser's foundations, industrial arts programs in the elementary school were developed around the country. These programs, in their individual schools, differed widely. For many years, no one or no group coordinated these efforts. In 1962, Elizabeth Hunt chartered a group which was to become the American Council for Elementary School Industrial Arts. This council, an affiliate of the American Industrial Arts Association, "has been striving to coordinate their efforts to provide leadership for those who teach children industrial arts in the schools (Hostetter, 1974, pp. 219-220)."

Industrial arts in the elementary school has a relatively short history. However, that history is founded upon the theories of recognized and authoritative educators.
W.R. Miller's research (1974) identified approximately 170 different industrial arts programs in the elementary schools throughout the United States. For the most part, these represent singular, unique programs in individual schools (p. 159). This section of the review of the literature outlines the foremost industrial arts programs for the elementary school. The programs include:

1. Technology for Children;
2. Technological Exploratorium; and
3. Project LOOM.

**Technology for Children**

Technology for Children is a program designed to foster unique technical learning environments for elementary students. This program was originally founded and directed by Elizabeth Hunt. According to Perusek (1975):

A major focus of the Technology for Children project has been on generating alternative learning experiences for children. This has been characterized by:
- a rich and changing material environment drawing upon technical activity
- teacher and child contribution to classroom activities
- activity based on choice and requiring decisions
- relating one area with another through experience
- child and teacher developed materials as a result of their working together (p. 52).
The Technology for Children program, incorporated to educate elementary school teachers about technology, operates an on-going teacher center in the state of New Jersey. This center permanently houses a workshop-classroom-laboratory used for workshops and idea development and exchange (Perusek, 1975, p. 54).

The Technology for Children program centers itself about a concern for children and their individual interaction with the total environment.

The initiation of this project was born of a deep conviction that every elementary school should provide maximum opportunity for boys and girls to interact with tools and materials, or, to put it another way, to interact with those things which are of technology (Hunt, 1967, p. 224).

The program also bears out the philosophy that technology is a product of people and therefore people control technology. According to Hunt (1967):

The products of technology are the results of man's ability to effectively think about and deal with the physical, material world. It is verily a human endeavor. Our attempt, therefore, would be to help the child develop effective ways of thinking about and dealing with these materials (p. 226).

Developing activities throughout this program has not followed a rigid curriculum development process. Rather, they have followed a philosophy that learning should be activity based and staged in an open and static environment. The learning environment should draw upon and enhance the individual's capacity to explore and learn. Hunt (1968) expounded:
The T4C Project is devising the kind of classroom environment which utilizes this basic exploratory, manipulative drive by including a wide variety of tools, materials, and other items. The energy, the interest, the curiosity of the child is released in this environment, to accrue for him information through all of his sensory channels (p. 254).

Throughout the program's summer workshops and technology laboratories, elementary teachers have been encouraged to explore the many facets of technology. They have been asked to consider the many ways people interact with technology and how they, as educators, can help their students better interact with and understand technology.

Technological Exploratorium, K-6

Technological Exploratorium was a developmental curriculum project conducted in Summit County, Ohio and funded through Title III monies from the Elementary and Secondary Education Act. The project was directed over its three year period by Norma Heasely.

The underlying philosophy of Technological Exploratorium was that people must understand themselves and their technology to willfully direct their futures. As technology is man-made, it was not considered to be dehumanizing. Heasely (1973) explained the responsibility education has of exposing the learner to technology and the environment.
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 the environment as it is, so that they will be better prepared to shape their environment as it could be (pp. 45-46).

The scope and sequence of Technological Exploratorium was categorized by two major thrusts. One thrust of this conceptual hierarchy was man's interactions with the environment. The second thrust of the scope and sequence deals with the uniqueness of man. Heasely (1973) further explained the scope and sequence:

Two main thrusts are represented within the scope and sequence of the conceptual hierarchy: the uniqueness of man and 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....

Man's interactions with his environment present the sequential development for the technological exploratorium. 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....

Units of study were developed to provide for the scope and sequence. These units contained multi-sensory activities aimed at developing skills in the psycho-motor, cognitive, and affective domains. Figure 1 represents the sequence for unit content.
### SEQUENCE FOR UNIT CONTENT

*(Based on Man Shaping his Environment through Technology)*

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<td>6</td>
<td>Effects of Technology on Man and Society</td>
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<td>Evolution of Technology</td>
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<td>II</td>
<td>4</td>
<td>Interpreting the Environment through Technological Developments</td>
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<td>Understanding Human Interaction through Technology</td>
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<td>Technology and the Individual's Environment</td>
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<td>I</td>
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<td></td>
<td>K</td>
<td>Introduction to Tools, Materials, Research and Development</td>
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<tr>
<td>EMR</td>
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<td>A Study of Technology for Children with Learning Disabilities</td>
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Figure 1. Sequence for Unit Content (Heasely, 1973, p. 51).
Throughout 1972 and 1973, an experimental evaluation was conducted on the Technological Exploratorium project. This evaluation attempted to identify improvements in students in such areas as social skills, self-reliance, word associations, verbal and non-verbal fluency, and creativity. First through sixth grade students were involved in the study and all but the third grade students showed marked development after being exposed to the Technological Exploratorium project (Heasely, 1975, pp. 30-31).

Other results of the study indicated that:

1. Parents overwhelmingly supported the project;
2. Teachers were committed to the project even without federal funding;
3. The Board of Education accepted project recommendations and planned to upgrade the program;
4. The project was expanded to other school districts in Summit County, Ohio; and
5. Involvement of university students and faculty was also expanded (Heasely, 1975, pp. 33-34).

Project LOOM

Project LOOM, originally funded in 1970 and directed by E.G. Berger, is an on-going activity-based career awareness project for grades K-8 in Florida. LOOM, an acronym for Learner-Oriented Occupational Materials, started as a curriculum research and develop-
ment project with five basic objectives, which included:

1. Developing an understanding of the role of career education awareness and the terminology associated with it at the elementary level....

2. Developing instructional materials of a utilized nature which would provide teachers with the necessary information and resources to conduct "hands-on" career awareness activities in the elementary schools.

3. Developing teacher competencies in the effective infusion of LOOM instructional units into their academic curricula.

4. Developing teacher abilities to use tools, equipment, and materials of the careers in a classroom situation.

5. Assisting participating school districts in the dissemination, diffusion, and adoption of the LOOM product (Berger, 1975, p.43).

During the first three developmental years, 350 teachers in 140 elementary schools worked with the project. The teachers authored and tested 157 career units complete with supplementary materials such as slides and filmstrips. The resultant product was a total career awareness program (Berger, 1975, p. 44).

Each of the career units was written with five student objectives in mind:

1. Develop each student's awareness and perception of the world of work and the wide variety of careers from which to choose.

2. Develop in each student positive and wholesome attitudes regarding the social and personal significance of work.

3. Develop each student's self-awareness of careers by participation in actual "hands-on" learning experiences involving that career.

4. Assist the student in beginning to develop career aspirations and an understanding of the need for decision-making regarding education and occupational choices.
5. Enhance academic education by providing realistic experiences which lend new meaning and relevance to academic subjects (Berger, 1975, p. 43).

During the 1973-74 school year, Project LOOM conducted a formal evaluation in five school districts throughout Florida. One hundred and twenty-three elementary teachers and 3,750 elementary students were involved (Berger, 1975, p. 44).

As a result of the evaluation and on-going research, Project LOOM reported a multitude of research findings, including:

1. Substantial student gains in vocabulary, reading skills, arithmetical skills, and general motivation.
2. Expanded student interest spans.
3. Teacher characteristics did not have any apparent impact on their attitudes towards LOOM.
4. Geography had no effect on teacher responses.
5. No differences in teacher attitudes towards ten sample units field tested.
6. Student academic abilities were inversely related to student approval of the LOOM materials.
7. Tendencies existed for teachers to separate rather than integrate LOOM materials from normal classroom activities (Berger, 1975, pp. 45-46).

Project LOOM has grown in numbers of teachers utilizing the materials since its original conception. The project, yet directed by Berger, operates through the Department of Industrial Arts, Florida State University.
Curriculum Development

This third and last section of the review of the literature will present information relative to curriculum development. The topic will be pursued in three areas: methods and procedures of curriculum development, Sarapin's Formative Evaluation Model, and the case study method.

Methods and Procedures

Curriculum has been described as "all the experiences which are offered to learners under the auspices or direction of the school (Doll, 1964, p. 15)." This definition scores the belief that the American educational system is predominantly locally controlled and that curriculum and its development is a function of the individual school, teachers, and classroom. This has not been reality until recent years. Grobman wrote, testifying to the situation, in 1970:

Despite...pride in the variability and flexibility in American public education, the fact is that, until about ten years ago, there has been a high degree of uniformity in schools within the same city or state, and even in schools throughout the country. Courses have been rather closely tied to textbooks that have had relatively few basic changes over the years....

...this was a situation in which the dead hand of the past made change difficult, despite periodic investigations of education with resultant recommendations for change by national and scholarly groups in education and other disciplines.... No...publisher could afford to undertake the responsibility.... The system for training teachers was geared to exis-
ting materials... and there was a general conservative tenor in most school systems. Thus, radical change, though repeatedly urged, was effectively discouraged (pp. 1-2).

During the 1930's and later years, a foundation was laid for a comprehensive theory of curriculum planning. Under the prompting of various committees of the Progressive Education Association, demands were made to consider such areas as human development, the nature of learning and social forces as bases for curriculum development (Taba, 1962, p. 3). These initial reports and subsequent research and writings paved the way for changes within the curriculum development process.

A historical review of the curriculum development process reveals many changes throughout the years. Doll (1964) listed several major trends.

Running through the whole panorama of American education from colonial times to the present, there appear several trends in the evolution of the curriculum:

1. In the past, ideas have often developed in private schools, and public schools have then adopted them.
2. Schools and school systems everywhere have frankly copied plans, procedures, and curriculum content from other schools, and school systems.
3. New institutions, such as the early academy and more recent junior-high school, have been established to satisfy unmet needs.
4. Educational principles, such as that of schooling for everyone, have been adopted in substance and modified in detail whenever they have struck a popular chord.
5. Experimentation has occurred, but it has usually been informal and its results have remained largely untested.
6. National committees have determined general objectives, policies, and programs.
7. Psychological and social theories and revelations have turned the efforts of curriculum planners in new directions.
8. American educators have been susceptible to using plans, some of them delusive, for making the difficult process of teaching and learning easier.
9. Even those educational ideas which have been based on the soundest evidence have been adopted very slowly by practitioners.
10. The schools, as an instrument of American society, have been subjected to numerous public pressures (pp. 13-14).

Another trend has greatly effected the curriculum by structuring its development. During the late 50's, the Physical Sciences Study Committee (PSSC) prepared innovative materials for high school physics courses. A singularly unique characteristic of the project was its means for producing instructional materials (Bailey and Stadt, 1973, pp. 307-308). They explained:

The mushrooming of developmental curriculum projects... has resulted in an emerging pattern for the curriculum development process. One of the more important discoveries of such projects is that there is no single, best method of achieving project objectives. Considerable variation is possible with respect to the operational conduct of a project. On the other hand, most successful projects are characterized by a rational, systematic process of decision-making and organization (p. 308).

Since the 1950's a multitude of developmental curriculum projects has taken place around the country at local, state and national levels. Concurrently, a few authors have detailed models for the curriculum planning process. One such model is Gilchrist and Robert's Paradigm: A Curriculum Development Evaluation Design (p. 87) (Figure 2).
Figure 2. The Paradigm: A Curriculum Development Evaluation Design (Gilchrist and Roberts, 1974, p. 87).
Gilchrist and Robert's model is a cyclical five-step process. Between each of the five processes are "grids representing special communicative processes.... The hardware and the evaluation techniques are incidental to the basic processes of communication and involvement that make up the system (Gilchrist and Roberts, 1974, p. 86)."

A second curriculum development model was presented by Saylor and Alexander (1974) (Figure 3). This model represents three principal phases of planning curriculum: a) curriculum designing; b) curriculum implementation; and c) curriculum evaluation. The authors viewed this model as a continuum, one not tied to grade level or time.

...the continuum notion in curriculum planning is incompatible with a graded school system; plans influenced by the continuum concept focus on objectives or competencies to be achieved instead of time and ground to be covered (Saylor and Alexander, 1974, p. 34).
Figure 3. The Curriculum Planning Process (Saylor and Alexander, 1974, p. 27).
A third example of a curriculum development model was published by Bailey and Stadt (1973) (Figure 4). Their model is a five phase structure which is:

...(1) sophisticated enough to guide curriculum development regardless of level, subject area, philosophy, or specific type of curriculum and (2) reflective of the reality of how curriculum actually evolves in most developmental curriculum projects (Bailey and Stadt, 1973, p. 309).

