THE TRANSITION FROM INDUSTRIAL ARTS TO TECHNOLOGY EDUCATION IN THE UNITED STATES: A HISTORICAL PERSPECTIVE

by

Mark Robert Snyder

Dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of DOCTOR OF EDUCATION in Vocational and Technical Education

APPROVED:

M. E. Sanders, Chairman

W. E. Dugger, Jr.

J. E. LaPorte

E. A. Bame

T. C. Hunt

J. K. Burton

July, 1992

Blacksburg, VA
THE TRANSITION FROM INDUSTRIAL ARTS
to technology education in the united states:
a historical perspective

by

Mark Robert Snyder

Committee Chairman: Mark E. Sanders
Technology Education

(abstract)

The intent of this historical study is to document the change from the educational program known as Industrial Arts to what is now titled Technology Education. A synthesis of prior historiographical perspectives on the evolution of industrial arts, including some new information, provides a basis for understanding the more recent history that is the primary focus of this study. The portion of this study dealing with the transition to technology education explores the individuals, events, and other factors that compelled the movement to begin and the issues surrounding the acceptance of technology as the motive for the profession. The primary program and policy goals of technology education will be examined and concerns and projections will be expressed for the future of technology education.
Acknowledgements

This study required the cooperation of a great many people. First, and foremost, I thank my advisor, Dr. Mark Sanders, for his guidance, as well as the time and effort that he put into this undertaking. Working as his assistant for two years was an invaluable experience.

To the remainder of my committee, I would like to thank Dr. Bame for taking an interest and helping out near the end; Dr. Burton for his cooperation and sense of humor; Dr. Dugger for his expertise and the wealth of resources he lent me; Dr. Hunt for his help with historiography early in the project; and Dr. LaForte for his perspectives.

Although too numerous to name, I am also grateful to the many professionals in technology education who in some way contributed to this study. Also, I would like to acknowledge the faculty members of Millersville University of Pennsylvania, Eastern Michigan University, and Virginia Tech who have contributed to my education in the profession.

Finally, I would like to thank my family, for their encouragement and support, especially Bonnie and Maeve, who provided a little extra motivation to achieve this goal.
It is only in the Realm of pure science that truth is an absolute criterion. When we deal with applied science, with technology - we deal with people. And when we deal with people, considerations other than truth enter the question.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Educational Philosophies and the Instruction of Technics Prior to the Industrial Revolution</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>The Development of Industrial Education and the Establishment of Industrial Arts in the United States</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>Factors that Influenced the Movement Toward Technology Education</td>
<td>136</td>
</tr>
<tr>
<td>5</td>
<td>The Process of Change and the Establishment of Technology Education</td>
<td>199</td>
</tr>
<tr>
<td>6</td>
<td>Concerns and Projections for the Future of Technology Education</td>
<td>247</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>288</td>
</tr>
<tr>
<td></td>
<td>Vita</td>
<td>309</td>
</tr>
</tbody>
</table>
CHAPTER 1

Introduction
Technology has been identified across many disciplines as a topic that should be addressed in educating the youth of the United States. Historically, there have been differing views regarding the need for instruction of technical processes. Throughout the past, numerous systems and methods have been devised to achieve this goal. Industrial Arts was one such form of education that was established in the United States for the benefit of American children. Throughout the twentieth century, a number of individuals from the profession of industrial arts have declared technology integral to their field. More recently, the broader study of technology has been accepted as the motive for the profession by the majority of those in the field.

The primary purpose of this study is to provide a historical account of the transition of the industrial arts profession to technology education in the United States, including a detailed description of that transition and its significance. It presents a general overview of the philosophies, methods, movements, circumstances, and individuals that have influenced the instruction of technics throughout the past as well as the development of our modern educational practices. This study will also provide a foundation and framework for understanding how the profession evolved and why the further change to technology education took place. This has been accomplished by identifying numerous resources and providing a synthesis of prior historiographical efforts as well as analyzing the more recent history of the profession.
Chapter two of this study, "Educational Philosophies and the Instruction of Technics Prior to the Industrial Revolution," traces the early advancement of technology and technical learning. It also describes the emergence of educational philosophies and how they have helped to shape technical instruction throughout the past and in modern society. Although the subsequent chapters were not specifically fixed on philosophy, an effort was made to remain attentive to educational philosophies throughout the composition.

Chapter three, "The Development of Industrial Education and the Establishment of Industrial Arts in the United States" like chapter two, is not an original topic. However, it does serve to synthesize the numerous accounts of the "evolution of industrial arts." Also, by exploring many primary sources it has introduced new observations. Primarily, it will serve the purpose of establishing a basis for understanding the remainder of the study.

Chapter four, "Factors that Influenced the Movement Toward Technology Education," makes an effort to isolate specific references by pioneer members of the profession relating to the influence of technology. In searching for that which inspired the movement toward technology education, the significant proposal for a "Curriculum to Reflect Technology" and other early appeals for a new approach to industrial arts were examined. A number of suggested approaches towards change in the profession were identified, especially during the period of numerous curriculum development efforts that took place in the 