Bailey and Stadt's general conceptual model for curriculum development includes five steps: selection of a curricular language; formulation of goals and objectives; preparation of instructional products; experimental tryout, evaluation and quality control; and diffusion and adoption. This model includes two phases neither Gilchrist and Roberts' nor Saylor and Alexander's incorporates: language selection and diffusion and adoption.

Bailey and Stadt suggest that language selection reflects the nature of a project and the staff's theoretical orientation (1973, p. 311). They also continue that diffusion and adoption are crucial if implementation of the curriculum is to be a reality (1973, p. 337). The authors suggest that both language selection, and diffusion and adoption are critical concepts to a curriculum development process.
Figure 4. Five Phases in Overall Structure for a General Curriculum Model (Bailey and Stadt, 1973, p. 309).
The Formative Evaluation Procedural Model

The Formative Evaluation Procedural Model, herein referred to as the model, was developed by Marvin I. Sarapin (1977) as an outcome of doctoral requirements completed at Iowa State University. The intended use of the model was for instructional material development and revision in industrial arts, although the model would be applicable in other curricular areas as well.

The model is a four phase sequence representing "the broad concepts associated with evaluation during the formative period in curriculum development (Sarapin, 1977, p. 165)." The four concepts included the following:

1. the identification of goals;
2. the identification of objectives;
3. the development of interim materials; and
4. field testing the materials.

These four concepts were presented as distinct phases within a model. Each phase incorporated the development and evaluation functions. This model (Figure 5) represents the flow from function to function within each phase, and also the flow from phase to phase. The initiation and subsequent completion of a function, or phase, was prerequisite to the initiation of the next function (Sarapin, 1977, pp. 88-89).

The first phase of the model is the identification of prelimi-
Figure 5. Sarapin's Formative Evaluation Procedural Model (1977, p. 93).
nary goals. If goals have been previously established, the second phase of the model becomes the staring point. If development of goals is required, phase one is used in entirety.

Throughout phase one, preliminary goals are identified and ordered. Each goal is evaluated according to established criteria, allowing for the deletion or possible inclusion of goals. If after the evaluation no goal priorities emerge, phase one is repeated. Phase two is initiated when goal priorities do emerge (Sarapin, 1977, pp. 94-96).

Preliminary objectives are identified and operationalized throughout phase two. Objectives are evaluated and subject to established criteria. If objective criteria do not emerge after the evaluation, the process requires repeating phase two. Phase three is initiated when objective criteria do emerge (Sarapin, 1977, pp. 96-98).

Interim materials are developed in phase three of the model. These materials reflect the established goals and objectives. The interim materials are evaluated for classroom readiness after edits and revisions. If the interim materials are not found to be satisfactory, further editing and revisions are required. Phase four of the model is initiated when interim materials are judged satisfactory and emerge (Sarapin, 1977, pp. 98-100).

Field testing of products takes place in phase four. The curricular products are tested in the classroom and evaluated against
established criteria. If major revisions are found to be necessary, phase three, the development of interim materials, must be repeated. If, as a result of field testing, satisfactory products emerge, the formative evaluation sequence has been completed (Sarapin, 1977, pp. 100-101).

The model was field tested from June 1976 through July 1977, including the school year (Sarapin, 1977, p. 167). Based upon the outcomes of that endeavor, Sarapin (1977) found that:

...employment of a formative evaluation model facilitates the development, assessment, and revision of educational goals, objectives, interim materials, and instructional products. The use of the formative evaluation model facilitated informed decision-making...at appropriate points in the curriculum development-assessment-revision continuum. The application of the formative evaluation model...served to organize the interrelated concepts and procedures of evaluation; to predict the flow of information and events during product planning, development, and assessment; and to represent a useful system of evaluation for...practitioners (pp. 171-172).

Sarapin further recommended that the formative evaluation procedural model be utilized to develop, assess and revise innovative curriculum materials for industrial arts (K-12) (p. 178).

The Case Study Method

Case studies represent one type of educational research. Good (1966) defines the case study as a means to "intensive investigation of the case unit...(p. 310)." Case study methods have been utilized
in education to research individuals, institutions, and communities (Good, 1966, pp. 310-311). Case study methods may also be applied to classes, as reported below:

In educational research, cases are most commonly individual persons, communities, and institutions. The case study method has been frequently employed in education in studying problem cases, maladjusted pupils, and scholarship difficulties. It is obviously an important source of educational ideas.

In addition to use of the case method for investigation of particular or individual instances of phenomena, it may be employed in studying the general characteristics of phenomena of any given class.... If the case method is to be used in the discovery of relationships thought to hold true for particular classes of conditions, then care must be taken to collect comparable data relating to the several cases investigated (Good, Barr, and Scates, 1941, p. 567).

Case study procedures have been identified and delineated by different authors. Good, Barr and Scates initially outlined the following five step procedures for making case studies:

1. Determine the status of the problem being investigated.
2. Collect data relative to the problem.
3. Ascertained the presence or absence of antecedents relative to the problem.
4. Adjust the circumstances related to the problem (holding all others constant).
5. Measure changes produced by the adjustments (Good, Barr and Scates, 1941, pp. 570-572).

These steps are further substantiated by a more recent publica-
tion by Good in 1966. His complementary steps included the following:

1. Recognition and determination of the status of the phenomenon to be investigated;...
2. Collection of data relating to the factors or circumstances associated with the phenomenon;....
3. Diagnosis or identification of causal factors as a basis for remedial or developmental treatment;....
4. Application of remedial or adjustment measures;....
5. Subsequent follow-up to determine the effectiveness of the corrective or developmental measures applied (Good, 1966, p. 313).

The case study method has been used extensively in such fields as medicine, psychology and journalism, as well as education. This approach to research represents one good method of analyzing complex human situations.

Chapter Summary

The review of the literature was presented in three sections: a historical review of industrial arts in the elementary school; elementary school curriculum projects in industrial arts; and the process of curriculum development. The review indicated that although industrial arts as a program has been advocated for use in the elementary school since the turn of the century, relatively little change has occurred in the public schools.

A brief historical review of industrial arts in the elementary schools was discussed to lay a foundation for further review. Special attention was given to the work of Dewey and Bonser. Their work has been identified as substantially contributing to the nature of
industrial arts in the elementary schools today.

Three major elementary curriculum projects in industrial arts were also reviewed. These programs - Technology for Children, Technological Exploratorium, and Project LOOM - reflect the status of industrial arts in the elementary schools today.

Finally, attention was focused on curriculum development. The evolution of the process of curriculum development was discussed and Sarapin's Formative Evaluation Procedural Model was detailed. The case study method was also highlighted.
CHAPTER III: ELEMENTARY SCHOOL INDUSTRIAL ARTS
A RATIONALE

Contemporary education in the United States takes on the burdensome job of preparing young people for living now and in the future. This is attempted without knowing what the future holds for any individual student. It is crucial, therefore, that the curriculum be as sound and thorough as possible.

Hass, Bondi and Wiles (1974) suggest there are four bases on which to build and establish the curriculum: social forces, the nature of knowledge, the nature of learning, and human development. These four bases were utilized to establish a rationale for implementing an industrial arts program in the elementary school curriculum.

Social Forces and the Nature of Knowledge

Social forces and the nature of knowledge, two of the identified bases of the curriculum, help establish the content of any educational program. They are herein presented in sequence to delimit the content of an industrial arts program. A summary of the implications of these two bases is also provided.
Social Forces

One of the major goals of any educational system is to transmit to students the existing culture and to help them internalize the values of the society. The contemporary American educational system must pursue this goal under the clamor of constant pressures and changes, both social and economic. Social forces must therefore be an integral component of all curriculum planning (Hass, Bondi and Wiles, 1974, xviii).

Identifying the social forces which affect education poses many problems for the curriculum developer. Social issues tend to be very complex and occur with great rapidity. Taba (1962) elaborated:

It is not an easy task to establish what demands society makes on education and what contribution education can or should make to culture, especially is a complex society in which vast and rapid changes are occurring. Yet it is precisely in such a society that a continuous examination of the goals and demands of society and of the forces operating in it is necessary in order to keep education reality-oriented... (p.31).

Wolfe (1973) identified what she terms 'the seven P's' to help curriculum planners consider the major social issues facing the nation. The seven P's included: population control, pollution, poverty, persecution and war, prejudice, protection from violence, and pot and other drugs. Wolfe explained the implications of the seven P's on education:

As we look at these seven P's of the 70's...we must see that they are complicated by the technological revolution and the revolution created by the expansion
of human knowledge. There is no doubt that the technological revolution has made possible the tremendous expansion of man's capabilities.... But certainly as we use the term technology and recognize the tremendous changes that have taken place in our society due to technology...there is no doubt that the school is challenged.... For one cannot look at advancing technology without recognizing its effect upon human values and individual growth and development (p. 51).

Taba (1962) also supported the notion of technology's far-reaching effects on humankind:

Early diagnoses of the social changes introduced by science and technology were rather optimistic.... Technological advance spelled automatic progress and improvement of society, and consequently the task of education was to impress these achievements on the minds of the young.... Gradually it has become evident, however, that technological "progress" cannot always be equated with social progress and that the changes wrought by it are not always in man's control or in accord with his own desires....

...technology has changed and is changing not only the face of the earth and the institutions of our society, but man himself.... Our minds are controlled by technology and by the thought forms and values created by it (pp. 35-36).

As technology wields such control over the human spirit and human endeavors, it is necessary for the schools to educate students concerning technology. Such a study might include many aspects of technology including the future and the human role. Kranzberg (1973) suggested that the future and advancing technology may not loom so oppressive if people are adequately prepared. He stated:

...ours is an exciting age in which to live, and we must prepare our students to live in a world of continuous and rapid change. It is the business of the future, said Alfred North Whitehead, to be danger-
ous. But we can accept the risks with composure and confidence if we set ourselves to the task of educating our future citizens to understand the social forces accompanying technological change and to play a meaningful part in the technological process itself. And, to assist us in the performance of this noble task, we must increasingly turn toward educators in the industrial arts (p. 34).

Industrial arts, as a study of industry and technology, can help prepare individuals for the future, but only if its curriculum planners heed the social forces. Though dealing with contemporary problems, as technology is one, industrial arts must still be relevant. Scobey and Graham (1974) identified specific areas of which industrial arts educators should be aware. They explained:

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 (p. 22).

Through responsibility to the social forces of the day, industrial arts becomes far more than a study of industry or industry's use of technology. Industrial arts, as a comprehensive study of both industry and technology, educates the learner concerning a major force of social change today.

Technology was not the only social force identified facing society today. Others, possibly more localized in nature, need
not be a national concern to affect the curriculum. Certainly many social forces can be identified at the local level and curriculum planners must also be aware of these, including the industrial arts curriculum planner.

Nature of Knowledge

The nature of knowledge, identified by Hass (1977) as the second base of the curriculum emerged as a concept during the 1960's. Foshay (1961) proposed that the nature of organized and formal knowledge is critical to the curriculum and should be considered along with social forces, human development and the nature of learning when developing curriculum. He explained:

I learned that curriculum decisions should be based on a knowledge of the child and of society.... What was left out of this theory was the nature of organized knowledge. As professional educators, we have taken organized knowledge - the disciplines out of which man's knowledge is made - for granted.... ...so I come to my modest proposal. It is simply this: that we educators take directly into account the nature of organized bodies of knowledge...as we try to make curriculum decisions (pp. 509-510).

Doll (1964) suggested that the nature of knowledge came to be regarded as a base for the curriculum for three reasons. Those reasons were:

1. Knowledge has exploded to a point at which it is necessary to select for teaching those items of knowledge that seem most significant, and to eliminate much that is inconsequential.
2. Subject specialists have recently had more to say about the nature of their fields, and about the teaching of these fields.
3. Experiments are being directed toward showing that subject-matter, old and new, can be placed in previously unthought-of locations in the life space of learners (p. 74).

Hass (1977) delineated three methods of considering knowledge. These methods included: (1) knowledge as represented in subjects or disciplines; (2) knowledge as a product of man's experiences; and (3) knowledge as a combination of both structure as well as experience (pp. 187-189).

Foshay (1977) discussed knowledge as represented by disciplines. He suggested that the main advantage to knowledge represented in disciplines is "that the students are offered subject matter as if it were reasonable (p. 204)." Foshay further explained that the disciplines offered the learner a general education:

At the bottom of every discipline we teach, one may say, is general education. At the bottom, that is, not at the top. A superficial acquaintance with science or mathematics consists only of knowledge of technique. The conceptual material is somewhat deeper. But at the conceptual level the vocabulary of the learned field turns out to be the intellectual vocabulary of general education. The fundamental concept of the fields we teach in the lower schools have very wide applicability (p. 204).

With the advent of discipline-oriented curriculum projects in the 50's and 60's, Foshay (1977) also recognized problems or limitations in the disciplines. He outlined four:

First, the disciplines proposal begs the question of the integration of knowledge... to teach subjects separately leaves the problem of integration of knowledge to the student himself to carry out, more or less unaided.
Second, the discipline proposal does not deal directly with the relationships between education and life - what we call "relevance...."

Third, the disciplines proposal failed to take into account the nature of and need for teacher education....

Fourth, the projects...did not seek to deal realistically with all the children in the schools.... (they) were conceived as suitable primarily for the college bound... (pp. 204-205).

Along with a multitude of discipline-related curriculum projects, the 60's brought about many social reforms and demands on education. Bruner (1977 (b)) explained the situation:

...by 1970 the concern was no longer to change schools from within by curriculum, but to refit them altogether to the needs of society, to change them as institutions. It is no longer reform but revolution that has come to challenge us. And it is not so plain what is the role of the academic in such an enterprise (p. 199).

Bruner further elaborated on the challenges he detected facing education as an institution of society. The curriculum, he suggested, must reckon with the problems of the day and put knowledge to work for the betterment of society. Bruner (1977 (b)) wrote:

If I had my choice now, in terms of a curriculum project for the seventies, it would be to find the means whereby we could bring society back to its sense of values and priorities in life. I believe I would be quite satisfied to declare, if not a moratorium, than something of a de-emphasis on matters that have to do with the structure of history, the structure of physics, the nature of mathematical consistency, and deal with curriculum rather in the context of the problems that face us. We might better concern ourselves with how those problems can be solved, not just by practical action, but by putting knowledge, wherever we find it and in whatever form we find it, to do work in these massive tasks. We might put vocation and intention back into
the process of education much more firmly than we had it there before (p. 201).

More recently, educators and social critics alike have suggested that the curriculum become all-inclusive toward the nature of knowledge. It must draw on the disciplines for general knowledge, but use 'now' problems to add greater meaning to the process of education.

Culkin elaborated the writings and works of Marshall McCluhan, just such an advocate, for educators. Culkin suggested that schools are no longer the sole supplier of information and that they can not possibly teach all available information. Culkin (1977) expressed the following viewpoints:

There is too much stuff to learn today.... And the information levels outside the classroom are now higher than those in the classroom. Schools used to have a virtual monopoly on information; now they are part-time competitors in the electronic informational surround. And all human knowledge is expanding at computer speed.

...we can no longer teach kids all about a subject; we can teach them what a subject is all about.... Its focus is not on content or detail but on the postulates, ground rules, frames of reference, and premises of each discipline (p. 224).

As the curriculum was and is widened to include far more than the three R's, the school has become suspect to many people. Critics have claimed that young students merely have not learned the rudiments of a basic education. Ausubel (1977) responded to these complaints:
One of the chief complaints of the critics of public education... is that modern children fail to learn the fundamentals because of the broadening of the elementary school curriculum to include such subjects as social studies, art, science, music and manual arts.... Fortunately, however, the benefits of an expanded curriculum have thus far not been accompanied by a corresponding deterioration in the standard of the Three R's. Evidently the decreased amount of time spent on the latter subjects has been more than compensated for by the development of more efficient methods of teaching and by the incidental learning of the fundamentals in the course of studying these other subjects (pp. 124-125).

Industrial arts, as a peripheral subject to the basic or core curriculum, can make a substantial contribution to the knowledge disseminated in the public schools. Including a study of technology, shown to be one of the major problems facing the world today, industrial arts can identify unique content for the schools to present. Industrial arts also offers the study of technology as an interface between other related disciplines and the 'real world.' Lauda (1976) expounded on this unique contribution of industrial arts to the curriculum.

Industrial arts teachers and teacher educators can definitely cope with our technological culture. There is identifiable content in the technologies which needs to be presented.... The industrial arts profession is one of the very few disciplines in a position to engage in such education. Although geared to out-dated production systems in many cases, the profession is involved in the three identified areas of technology (production, communication, and energy) (p. 108).

These three areas of industrial technology - production, communication and energy - provide for the unique content of industrial arts.
Through them, a study of technology can relate the academic disciplines of general education to the everyday experiences of people.

Summary

Technology was established as a major social force confronting people today. Its implications have far-reaching effects on human-kind and, consequently, on education. Kranzberg (1973) suggested that education turn to industrial arts to prepare young people for the future and its many changes in technological society.

Technology was also identified by Lauda (1976) as the content base of industrial arts. Technology, he further suggested, was represented in three cluster areas: production, communications, and energy. Resultantly, these three cluster areas also establish a content organization for industrial arts.

Prevailing social forces and a review of the nature of knowledge established the content base for industrial arts as technology. Technology, then, must be the theoretical orientation of the curriculum developer in industrial arts.

The Nature of Learning and Human Development

The nature of learning and human development, the last two bases of the curriculum, help to identify the appropriate methodologies to be used with students. The two bases are presented to establish the appropriateness of industrial arts methods. A
summary of the implications of the nature of learning and human development is also provided.

The Nature of Learning

Hass (1977) identified the nature of learning as the third major base of the curriculum. He likewise stated that today four families of learning theory represent the nature of learning. The four families included:

1. Freudian learning theory;
2. Gestalt learning theory;
3. Stimulus-response learning theory; and
4. Social learning theory (pp. 146-149).

Freudian learning theory grew from the original work of Sigmund Freud. Three basic units of learning are identified in Freudian theory: "awareness, which is freedom or self-understanding; identification; and limitation (Hass, 1977, p. 148)."

Freudian theorists maintained that the vast amounts of knowledge that people learn throughout life are learned by imitation. Important persons associated with an individual, such as parents, peers or teachers, serve as models for the learner. Often times, what the learner sees in these important persons are inconsistent behavior and actions. Consequently, it is critical that each learner develops self-knowledge or awareness (Hass, 1977, pp. 148-149).
The self-concept results from the totality of the beliefs one possesses of himself according to Freudian theory. The self-concept affects behavior and learning as it affects the individual's perception of the environment. Avila and Purkey (1977) elaborated on this concept:

...behavior is determined by the individual's subjective perceptions of the situation rather than by the situation itself. Thus, we have the indispensable construct of the phenomenological world. Central to the phenomenological world is one's self-awareness. All of the beliefs, opinions, and attitudes that an individual holds about himself have come to be called self concept... (Avila and Purkey, 1977, pp. 175-176).

Self-awareness or self-knowledge is the basic premise of Freudian learning theory and Freudian psychology. To facilitate optimum learning, teachers must help students become increasingly more aware of their unique feelings and thoughts.

Gestalt learning theory or 'field' theory, the second family of learning theory, holds 'wholeness' to be primary. When teaching or learning, the individual should begin with an overview and then proceed to particulars. A major belief in field theory is "that the whole is always greater than the sum of its parts (Hass, 1977, p. 147)." Hass further explained:

Gestalt is a term that emphasizes wholeness and means that field theories reject elemental analysis in terms of stimuli and responses as the most significant factors in learning. The meaning of learning cannot be derived from its parts in summation. The whole is greater than the sum of its parts (p. 148).
Gestalt learning theorists contend that people learn only through their own unique responses. To a degree, learning occurs as a result of an active process of selecting and organizing. Taba (1962) considered this action:

...the common feature of these (field) theories is that they assume that cognitive processes - insight, intelligence, and organization - are the fundamental characteristics of human response, present even in the simplest perception of the environment. Human actions are marked by quality of intelligence and the capacity to perceive and to create relationships. This understanding of relationships steers man's actions (p. 80).

Taba (1962) also wrote that motivation is crucial to the Gestalt theory and that learning is considered a social process:

Field theory views learning as essentially a social process. To learn, an organism must interact with others. For this reason, provision for group work and interaction, such as discussion, are an important element of curriculum planning....

...motivation is central to this theory. Learning occurs largely in response to basic motivating needs and goals and is enhanced by interest and motivation as well as practice, which is not synonymous with repetition.... Learning engendered by intrinsic motivation is more likely to be retained and used again (p. 82).

Throughout all the field theories, the learner must think, select and organize. This is the source of learning.

Stimulus-response (S-R) learning theory "assumes that man is a collection of responses to specific stimuli (Taba, 1962, p. 80)." S-R learning theories can be identified around certain concepts: stimulus-response, behaviorism, associationism, connectionism, conditioning, reward, and pleasure or pain.
All the aforementioned concepts center about experience. Learning is a process or stimulus which allows the student to acquire new and different responses. Hass (1977) explained:

Behavior is directed by stimuli from the environment. A person selects one response instead of another because of the particular combination of prior conditioning and physiological drives operating at the moment of action. A person does not have to want to learn something in order to learn it. Anyone can learn anything of which he is capable if he will allow himself to be put through the pattern of activity necessary for conditioning to take place (p. 147).

Taba (1962) further elaborated on S-R theory:

This theory has been called elementaristic because behavior is essentially assumed to consist of discrete events. The basic problem of this theory, therefore, is to show how the discrete events of experience get joined together. Associationism - that is, a connection between contiguous events - was the earliest explanation. The later behavioristic theories postulated either classical conditioning or other more complicated mechanisms... (p. 80).

Stimulus-response learning theory links individual learning to the immediate environment. The total of an individual's experiences illicits certain responses, hence learning.

Social learning theory, the last of the four families of learning theory, purports that "humans have unlimited capacity to learn (Hass, 1977, p. 149)." This theory, backed by sociologists, anthropologists and social psychologists, maintains that learning is only limited by societal constraints. Hass (1977) elaborated:
The actual capacity to learn, however, is confined by social expectations and by limitations in behavior patterns that the immediate social environment considers appropriate.... The learning process is primarily social, and learning occurs through socialization.... Learning through socialization continues throughout life. The basic unit of learning is the dyadic relationship, which refers to a relationship between two people. But it takes a group to make an individual; there is no such thing as a self-made man or woman (p. 149).

Social learning theory is an eclectic theory. Its theorists use basic units of learning common to the other theories. These include reward responses, transfer, self-concept, meaningfulness of the whole, the importance of generalizations and organization, and others (Hass, 1977, p. 149).

All four of the learning theories attempt to delineate how the student learns. No one theory has proved itself to date, nor disproved the other learning theories. So, in actuality, most schools or learning environments display a combination of learning theories.

Industrial arts teaching methodology lends itself to the broad range of learning theories. Students, often functioning within small groups or as individuals, are given numerous opportunities to explore and experiment with new materials and processes. So doing, these students can increase their ranges of experiences and successes allowing for the further development of their unique self-knowledges and self-concepts. These being integral components of Freudian and Gestalt learning theories.
Industrial arts also offers the individual more opportunities to function with groups in different, unique situations. While exploring the associations between making and using in manufacturing or the many ways people utilize energy sources, students are also establishing more ties with other students and refining their relationships with one another. These refined relationships are crucial to socialization, the process by which, social learning theorists claim, people learn all.

Industrial arts teaching methodology also supports the S-R learning theory by offering the individual learner more and varied learning situations with tools, materials, and processes. Each of these can work as an initiator to learning, a stimulus, and requiring certain responses from the student.

Regardless of learning theories employed in a particular school, certain other characteristics are desirable in the learning environment. Waetjen (1965) elaborated:

The educational situation which most effectively promotes significant learning is one that has certain characteristics. First and foremost is the characteristic that the uniqueness of the learner is valued, cherished, and his uniqueness is brought into play in the learning situation....

Another characteristic of the educational situation that promotes significant learning is the one in which the learner is free to explore ideas, materials, and resources that are available to him... (p.243).

Gordon (1977) also wrote describing optimum situations for learning:
Any way in which children learn a skill, can demonstrate adequacy, or are treated as adequate in real-life settings has both affective as well as cognitive payoff.... Children are not easily fooled by phony situations. They learn best when learning is "real" and respects their integrity (p. 167).

Industrial arts contributes to general education by allowing the individual first-hand, concrete experiences with the same tools, materials and processes that are used to control and change the human environment.

**Human Development**

Research in human development, the fourth and final base of the curriculum, attempted to identify patterns of sequences in the ways people grow and mature. Mass (1977) identified five elements of human growth and development. These elements were:

1. The biological basis of individual differences
2. Physical maturation
3. Intellectual development and achievement
4. Emotional growth and development
5. Cultural and social development (pp. 89-90).

Three human development theorists are prominent in their efforts to research varied elements of human growth. The first, Piaget, explained the biological, psychological and cultural elements of development with his four stages of growth. Secondly, Erikson's nuclear stages toward a mature personality emphasized emotional growth and development. Lastly, Havighurst also explained the biological, psychological and cultural elements of development with
what he terms 'developmental tasks.'

Piaget's theory of human development identified intellectual development as a continual process of organization and reorganization of knowledge. This process occurred over a four-stage developmental sequence within the learner. The four stages included:

1. the sensory-motor phase, ages 0-2 years;
2. the preoperational phase, ages 2-7 years;
3. the concrete operations phase, ages 7-11 years; and
4. the formal operations phase, ages 11-15 years

(Phillips, 1975, p. 20).

Piaget's third phase of concrete operations correlates to the elementary school aged child. During this phase, the child must first experience physical or 'concrete' events before the child is able to extend what is learned to a social or cognitive sphere. A "widening awareness of physical factors always precedes an awareness of social factors (Maier, 1965, p. 132)." Ault (1977) further substantiated this interpretation of Piaget's theory:

...as implied by the term "concrete," the Concrete Operational child applies his mental operations solely to real (concrete) objects or events. One can ask the child to consider the following question: If all dogs were pink and I had a dog, would it be pink, too? The Concrete Operational child will balk at such a question, rejecting the initial supposition by stating that dogs cannot be pink. The Concrete Operational child cannot divorce himself from the objective world and think about purely hypothetical propositions (p. 72).
According to Piaget, an elementary school aged child must learn from reality. The environment in which the child functions must be such as to allow the learner free access to a multiplicity of real objects and events.

Erikson's (1950) theory of human development is represented in eight stages. The first five stages, representing childhood, were "a reformulation and expansion of Freud's psychosexual developmental stages (Maier, 1965, p. 28)." The last three stages fall within adulthood. Erikson's eight stages included:

1. sense of basic trust;
2. sense of autonomy;
3. sense of initiative;
4. sense of industry;
5. sense of identity;
6. sense of intimacy;
7. sense of generativity; and
8. sense of integrity (Erikson, 1950, pp. 219-234).

Erikson's fourth stage, acquiring a sense of industry and resul-tantly warding off a sense of inferiority, parallels the elementary school aged child. It is during this stage that the learner attempts to master whatever is tried or experienced with great deter-mination. Maier (1965) explained the fourth stage:

Roughly between the ages of 7 to 11, the child tries to solve these fears of inferiority; he delves dili-gently into all opportunities to learn by doing and
Erikson's theory suggests that the child learns by freely interacting with real objects and events in the environment.

Havighurst (1977) devised the developmental task concept as the basis for his human growth theory. He defined developmental tasks as follows:

A developmental task is a task which arises at or about a certain period in the life of the individual, successful achievement of which leads to his happiness and to success with later tasks, while failure leads to unhappiness in the individual, disapproval by the society, and difficulty with later tasks (p. 102).

Havighurst (1977) identified six stages of human growth. These included: infancy and early childhood; middle childhood; adolescence; early adulthood; middle age; and later maturity (pp. 102-103). He identified varying developmental tasks for each stage of human growth. Successful achievement of these tasks were considered requisite to future happiness.

Havighurst (1977) detailed nine developmental tasks for middle childhood, which corresponds to the elementary school aged child. Those tasks included:

1. Learning physical skills necessary for ordinary games
2. Building wholesome attitudes toward oneself as a growing organism
3. Learning to get along with agemates
4. Learning an appropriate masculine or feminine social role
5. Developing fundamental skills in reading, writing, and calculating
6. Developing concepts necessary for everyday living
7. Developing conscience, morality, and a scale of values
8. Achieving personal independence
9. Developing attitudes toward social groups and institutions (pp. 102-103).

Havighurst suggested that the concept of developmental tasks can readily be used by educators. Developmental tasks not only specify the purposes of education, but help to identify the immediate needs of the learner. According to Havighurst (1977):

There are two reasons why the concept of developmental tasks is useful to educators. First, it helps in discovery and stating the purposes of education in the schools....

The second use of the concept is in the timing of educational efforts. When the body is ripe, and society requires, and the self is ready to achieve a certain task, the teachable moment has come (p. 103).

Maley further substantiated Havighurst's theory that developmental tasks were crucial to curriculum planning. Maley explained:

The research and the literature dealing with this area of developmental tasks makes the point obvious and clear that educational program design and teacher's actions can not ignore the reality of, nor the impact of developmental growth processes being experienced by the learner.... The game of education must start with students. It must be fashioned to interface with their levels of maturity and socialization processes (1975, p. 241).

All three human development theories - Piaget's, Erikson's,
Havighurst's - have implications for education. The curriculum planner must be aware of each to adequately design the curriculum for the level of students.

The elementary school child can be characterized as activity centered. Weiner and Elkind (1972) summarized the stage of development of the elementary school child and explained the role of education to foster that development. They reported:

Perhaps more than anything else a school-age child is a doer. His newly attained intellectual powers are such that he is constantly mentally active, curious, and absorbed....

...during the elementary-school years a child's conception of himself as a doer also becomes differentiated, and he comes to think of himself as good in sports but not at math, as handy or clumsy with tools.... As a result of his elementary-school experiences, therefore, a young person moves into adolescence with a fairly good idea of himself as a doer in various realms (p. 126).

Industrial arts in the elementary school curriculum would enhance the further development of the young child. This would be accomplished by providing more and varied experiences for the learner. Experiences which would allow the learner more social interaction, varied concrete activities with diversified materials and tools, and more opportunities to test or evaluate oneself in multiple situations.
Summary

The elementary school aged child was characterized as an active, curious and inventive individual. One who is constantly exploring the environment and, so-doing, building self-knowledges and concepts. The learning of these concepts is critical to the young child as they represent the limitations the child ascribes to himself, what is believed he can or can not do.

Industrial arts can provide for the further development of the young child by providing a host of varied, and unique experiences. Generally, these experiences are activity-oriented and allow the child opportunties to explore new tools, materials, and processes.

Learning theories and an understanding of the developmental stage of the young student established industrial arts methods as appropriate and beneficial to the elementary school.
CHAPTER IV. METHODOLOGY

The problem of this study was to plan and articulate an industrial arts program for the elementary school, K-3. To do so, a Formative Evaluation Procedural Model developed by Sarapin (1977) was utilized.

Pre-development Activities

Pre-development activities included the establishment of a rationale for including industrial arts in the elementary school curriculum, and identifying various committee members for the study.

Rationale Development

One of two questions of this study was whether or not an appropriate base could be found to substantiate the development of an industrial arts program for the elementary school. The four bases of curriculum development, as identified by Hass, Bondi, and Wiles, were researched to reply to this question. The four bases included: social forces, human development, the nature of learning, and the nature of knowledge (1974). Current literature covering each of the four bases was reviewed.

Purposes of industrial arts were linked to the four
bases and unique contributions of industrial arts were exemplified. The sum total of which established a rationale for including a study of industrial arts in the elementary school. This rationale was presented in Chapter III.

Committee Selection

Two central committees were organized to carry out this research: a Development Committee and an Expert Review Committee. Both committees worked to promote and check the work of the other. The Development Committee's task was to initiate the development of goals, objectives, and materials for industrial arts in the elementary school. The Expert Review Committee reviewed, criticized, and evaluated the Development Committee's progress throughout each phase of the study.

The Development Committee was comprised of the following members:

(1) the researcher;

(2) an elementary classroom teacher;

(3) a recognized and knowledgeable person in elementary school industrial arts; and

(4) a recognized and knowledgeable person in industrial arts education.

These four people were included to give the Development Committee a broad area of expertise including industrial arts,
the elementary school curriculum, and the elementary school child.

Criteria were established for the selection of each individual committee member. The criteria assured that each chosen member possessed the needed attributes and knowledges to contribute fully to the Development Committee. The criteria were as follows:

(1) the elementary teacher was to have a minimum of one year teaching experience and some familiarity with industrial arts;

(2) the elementary school industrial arts expert was to previously have experiences in curriculum development, be familiar with The Iowa Guide for Curriculum Improvement in Industrial Arts¹, and to have both worked and published in the area of elementary school industrial arts; and

(3) the industrial arts expert was to be a teacher educator with experience in curriculum development, be familiar with The Iowa Guide, and to have expressed interest in elementary school industrial arts.

¹Herein referred to as the Iowa Guide.
A list of these committee members is located in Appendix A.

The second committee, the Expert Review Committee, was established concurrently with the Development Committee. The Expert Review Committee was comprised of ten (10) members:

1-4) four elementary classroom teachers, one from each grade level, K-3;

5) an elementary curriculum coordinator;

6) a curriculum development specialist; and

7-10) four elementary school industrial arts experts.

Criteria were established for the selection of individual members of the committee. The criteria assured that each chosen member possessed the needed skills and knowledges to contribute fully to the Expert Review Committee. The criteria were as follows:

1) the elementary classroom teachers were to be presently teaching with at least one year of previous teaching experience and have the capability to field test the developed materials;

2) the elementary curriculum coordinator was to have experience in curriculum development and knowledge of elementary school industrial arts;
(3) the curriculum development specialist was to be knowledgeable of industrial arts, have experiences in curriculum development, and be familiar with formative evaluation procedures; and

(4) the elementary school industrial arts experts were to have worked and published in the area of industrial arts for the elementary school, and have had previous experiences with curriculum development.

The four elementary classroom teachers and the curriculum coordinator were selected from within the same school system to facilitate field testing. The Jefferson Community Schools, Jefferson, Iowa, were chosen because an interest in elementary school industrial arts had been expressed at an earlier date and also because the school system is representative of typical elementary schools located throughout the state of Iowa.

Jefferson, Iowa is an agri-business community located approximately forty-five miles west of Iowa State University. Predominantly a farming community, the city does have numerous small businesses and industries which support a population of approximately forty-five hundred (4500). The Jefferson schools have an enrollment of approximately one thousand (1000) students.
The curriculum coordinator for the Jefferson Community Schools was contacted by the researcher. The coordinator sought the approval of the school administrators, after reviewing the proposal, for the research to be conducted in the Jefferson Community Schools. Upon gaining administrative approval, the elementary principal was asked to recommend four teachers for the study based on the criteria previously established. The curriculum coordinator met individually with each teacher, and all agreed to be members of the Expert Review Committee.

The identification of nationally recognized leaders in elementary school industrial arts was completed with the assistance of the 1978 president of the American Council for Elementary School Industrial Arts. Four individuals were identified and all agreed to participate in the study as members of the Expert Review Committee.

The individual identified as the curriculum development specialist was the developer of the Formative Evaluation Procedural Model utilized throughout the study. He was contacted and agreed to work on the Expert Review Committee. A comprehensive list of the ten members of the Expert Review Committee can be located in Appendix A.
Phase One: Identification and Ordering of Goals

After a rationale for an elementary school industrial arts program was established, the Development Committee undertook the responsibility of beginning the curriculum development process. Following the Formative Evaluation Procedural Model\(^2\), initial work was completed in goal identification. Goal statements were identified from multiple sources including state curriculum guides, books and professional journal articles.

Copies of these goal statements were reviewed by each member of the Development Committee. The goals were rated either positive, acceptable, or negative (+, √, or -) by each member of the committee. Those given a composite minus rating were deleted. The remaining goals and others added were re-written and edited into a tentative list of nine.

The nine tentative goals were compiled on an evaluation form and disseminated to the Expert Review Committee members. The form was modelled after Sarapin's evaluation form and consisted of the following five point Likert Scale:

\[
\begin{align*}
5 & = \text{very important;} \\
4 & = \text{important;} \\
3 & = \text{neutral;} \\
2 & = \text{unimportant;} \text{ and} \\
1 & = \text{very unimportant.}
\end{align*}
\]

\(^2\)Herein referred to as the Sarapin Model.
The experts were asked to rate each goal. They were also given the opportunity to add more goals. A copy of the evaluation form and corresponding cover letter is located in Appendix B.

The Development Committee met to determine the final rankings of the goals for industrial arts in the elementary school when all the evaluation forms were returned by Expert Review Committee members. Members reviewed the data procured from the evaluation instruments and arrived at the following decisions.

1. The Expert Review Committee ratings were the primary bases for the decision-making process.

2. Goals rated greater than or equal to 3.5 were retained.

3. The goals were rearranged into priority order using the means from the Expert Review Committee ratings.
   a. Where there were equal means for two goals, the standard deviation was used as a discriminatory factor.
   b. In cases where two goals had both equal means and equal standard deviations, the mean score of the combined ratings of the Development Committee and the Expert Review Committee were
used as a discriminatory factor.

A priority list of goals for industrial arts in the elementary school emerged as an outcome of this decision-making process.

Copies of these seven goals were distributed to members of the Expert Review Committee. No changes were recommended by the Expert Review Committee.

Phase Two: Identification and Operationalization of Objectives

The Development Committee began to write objectives, using the priority list of goals for elementary school industrial arts as a base. The committee members drew on their cumulative knowledges and expertise to accomplish this task. These objectives are listed in Appendix C.

The objectives were reviewed, evaluated, and edited for clarity, continuity, and completeness. After agreement was attained between the Development Committee members, a tentative list of objectives for industrial arts in the elementary school was prepared.

This list of objectives was then included within an evaluation instrument, located in Appendix D. Using this instrument, the Expert Review Committee was to evaluate each objective for two components:
1. worth and merit of the objective; and
2. congruity or degree of agreement between the goal and the objective.

They were also given the opportunity to write in any comments concerning either the goals or the objectives. Likert Scales were utilized to evaluate both components.

The worth and merit of each objective was evaluated using the following scale:

- 5 = extremely important;
- 4 = very important;
- 3 = important;
- 2 = not too important; and
- 1 = not important.

The congruity or degree of agreement between the goal and the objective was evaluated using the following scale:

- a = complete agreement (5);
- b = considerable agreement (4);
- c = some agreement (3);
- d = little agreement (2); and
- e = no agreement (1).

This evaluation instrument, too, was modelled after Sarapin's evaluation form.

The Development Committee met to assess the objective evaluations when all the forms were returned by the Expert Review Committee members. Considering the descriptors used to evaluate the objectives, the Development Committee decided to use a mean of greater than or equal to 3.5 for ratings of worth, and a scale of greater than or equal to 4.0 for ratings
of congruence for an objective to be retained. A final list of both goals and objectives for an industrial arts program in the elementary schools is located in Appendix E.

Phase Three: Development of Interim Materials

The third phase of the curriculum development process centered on the development of interim, written materials for an industrial arts program in the elementary school. These materials were a direct outcome of phases one and two: specification of goals and objectives. The Development Committee was responsible for the initiation and completion of this phase of the curriculum development process.

The Development Committee considered alternatives for organizing and writing the interim materials. These alternatives included singular activity packages, individualized instructional packages, and units. The committee members agreed, after careful consideration, to organize the materials in unit fashion. The unit approach was selected because it allowed flexibility in the materials, allowing the elementary school teacher freedom in selecting activities and methods of classroom presentation.

Four units were identified for an elementary school industrial arts program. The four units represented a knowl-
edge base to the program, and were identified using both the priority list of goals and the list of objectives established previously. The four units included the following: Technology and Society; Production; Energy; and Communications.

Initial materials for each unit were written and compiled. These materials were edited and revised for continuity, content and clarity. Each unit was comprised of the following sections: an Introduction; Educational Goals; Unit Goals and Objectives; Guidelines for Implementation; Integration of Activities; Example Activities; and Resources.

The prototype materials were then evaluated by the elementary classroom teachers and the curriculum coordinator on the Expert Review Committee. They were asked whether or not they thought the materials were ready for use in the classroom. The teachers and the curriculum coordinator answered this question by rating each section of the four units on a five point scale. The descriptors for that scale were as follows:

- 5 = completely appropriate;
- 4 = acceptable;
- 3 = needs some revision;
- 2 = too general; and
- 1 = unacceptable.

The evaluations were reviewed and decisions made. To be considered ready for field testing, a unit had to have all its seven sections rated 4.0 or better. The Production unit alone passed the evaluation. The other three units were then recycled
for revision. The evaluation form used in this phase is located in Appendix F, along with the teacher evaluations of the units.

The three units considered not ready for field testing (Technology and Society, Energy, and Communications) were revised. Changes were made according to the evaluations and suggestions outlined by the teachers and curriculum coordinator. These three units were then re-evaluated using the same evaluation form and procedures. All three units passed the second evaluation.

Phase Four: Field Testing of Products

The Production unit solely met all criteria for field testing. Each of the seven sections of the Production unit were evaluated (Phase Three) and none needed any revisions. The other three units needed some revisions. Hence, the Production unit was the only unit field tested.

In preparation for the field testing activity, the four teachers were asked to identify some product their class might like to mass produce. Alternatives were suggested to the teachers, with each teacher finally selecting one. In the third grade, the students selected the project. In the Kindergarten, first and second grades the teachers selected items appropriate as Father's Day gifts.
The materials necessary for each class to mass produce its product were assembled by the researcher. This included procurement of such materials as leather and acrylic; the assembly of hand tools, drill press, and safety glasses; and the preparation of stock materials such as wood and adhesives. These materials, along with a copy of the Production unit, were disseminated to each teacher.

At the time of the dissemination, plans for the unit were reviewed with each teacher. Suggestions for organizing the production activity within each classroom were made, as well as answering the teachers' questions. Final organization and presentation of the unit, however, was left to the discretion of each individual teacher, as per the intent of the unit approach.

Three of the teachers conducted the field testing solely on their own. One teacher, somewhat more apprehensive, requested assistance in organizing and presenting the unit in her classroom. A teacher educator from Iowa State University assisted this teacher throughout the field testing activity.

Throughout the field testing, the teachers were asked to implement the Production unit in their classrooms using only the materials given them and the unit itself. After completing this activity, the teachers were asked to individually complete
a field testing evaluation form (Appendix G).

The results of this form were compiled to reveal the teachers' attitudes and opinions towards the materials and their effectiveness in their respective classrooms. Comments made by the teachers on the evaluation forms, and other comments by members of the Expert Review Committee made throughout the curriculum development process, are located in Appendix H.
CHAPTER V. FINDINGS

Two original questions were identified for this study. They included the following:

1. Could an appropriate base be found to substantiate the development of an industrial arts program for the elementary school?

2. What was to be the content of an industrial arts curriculum for the elementary school, K-3?

The findings presented herein are divided into two sections. Each section responds to a particular question.

Question One

Could an appropriate base be found to substantiate the development of an industrial arts program for the elementary school?

A rationale for implementing an industrial arts program in the elementary school was established on the four bases of the curriculum as suggested by Hass, Bondi and Wiles (1974). These four bases included: social forces; the nature of knowledge; the nature of learning; and human development.

Taba (1962) and Wolfe (1973) identified technology as a pervasive and major social issue facing modern man. Kranzberg (1973)
substantiated their beliefs and went on to suggest that education look to industrial arts to supply a study of technology in the public schools.

Industrial arts was found to be a comprehensive study of both technology and industry, educating the learner about a major social force. Industrial arts was also found to effectively deal with social forces identified at a more local level.

Foshay (1961) proposed that the nature of knowledge should be considered as one of the bases of education. Hass (1977) delineated three methods of considering knowledge: knowledge as represented in subjects; knowledge as a product of man's experiences; and knowledge as a combination of both structure as well as experience.

Contemporary educators and social critics, including Bruner and McQuilkan, have suggested that the curriculum should draw on the disciplines for content but that the content should also be tempered with social problems. Lauda (1976) suggested that industrial arts offers a unique content dealing with a major social force: technology.

Hass (1977), who identified the nature of learning as a third base for the curriculum, also identified four families of learning theory, including:

1. Freudian learning theory;
2. Gestalt learning theory;
3. Stimulus-response learning theory; and
4. Social learning theory.

All four families of learning theory attempted to identify how the student learns. To date, no one theory has either proved itself or disproved the other theories.

Industrial arts was shown to lend itself to the broad range of learning theories by allowing the student varied experiences in hands-on learning and alternative group activities.

Human development, the fourth and final base of the curriculum, was represented by three developmental theories proposed by Piaget, Erikson and Havighurst. Each explained one or more elements of human growth and development. Each theory was shown to have implications for education and to adequately design a curriculum, the planner must be aware of each.

Weiner and Elkind (1972) summarized the elementary school child as being a doer that is constantly mentally active and curious. Industrial arts was shown to enhance the development of the young child by providing more and varied experiences for the learner. These experiences would allow more social interaction, more concrete activities and afford the individual more opportunities to test or evaluate oneself.

Industrial arts can enhance the elementary curriculum through both content and methods, which directly correlate to the four bases of the curriculum.
Question Two

What was to be the content of an industrial arts curriculum for the elementary school, K-3?

The formative evaluation procedural model utilized throughout this study was comprised of four phases. Each phase represented a separate segment of the research. During the first phase goals were identified and ordered; objectives were determined in the second phase; interim materials developed during the third phase; and field testing occurred during the last phase.

**Identification of Goals**

Within the first phase of the curriculum development process the Development Committee identified a tentative list of nine goals for industrial arts in the elementary school. The nine goals are reported on Table 1.

The nine goals were evaluated by the Expert Review Committee using a prepared evaluation form (Appendix B). Development Committee members also evaluated the goals using the same instrument.

The evaluators were asked to rate each goal on its importance, using a Likert scale from one to five. A mean score and standard deviation for the Expert Review Committee and the Development Committee were calculated for each goal. Equal means and standard deviations within this data necessitated calculating
Table 1. Tentative developmental goals for industrial arts in the elementary school

<table>
<thead>
<tr>
<th>Goal Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To promote a beginning awareness of occupations typically found in the industrial/technical society.</td>
</tr>
<tr>
<td>2. To promote discovery of individual broad-based interests and abilities related to careers in an industrial/technical society.</td>
</tr>
<tr>
<td>3. To promote insight into the personal and social significance of work and the worker.</td>
</tr>
<tr>
<td>4. To promote insight into the importance and effect of industry upon contemporary society.</td>
</tr>
<tr>
<td>5. To promote a beginning awareness of the evolutionary development of industry and technology.</td>
</tr>
<tr>
<td>6. To promote a beginning awareness of the current organization and systematic processes of industry.</td>
</tr>
<tr>
<td>7. To promote an awareness of the influence of and basic relationship between technology and the natural environment.</td>
</tr>
<tr>
<td>8. To promote an awareness of technological concepts found in the industrial areas of: communications, production, and energy.</td>
</tr>
<tr>
<td>9. To provide opportunities for students to safely use tools, materials, and processes to study the technology of industry.</td>
</tr>
</tbody>
</table>
combined score for the Expert Review Committee and the Development Committee. Results of these calculations are reported in Table 2.

The Development Committee retained goals with a minimum Expert Review Committee mean of 3.50. This criteria was established based upon the descriptors used during the evaluation. Two goals were subsequently dropped: goal number 2, with a mean score of 3.25; and goal number 7, with a mean score of 3.00.
Table 2. Mean, standard deviation, and priority rank order or ratings of elementary school industrial arts goals

<table>
<thead>
<tr>
<th>Goal</th>
<th>Expert Ratings</th>
<th>Combined Ratings</th>
<th>Developer Ratings</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=10 *N=9</td>
<td>N=14 *N=13</td>
<td>N=4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  sd Rank</td>
<td>X  sd Rank</td>
<td>X  sd Rank</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4.20 0.75 2</td>
<td>4.29 0.70 2</td>
<td>4.50 0.50 1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3.40 0.80 9</td>
<td>3.36 1.04 9</td>
<td>3.25 1.48 8</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>4.20 0.75 2</td>
<td>4.21 0.67 3</td>
<td>4.25 0.43 2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>3.80 0.87 6</td>
<td>3.93 0.88 4</td>
<td>4.25 0.83 3</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>3.40 0.66 8</td>
<td>3.43 0.98 8</td>
<td>3.50 1.50 7</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>3.80* 0.67 5</td>
<td>3.77* 0.89 6</td>
<td>3.75 1.09 5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>4.20 0.75 2</td>
<td>3.86 0.83 5</td>
<td>3.00 0.00 9</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>3.70 0.46 7</td>
<td>3.71 0.70 7</td>
<td>3.75 1.09 5</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>4.40 0.66 1</td>
<td>4.36 0.72 1</td>
<td>4.25 0.83 3</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Ratings of 5 = very important, 4 = important, 3 = neutral, 2 = unimportant, 1 = very unimportant.
The remaining seven goals were arranged into a priority order. Copies of the seven goals were given to members of the Expert Review Committee, who recommended no changes. The goals, as finalized, are reported in Table 3.

Table 3. Priority rank order of goals for industrial arts in the elementary school

<table>
<thead>
<tr>
<th>Rank</th>
<th>Developmental Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To provide opportunities for students to safely use tools, materials, and processes to study the technology of industry.</td>
</tr>
<tr>
<td>2</td>
<td>To promote a beginning awareness of occupations typically found in the industrial/technical society.</td>
</tr>
<tr>
<td>3</td>
<td>To promote insight into the personal and social significance of work and the worker.</td>
</tr>
<tr>
<td>4</td>
<td>To promote an awareness of the influence of and basic relationships between technology and the natural environment.</td>
</tr>
<tr>
<td>5</td>
<td>To promote a beginning awareness of the current organization and systematic processes of industry.</td>
</tr>
<tr>
<td>6</td>
<td>To promote insight into the importance and effect of industry upon contemporary society.</td>
</tr>
<tr>
<td>7</td>
<td>To promote an awareness of technological concepts found in the industrial areas of: communications, production, and energy.</td>
</tr>
</tbody>
</table>
Identification of Objectives

In the second phase of the curriculum development process, objectives were identified stemming from each accepted goal. A list of twenty-nine objectives was prepared by the Development Committee and disseminated to the Expert Review Committee on an evaluation form (Appendix D). Members of the Expert Review Committee were asked to evaluate each objective on two characteristics: (1) worth of the objective, and (2) congruence between the goal and the objective. The descriptors for these evaluations were:

for worth:
5 = extremely important,
4 = very important,
3 = important,
2 = not too important, and
1 = not important;

and for congruence,
5 = complete agreement,
4 = considerable agreement,
3 = some agreement,
2 = little agreement, and
1 = no agreement.

A mean score and standard deviation were calculated for each objective. The Development Committee retained objectives with a minimum rating of 3.5 for worth and a rating of 4.0 for congruence. These criteria were established based upon the descriptors used during the evaluation. Objective ratings for worth and congruence are reported in Table 4.
Table 4. Mean and standard deviation of worth of developmental objectives and congruence between objectives and goals for industrial arts in the elementary school

<table>
<thead>
<tr>
<th>Objective Number</th>
<th>Worth Ratings</th>
<th>Congruence Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=10</td>
<td>*N=9</td>
</tr>
<tr>
<td></td>
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Note: Criteria for worth: X greater than or equal to 3.5

*Criteria for congruence: X greater than or equal to 4.0
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<th>Criteria of congruence**</th>
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<tr>
<td>7.6</td>
<td>yes</td>
<td>yes</td>
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</tr>
</tbody>
</table>

*Note: criteria = overall mean of 3.5 or greater

**Note: criteria = overall mean of 4.0 or greater
Three objectives were dropped from the original list of twenty-nine; none were added. A summary of the overall ratings of the objectives is reported in Table 5. A final listing of both goals and objectives for industrial arts in the elementary school is located in Appendix E.

**Development of Interim Materials**

The Development Committee wrote and edited four potential instructional units. The four units covered all of the goals and objectives determined earlier, with some overlap occurring.

Five members of the Expert Review Committee, the four classroom teachers and the curriculum coordinator, evaluated the four units. They separately evaluated each of the seven sections of the units for use in the classroom.

During interviews, each teacher and the curriculum coordinator rated the unit sections utilizing a five point evaluation form (Appendix F). The descriptors for that scale were as follows:

- 5 = completely appropriate;
- 4 = acceptable;
- 3 = needs some revision;
- 2 = too general; and
- 1 = unacceptable.

A mean rating was calculated for each section. A unit was considered ready for field testing if all of its sections were rated 4.00 or better. This criteria was established based upon the descriptors used during the evaluation. The Production unit alone passed this criteria during the first evaluation. The first ratings of all sections of the four units are reported in Table 6.
Table 6. Mean ratings of assessment activity for interim materials

<table>
<thead>
<tr>
<th>Sections of units being evaluated</th>
<th>Technology and Society</th>
<th>Production</th>
<th>Energy</th>
<th>Communications</th>
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<td>4.20</td>
<td>3.80</td>
</tr>
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<td>Educational Goals</td>
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<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Unit Goals and Objectives</td>
<td>4.00</td>
<td>4.00</td>
<td>4.20</td>
<td>4.00</td>
</tr>
<tr>
<td>Guidelines for Implementation</td>
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<td>4.40</td>
<td>3.80</td>
<td>4.20</td>
</tr>
<tr>
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<td>4.40</td>
<td>3.60</td>
<td>4.00</td>
</tr>
<tr>
<td>Example Activities</td>
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<td>4.60</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Resources</td>
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<td></td>
</tr>
<tr>
<td>Are criteria met?</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

Note. Criteria: all sections rated greater than or equal to 4.00
The Technology and Society, Energy, and Communications units were returned to the Development Committee for revisions. Those sections with weak ratings (below 4.00) were revised according to the criticisms and suggestions of the evaluators. Revisions were also made in marginal sections (rated 4.00), based again on criticisms and suggestions.

These three units were re-evaluated, utilizing the same evaluators, evaluation form, procedures, and criteria. The three remaining units passed the second evaluation. The second ratings of the Technology and Society, Energy, and Communications units are reported in Table 7.

Field Testing

The four elementary classroom teachers serving on the Expert Review Committee conducted the field testing activities in their respective classrooms. Each teacher presented the Production unit, commensurate with the age and level of her students. All necessary tools, materials, and information were supplied to the teachers who were, in turn, responsible for organizing and conducting the unit at their discretion.

Upon the completion of the unit, each teacher completed the field testing evaluation form (Appendix G). The purpose of this questionnaire was to determine the teachers' attitudes
Table 7. Second mean ratings of assessment activity for interim materials

<table>
<thead>
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<table>
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<tr>
<td>Resources</td>
<td>4.00</td>
</tr>
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<table>
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</tr>
<tr>
<td>Are criteria met?</td>
<td>yes</td>
</tr>
</tbody>
</table>

Note. Criteria: all sections rated greater than or equal to 4.00
and feelings towards the activity and to ascertain a relative indication of success.

The questionnaire was divided into two parts. The first part was an objective section composed of five questions. The five questions related to the value and ease of implementing the Production unit. A Likert scale was utilized in the first section, with the following descriptors:

5 = strongly agree;
4 = agree;
3 = neutral;
2 = disagree; and
1 = strongly disagree.

The composite mean ratings of the five questions in the first section are reported in Table 8.

<table>
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<td>1. The production activity was different and unique.</td>
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<tr>
<td>2. The production activity supplemented the existing elementary curriculum.</td>
<td>3.75</td>
</tr>
<tr>
<td>3. The production activity was motivating for your students.</td>
<td>4.75</td>
</tr>
<tr>
<td>4. The production activity could be easily integrated with other classroom activities.</td>
<td>4.50</td>
</tr>
<tr>
<td>5. The production activity was implemented with minimal difficulty.</td>
<td>3.50</td>
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</table>
The second section of the field testing evaluation form was composed of seven essay or subjective questions concerning the teachers' attitudes before, during and after running the Production unit. Those seven questions are listed below.

1. Prior to actually participating in this activity, did you feel a production unit would be realistic or possible at your grade level?
2. After running a production unit, do you feel this activity is realistic for your grade level?
3. What problems did you encounter throughout the production activity?
4. What special techniques or teaching aids would you suggest to other teachers using these materials?
5. What was the reaction and attitude of your students towards the production activity?
6. What was your overall reaction and attitude regarding the usefulness and appropriateness of the production activity?
7. Will you use the materials and ideas again?

All four teachers responded positively to the questions. They indicated some hesitance prior to the unit, but all the teachers reported success in their classrooms. More detailed responses for each question are located in Appendix H.
CHAPTER VI: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The five preceding chapters of this document introduced the nature of the problem researched, reviewed related literature, outlined a rationale for including industrial arts in the elementary school curriculum, and detailed the methodology and findings of the study. In this, the sixth and final chapter, the study is summarized, conclusions presented, and recommendations made.

Summary

Restatement of the Problem

The problem of this study was to plan and articulate an industrial arts program for the elementary school, K-3.

Restatement of the Purpose

The purposes of this study were to:
1. provide a rationale for implementing an industrial arts curriculum for the elementary grades in the public schools; and
2. assist elementary school administrators and teachers with implementing an industrial arts curriculum for the elementary school.
A review of the literature was conducted to support this research. This review was conducted in three areas: a historical review of industrial arts in the elementary school, contemporary curriculum projects in industrial arts for the elementary school, and curriculum development.

Within the historical review, the origins of industrial arts in the elementary school were traced to manual training. Though influenced and substantiated by the philosophies of innovative educators such as Pestalozzi, Herbart and Froebel, these early programs did not gain a sound foothold until the turn of the century when John Dewey supported and stimulated educational reform in the public schools.

During the 20's, Frederick G. Bonser applied Dewey's beliefs and educational theories to the elementary school utilizing industrial arts. In a book co-authored with L.C. Mossman, Industrial Arts for the Elementary Schools, Bonser extolled the value of industrial arts as general education for the elementary student.

In the years to come, industrial arts programs for the elementary school were developed around the country. In 1962, the American Council for Elementary School Industrial Arts was formed to coordinate these industrial arts programs.

The second area covered in the review of the literature was contemporary curriculum projects in industrial arts. Miller's research (1974) identified as many as 170 industrial arts programs
in the elementary schools throughout the United States. Three of these programs, foremost in the field, were reviewed. These included:

1. Technology for Children;
2. Technological Exploratorium; and
3. Project LOOM.

Each of the programs was reviewed for their respective origins, organization, content, current status and evaluations. Each contributed uniquely to the field of industrial arts.

The third and final area of the review of the literature covered curriculum development: its methods and procedures, Sarapin's Formative Evaluation Model, and the case study method. Within this section, a historical perspective of curriculum development was presented as well as a current definition given.

Recent innovations in the methods and procedures of curriculum development have led to detailed models of the curriculum planning process. Three of these models were presented and discussed in detail. The models included:

1. A Paradigm: A Curriculum Development Evaluation Model (Gilchrist and Roberts, 1974);
2. The Curriculum Planning Process (Saylor and Alexander, 1974); and

Sarapin's Formative Evaluation Procedural Model was likewise
discussed in detail in the third section of the review. The exact procedures were outlined as this model was utilized throughout the study. Sarapin recommended that the model be utilized to develop innovative curriculum materials for industrial arts in the elementary school.

Finally, the case study method of educational research was reviewed. A five step procedure for making case studies, detailed by Good (1966), was presented.

In the third chapter a rationale for including industrial arts in the elementary school was provided. This rationale was established on the four bases of the curriculum as identified by Hass (1977): social forces, the nature of knowledge, the nature of learning, and human development.

Contemporary social forces and trends tend to be very complex and occur with great rapidity. As a result, it is difficult yet all the more necessary for the curriculum planner to remain abreast of social trends.

Technology was identified as perhaps the most significant social force confronting society and education. Industrial arts was identified as a unique program capable of adequately dealing with technology in the school curriculum.

The nature of knowledge is a relatively new base for the curriculum, emerging as it did during the 60's. Three methods of considering knowledge were outlined, including:
1. knowledge as represented in subjects or disciplines;
2. knowledge as a product of man's experiences; and
3. knowledge as a combination of both structure as well as experience.

Each method for considering knowledge was reviewed for advantages and disadvantages. Following the more contemporary approach, that of the combination of structure as well as experience, industrial arts was shown to contribute to general education by its unique study of technology and by acting as an interface between the academic disciplines and the everyday experiences of people.

A review of the nature of learning revealed four families of learning theory, including:

1. Freudian learning theory;
2. Gestalt learning theory;
3. Stimulus-response learning theory; and
4. Social learning theory.

Each of the four families of learning theory was explained, including a discussion of their unique philosophies, tenets, and proponents. Though no theory has proved itself or disproved others to date, each attempts to describe how the student learns.

Industrial arts was shown to lend itself to all the learning theories, in part, through the use of multiple and varied teaching strategies, materials, and processes. Industrial arts also worked to develop self-knowledge and self-concepts, integral components of
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some of the theories.

Human development, the fourth and final base of the curriculum, was reviewed by an in-depth look at three theories of human growth. These included Piaget's theory of intellectual development, Erikson's nuclear stages toward a maturing personality, and Havighurst's concept of developmental tasks.

Industrial arts was shown to foster the unique and individual development of the young child. This occurred through the provision of more and varied learning experiences for the student.

The methodology chapter outlined the procedures followed throughout the study. These can roughly be sectioned into two areas: pre-development activities and development activities.

As part of the pre-development, the rationale for including industrial arts in the elementary school was established. Also as pre-development work, two central committees were organized and staffed to facilitate the research. These were the Development Committee, four persons responsible for the actual development of materials; and the Expert Review Committee, ten persons responsible for evaluating the materials. The field testing site was also selected.

The development activities correlated with the curriculum development model identified by Sarapin which was a four phase model, including:
Phase One: Identification and ordering of goals;
Phase Two: Identification and operationalization of objectives;
Phase Three: Development of interim materials; and
Phase Four: Field testing of products.

During each of the first three phases, respective materials were initially developed by the Development Committee members. The tentative materials were then disseminated to the Expert Review Committee members who evaluated the materials on certain criteria. As respective materials emerged as satisfactory from a phase, the subsequent phase was begun.

During the fourth phase, a single unit was field tested in four classrooms, K-3. Each teacher was asked to organize and present the unit at her discretion. Upon completion of the field testing activity, each teacher completed a field testing evaluation form.

Conclusions

The conclusions of this study are presented based upon the two original questions. The relationship between the findings and the problem of the study are also discussed.
**Question One**

Could an appropriate base be found to substantiate the development of an industrial arts program for the elementary school?

**Conclusion**  It was concluded that a thorough and appropriate base, founded upon the four bases of the curriculum, could and does, substantiate the development of an industrial arts program in the elementary school.

**Discussion**  The rationale for implementing industrial arts in the elementary school curriculum, founded upon the four bases of the curriculum, social forces, the nature of knowledge, the nature of learning, and human development, revealed that a study of industrial arts in the elementary school could help to meet the goals of general education.

Technology was identified as a major social force affecting public education today. A review of the nature of knowledge further scored technology as the content base of industrial arts. Weighing these two bases of the curriculum, social forces and the nature of knowledge, a study of technology in the elementary school through industrial arts was shown to supplement and make more relevant the elementary curriculum.

An examination of four learning theories stressed the importance of the nature of learning in the elementary school. The developmental theories of Piaget, Erikson, and Havighurst
established the elementary student as an individual exploring and responding to the immediate environment. This examination of the nature of learning and human development revealed that industrial arts as an activity-based, hands-on program can respond to the needs of young students with regards to teaching and learning methodology.

Question Two

What was to be the content of an industrial arts program for the elementary school?

Conclusion It was concluded that the content of an industrial arts program for the elementary school, K-3, centers about the study of technology: its industrial applications and its role in contemporary society.

Discussion Technology, as the content base for industrial arts in the elementary school, can be classified into three clusters: production, communications, and energy. These three technological clusters represent the whole of industrial arts as identified by Lauda (1976).

Each of the technological clusters is represented in a unit of study in the elementary industrial arts program. A fourth unit, Technology and Society, deals with the human elements involved in a technological society. This unit was
added to the elementary program to further educate students about their individual roles in a technological society. This unit emphasizes the development of self-knowledges and self-concepts for the young students.

Restatement of the Problem

The problem of this study was to plan and articulate an industrial arts program for the elementary school, K-3.

Discussion An industrial arts program for the elementary school was planned and articulated based upon the rationale for implementing such a program in the elementary curriculum. The rationale supported the inclusion of industrial arts in the elementary school as a result of its unique technology content base and as a result of its activity oriented methods.

The industrial arts program was written in unit fashion to allow for flexibility in programming and the discretionary practices of the individual teacher. The four units represent technology as a base for industrial arts.
Recommendations

The recommendations for this study result from the presented findings and conclusions. Each is listed below:

1. It is recommended that industrial arts be implemented in the elementary school with technology as the content base.

2. It is recommended that the developed curriculum materials for industrial arts, K-3, be expanded and extensively field tested and evaluated.

3. Periodic research is recommended to continually update and evaluate the stated goals and objectives for industrial arts, K-3.

4. Further work is recommended to extend the knowledge of and implications of an industrial arts, activity oriented program for the developing elementary student.

5. Further research is recommended to expand the list of industrial arts goals and objectives for the elementary school to include grades 4-6.

6. Further work is recommended to develop and evaluate curricular materials for industrial arts in grades 4-6.


Lux, D.G. The emerging nature of industrial arts and the elementary school. The Industrial Arts Teacher, 1958, 3, pp. 6-8.


Pierson, M.J. Psychological base for education. Monographs of the Texas Industrial Arts Curriculum Study, 1974, 1. (a)

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ACKNOWLEDGEMENTS

It would be next to impossible for me to identify all my professors, colleagues and friends whose support and encouragement have seen me through my graduate studies. A few notable exceptions, however, must be called out.

My most sincere appreciation is extended to Dr. Robert J. Gelina whose concern as an advisor and friend helped make my graduate experiences all the more important, rewarding and beneficial to me.

To Dr. Ray D. Loyd, a special thanks for your friendship over the years, and also for your guidance as supervisor.

To Dr. William D. Wolansky, thank you for your support and guidance during my research and graduate studies.

To the members of my graduate committee, Drs. Clark, Gelina, Loyd, McPherson, Warren and Wolansky, thank you for your assistance and guidance throughout my graduate studies.

To the members of the Development Committee, Drs. Breiter, McPherson and Smith, thank you for your unique contributions and assistance to this research.

To the members of the Expert Review Committee, including K. Wilhelm, L. Harris, C. Allensworth, V. Pottroff, C. Pytlik, W. Wonacott, N. Heasely, and Drs. Sarapin, Downs and Scobey, thank you for your evaluative contributions to this research.
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To Mr. and Mrs. John A. Moss, my sister and brother-in-law, my loving thanks for your support, faith and encouragement over the years.

Finally, and most of all, to my parents, Mr. and Mrs. Robert B. Keller, my loving and grateful thanks for your love and faith through the years and for instilling in me the desire to learn and grow.
APPENDIX A: DEVELOPMENT COMMITTEE MEMBERS

EXPERT REVIEW COMMITTEE MEMBERS
DEVELOPMENT COMMITTEE MEMBERS

Denise Helene Keller  
Researcher  
Industrial Education Department  
Iowa State University

Dr. William McPherson  
Elementary School Industrial Arts Expert  
Industrial Education Department  
Iowa State University

Dr. Roger Smith  
Industrial Education Expert  
Industrial Education Department  
Iowa State University

Dr. Joan Breiter  
Elementary Education Teacher Educator  
Elementary Education Department  
Iowa State University
EXPERT REVIEW COMMITTEE MEMBERS

Ms. Karen Wilhelm
Kindergarten Teacher
Jefferson Community Schools
Jefferson, Iowa

Ms. Louise Harris
First Grade Teacher
Jefferson Community Schools
Jefferson, Iowa

Ms. Connie Allensworth
Second Grade Teacher
Jefferson Community Schools
Jefferson, Iowa

Ms. Viola Pottroff
Third Grade Teacher
Jefferson Community Schools
Jefferson, Iowa

Ms. Clay Pytlik
Curriculum Coordinator
Jefferson Community Schools
Jefferson, Iowa

Dr. Marvin I. Sarapin
Curriculum Development Specialist
Industrial Education Department
University of Maryland
College Park, Maryland

Mr. Wayne Wonacott
Elementary School Industrial Arts Expert
Los Angeles City Schools
Los Angeles, California

Dr. William A. Downs
Elementary School Industrial Arts Expert
Industrial Arts & Technology Department
Central Missouri State University
Warrensburg, Missouri
EXPERT REVIEW COMMITTEE MEMBERS
(continued)

Ms. Norma Heasely
Elementary School Industrial Arts Expert
Summit County Board of Education
Akron, Ohio

Dr. Mary-Margaret Scobey
Elementary School Industrial Arts Expert
Educational Consultant
Eugene, Oregon
APPENDIX B: GOAL EVALUATION INSTRUMENT
Enclosed you will find the first round of my materials in my curriculum development process. Goals for industrial arts at the elementary school level have been identified by a committee of four. Now it is your turn to rank these goals.

Directions for completing the form can be located at the top of the page. Please read and follow these explicitly. If you have any questions, please call me collect in the evening at (515)292-7214.

Thank you for your time and knowledgeable efforts. I would greatly appreciate receiving the completed forms as soon as possible!

Thank you again.
Sincerely,

Denise Keller  
Dept. of Industrial Education  
Iowa State University  
Ames, Iowa  50010
Assessment Activity on Educational Goals

Rater's Name

Instructions: This questionnaire is being administered to ascertain your opinion of the developmental goal statements listed below. Please read each goal carefully and circle the rating corresponding to your assessment of the goal's importance for industrial arts at the elementary level, K-3.

Goal Rating Scale: (5) Very Important
(4) Important
(3) Neutral
(2) Unimportant
(1) Very Unimportant

Industrial Arts Goals, K-3:

1. To promote a beginning awareness of occupations typically found in the industrial/technical society. 5 4 3 2 1
2. To promote discovery of individual broad-based interests and abilities related to careers in an industrial/technical society. 5 4 3 2 1
3. To promote insight into the personal and social significance of work and the worker. 5 4 3 2 1
4. To promote insight into the importance and effect of industry upon contemporary society. 5 4 3 2 1
5. To promote a beginning awareness of the evolutionary development of technology and industry. 5 4 3 2 1
6. To promote a beginning awareness of the current organization and systematic processes of industry. 5 4 3 2 1
7. To promote an awareness of the influence of and basic relationships between technology and the natural environment. 5 4 3 2 1
8. To promote an awareness of technological concepts found in the industrial areas of: communication, production, and energy. 5 4 3 2 1
9. To provide opportunities for students to safely use tools, materials, and processes to study the technology of industry. 5 4 3 2 1
APPENDIX C: TENTATIVE INSTRUCTIONAL OBJECTIVES
GOAL #1. TO PROVIDE OPPORTUNITIES FOR STUDENTS TO SAFELY USE TOOLS, MATERIALS, AND PROCESSES.

1. Students will safely use tools, materials, and processes in concrete, construction activities.
2. Students will safely use tools, materials, and processes to explore their individual interests and abilities.
3. Students will safely use tools, materials, and processes to develop their psycho-motor skills.

GOAL #2. TO PROMOTE A BEGINNING AWARENESS OF OCCUPATIONS TYPICALLY FOUND IN THE INDUSTRIAL/TECHNICAL SOCIETY.

1. Students will be able to describe and identify workers common to most communities.
2. Students will be able to describe and identify workers somewhat unique to their own community.
3. Students will be able to describe and identify workers typically found in the industrial/technical society but not necessarily found in their own community.

GOAL #3. TO PROMOTE INSIGHT INTO THE PERSONAL AND SOCIAL SIGNIFICANCE OF WORK AND THE WORKER.

1. Students will begin to identify the places people work (i.e.: in the home, in school, on the job, and in the community).
2. Students will begin to recognize the interdependence of all people.
3. Students will begin to explore why people work (i.e.: for self gratification, to support themselves and their families, to help others, etc.).
4. Students will begin to compare and contrast the socio-economic status of workers and non-workers.
5. Students will begin to explore the demands that work makes on an individual (i.e.: time, energy, etc.).
GOAL #4. TO PROMOTE AN AWARENESS OF THE INFLUENCE OF AND BASIC RELATIONSHIPS BETWEEN TECHNOLOGY AND THE NATURAL ENVIRONMENT.

1. Students will begin to recognize ways in which the environment supports industry.
2. Students will begin to explore ways in which industry appropriately uses the environment.
3. Students will begin to explore ways in which industry misuses the environment.
4. Students will begin to recognize the outcomes of industry's use and misuse of the environment.

GOAL #5. TO PROMOTE A BEGINNING AWARENESS OF THE CURRENT ORGANIZATION AND SYSTEMATIC PROCESSES OF INDUSTRY.

1. Students will begin to realize that, for many activities, groups of people function more efficiently than individuals.
2. Students will begin to realize that cooperation between group members enhances organization.
3. Students will begin to realize that organization promotes efficiency and progress.

GOAL #6. TO PROMOTE INSIGHT INTO THE IMPORTANCE AND EFFECT OF INDUSTRY UPON CONTEMPORARY SOCIETY.

1. Students will begin to identify the role of industry in contemporary society.
2. Students will begin to identify the many commodities made available to them through industry.
3. Students will begin to recognize some of the problems industry has imposed on society.
4. Students will begin to recognize some of the many advantages industry has created for society.
5. Students will begin to evaluate the effects industry has had on society by comparing its problems with its advantages.
GOAL #7. TO PROMOTE AN AWARENESS OF TECHNOLOGICAL CONCEPTS FOUND IN THE INDUSTRIAL AREAS OF: COMMUNICATION, PRODUCTION, AND ENERGY.

1. Students will begin to identify potential sources of energy.
2. Students will begin to explore the many ways people use energy.
3. Students will begin to explore energy systems: sources, conversion devices, transmission, and storage and retrieval.
4. Students will begin to explore why people communicate.
5. Students will begin to explore the many ways people communicate.
6. Students will begin to explore communication systems.
7. Students will begin to explore why people produce.
8. Students will begin to explore the ways people produce.
9. Students will begin to explore production systems.
APPENDIX D: OBJECTIVE EVALUATION INSTRUMENT
Enclosed you will find the second round of materials in the curriculum development process. This is the final set of materials for you to evaluate.

The goals for industrial arts in the elementary school, which you evaluated earlier, are identified in a priority order. Seven of the original nine goals were retained. Each of the goals is presented with corresponding objectives. Please evaluate each objective separately for both merit and degree of agreement with the goal.

More elaborate directions for completing this form can be located on the following page. Please read and follow these explicitly.

As I am facing a very stringent time line, I would greatly appreciate receiving the completed forms as soon as possible!

Please allow me to thank you now for your time and scholarly efforts. Without these, my research would not nearly be so rewarding.

Thank you.
Sincerely,

Denise Helene Keller
Dept. of Industrial Education
Iowa State University
Ames, Iowa 50010
Industrial Arts for the Elementary School

ASSESSMENT ACTIVITY ON INSTRUCTIONAL OBJECTIVES

Introduction
The purpose of this assessment activity is to collect feedback data on the instructional objectives developed for an industrial arts program for elementary schools. The educational goals have been previously rated for the elementary level. These goals for industrial arts in the elementary school are listed in this instrument in priority order (1.0 is highest priority). Please take the time to provide further evaluative feedback concerning the objectives listed under each goal.

Directions (1)
Rate the worth and merit of each objective for an industrial arts program in the elementary school.

Scale
(5) extremely important
(4) very important
(3) important
(2) not too important
(1) not important

(2) Rate the congruity or degree of agreement between the goal and the objective.

Scale
(a) complete agreement
(b) considerable agreement
(c) some agreement
(d) little agreement
(e) no agreement

Please feel free to write in comments concerning the goals and objectives.
Goals are listed in priority order. Please CIRCLE RESPONSES.

**Goals**

1.0 To provide opportunities for students to safely use tools, materials, and processes.

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**Objectives**

1.1 Students will safely use tools, materials, and processes in concrete, construction activities.

1.2 Students will safely use tools, materials, and processes to explore their individual interests and abilities.

1.3 Students will safely use tools to develop their psycho-motor skills.

Please write in comments or additional objectives for goal 1.0.
Goal

2.0 To promote a beginning awareness of occupations typically found in the industrial/technical society.

Objectives

2.1 Students will be able to describe and identify workers common to most communities.

2.2 Students will be able to describe and identify workers somewhat unique to their own communities.

2.3 Students will be able to describe and identify workers typically found in the industrial/technical society, but not necessarily found in their own community.

Please write in comments or additional objectives for goal 2.0.
Goal

3.0 To promote insight into the personal and social significance of work and the worker.

Objectives

3.1 Students will begin to identify the places people work. (i.e.: in the home, in school, on the job, and in the community)

3.2 Students will begin to recognize the interdependence of all people.

3.3 Students will begin to explore why people work. (i.e.: for self-gratification, to support themselves, to help others, etc.)

3.4 Students will begin to compare and contrast the socio-economic status of workers and non-workers.

3.5 Students will begin to explore the demands that work makes on an individual. (i.e.: time, energy, etc.)

Please write in comments or additional objectives for goal 3.0.
Goal
4.0 To promote an awareness of the influence of and basic relationships between technology and the natural environment.

Objectives

4.1 Students will begin to recognize ways in which the environment supports industry.

4.2 Students will begin to explore ways in which industry appropriately uses the environment.

4.3 Students will begin to explore ways in which industry misuses the environment.

4.4 Students will begin to recognize the outcomes of industry's use and misuse of the environment.

Please write in comments or additional objectives for goal 4.0.
Goal
5.0 To promote a beginning awareness of the current organization and systematic processes of industry.

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Objectives
5.1 Students will begin to realize that, for many activities, groups of people function more efficiently than individuals.
5.2 Students will begin to realize that cooperation between group members enhances organization.
5.3 Students will begin to realize that organization promotes efficiency and progress.

Please write in comments or additional objectives for goal 5.0.
**Goal**

6.0 To promote insight into the importance and effect of industry upon contemporary society.

**Objectives**

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6.1 Students will begin to identify the role of industry in contemporary society.

6.2 Students will begin to identify the many commodities made available to them through industry.

6.3 Students will begin to recognize some of the problems industry has imposed on society. (i.e.: pollution, rapid consumption of raw materials, etc.)

6.4 Students will begin to recognize some of the many advantages industry has created for society. (i.e.: jobs for workers, goods for people, etc.)

6.5 Students will begin to evaluate the effects industry has had on society by comparing its problems with its advantages.

Please write in comments or additional objectives for goal 6.0.
### Goal 7.0

To promote an awareness of technological concepts found in the industrial areas of: communications, production, and energy.

<table>
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<tr>
<th>ASSESSMENT</th>
<th>Objectives</th>
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<td>(5) (4) (3) (2) (1) (a) (b) (c) (d) (e)</td>
<td>7.1 Students will begin to identify potential sources of energy.</td>
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<td>(5) (4) (3) (2) (1) (a) (b) (c) (d) (e)</td>
<td>7.2 Students will begin to explore the many ways people use energy.</td>
</tr>
<tr>
<td>(5) (4) (3) (2) (1) (a) (b) (c) (d) (e)</td>
<td>7.3 Students will begin to explore why people communicate.</td>
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<td>(5) (4) (3) (2) (1) (a) (b) (c) (d) (e)</td>
<td>7.4 Students will begin to explore the many ways people communicate.</td>
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<td>(5) (4) (3) (2) (1) (a) (b) (c) (d) (e)</td>
<td>7.5 Students will begin to explore why people produce.</td>
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<tr>
<td>(5) (4) (3) (2) (1) (a) (b) (c) (d) (e)</td>
<td>7.6 Students will begin to explore the ways people produce.</td>
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</tbody>
</table>

Please write in comments or additional objectives for goal 7.0.
APPENDIX E: GOALS AND OBJECTIVES FOR AN INDUSTRIAL ARTS PROGRAM IN THE ELEMENTARY SCHOOLS
ELEMENTARY SCHOOL INDUSTRIAL ARTS
GOALS AND OBJECTIVES

1.0 To provide opportunities for students to safely use tools, materials, and processes.

1.1 Students will safely use tools, materials, and processes in concrete activities.

1.2 Students will safely use tools, materials, and processes to explore their individual interests and abilities.

1.3 Students will safely use tools to develop their psycho-motor abilities.

2.0 To promote a beginning awareness of occupations typically found in the industrial/technical society.

2.1 Students will be able to describe and identify workers common to most communities.

2.2 Students will be able to describe and identify workers somewhat unique to their own communities.

2.3 Students will be able to describe and identify workers typically found in the industrial/technical society, but not necessarily found in their own community.

3.0 To promote insight into the personal and social significance of work and the worker.

3.1 Students will begin to recognize the interdependence of all people.

3.2 Students will begin to explore why people work (i.e.: for self gratification, to support themselves, to help others, etc.).

3.3 Students will begin to explore the demands that work makes on an individual.
4.0 To promote an awareness of the influence of and basic relationships between technology and the natural environment.

4.1 Students will begin to recognize ways in which the environment supports industry.

4.2 Students will begin to explore ways in which industry appropriately uses the environment.

4.3 Students will begin to explore ways in which industry misuses the environment.

4.4 Students will begin to recognize the outcomes of industry's use and misuse of the environment.

5.0 To promote a beginning awareness of the current organization and systematic processes of industry.

5.1 Students will begin to realize that, for many activities, groups of people function more efficiently than individuals.

5.2 Students will begin to realize that cooperation between group members enhances organization.

5.3 Students will begin to realize that organization promotes efficiency and progress.

6.0 To promote insight into the importance and effect of industry upon contemporary society.

6.1 Students will begin to identify the role of industry in contemporary society.

6.2 Students will begin to identify the many commodities made available to them through industry.

6.3 Students will begin to recognize some of the problems industry has imposed on society (i.e.: pollution, rapid consumption of raw materials, etc.).

6.4 Students will begin to recognize some of the many advantages industry has created for society (i.e.: jobs for workers, goods for people, etc.).
7.0 To promote an awareness of technological concepts found in the industrial areas of: communication, production, and energy.

7.1 Students will begin to explore potential sources of energy.

7.2 Students will begin to explore the many ways people use energy.

7.3 Students will begin to explore why people communicate.

7.4 Students will begin to explore the many ways people communicate.

7.5 Students will begin to explore why people produce.

7.6 Students will begin to explore the ways people produce.
APPENDIX F: INTERIM MATERIALS EVALUATION FORM
Elementary School Industrial Arts

Assessment Activity for Interim Materials

Directions: You are being interviewed to evaluate the interim units for an elementary school industrial arts program. Please evaluate each unit while keeping the following criteria in mind.

1. Could you teach the unit using the materials as presented?

2. Is the unit ready for classroom tryout with your elementary students?

Please rate each section of the four units using the following Likert Scale:

5 = Completely Appropriate
4 = Acceptable
3 = Needs Some Revision
2 = Too General
1 = Unacceptable
### Technology and Society Unit

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Educational Goals</th>
<th>Unit Goals and Objectives</th>
<th>Guidelines for Implementation</th>
<th>Integration of Activities</th>
<th>Example Activities</th>
<th>Resources</th>
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### Production Unit

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### Energy Unit

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### Integration of Activities

### Example Activities

### Resources

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### Communications Unit

**Introduction**

**Educational Goals**

**Unit Goals and Objectives**

**Guidelines for Implementation**

**Integration of Activities**

**Example Activities**

**Resources**
APPENDIX G: FIELD TESTING EVALUATION FORM
Introduction: The purpose of this activity is to collect information needed to evaluate the production materials field tested in your classroom. Previously, educational goals and objectives were identified, rated and evaluated. Interim materials were developed, designed to teach selected goals and objectives. This evaluative activity will provide insight into the effectiveness and usefulness of the materials.

Directions: This evaluation form is divided into two (2) main sections. The first section utilizes a Leichert Scale. Please interpret the scale as follows:

- 5 = Strongly Agree
- 4 = Agree
- 3 = Neutral
- 2 = Disagree
- 1 = Strongly Disagree

Space is also provided in this first section for further comment or elaboration.

The second section of this evaluation form is comprised of seven (7) short, essay questions. Please feel free to be candid and open when responding. Your honest responses are most valuable.
Section One.

1. The production activity was different and unique.  
   5 4 3 2 1

2. The production activity supplemented the existing elementary curriculum.  
   5 4 3 2 1

3. The production activity was motivating for your students.  
   5 4 3 2 1

4. The production activity could be easily integrated with other classroom activities.  
   5 4 3 2 1

5. The production activity was implemented with minimal difficulty.  
   5 4 3 2 1

Section Two.

1. Prior to actually participating in this activity, did you feel a production unit would be realistic or possible at your grade level?
2. After running a production unit, do you feel this activity is realistic for your grade level?

3. What problems did you encounter throughout the production activity?

4. What special techniques or teaching aids would you suggest to other teachers using these materials?

5. What was the reaction and attitude of your students towards the production activity?

6. What was your overall reaction and attitude regarding the usefulness and appropriateness of the production activity?

7. Will you use the materials and ideas again?
APPENDIX H: FIELD TESTING EVALUATION FORMS
SECOND SECTION - TEACHER RESPONSES
Field Testing Evaluation Forms  
Second Section - Teacher Responses

#1. Prior to actually participating in this activity, did you feel a production unit would be realistic or possible at your grade level?

All four of the teachers indicated that indeed they thought the unit would be possible, but each harbored some concerns. Those concerns were attributed to the time involved in the activities and the degree of difficulty in organizing and carrying out the activity.

#2. After running a production unit, do you feel this activity is realistic for your grade level?

All four of the teachers indicated appropriateness for this unit at their respective grade levels. Two teachers further indicated that additional adult supervision might be warranted.

#3. What problems did you encounter throughout the production activity?

Each of the four teachers mentioned a number of problems encountered. Most of the problems were of a technical nature:
adhesives and coatings might be improved; improvements in safety apparatus might be warranted; and more and better tools and equipment. One teacher mentioned other problems, what she termed "the usual ones - not following directions, for one."

#4. What special techniques or teaching aids would you suggest to other teachers using these materials?

The suggestions made in response to this question by all four teachers reiterated some aforementioned concerns: more adult supervision; improved safety precautions. The suggestions also made included example or prototype products, and more multi-media on production.

#5. What was the reaction and attitude of your students towards the production activity?

All four teachers indicated that, in their own words, their students "loved" the activities. The unit was stimulating and motivating for most students.

#6. What was your overall reaction and attitude regarding the usefulness and appropriateness of the production activity?
All four of the teachers responded favorably to this question, some with reservations. Their comments included the following: "I was very impressed with how quickly and easily everything went once it was organized. I felt it was very useful." "Good, although it is hard to add any more activities to our existing curriculum."

#7. Will you use the materials and ideas again?

All four of the teachers indicated they would use the unit again. "Yes, I plan to. They will be modified slightly to avoid problems encountered this time." "Yes, I would like to if I could find a way to cover the cost or come by free materials."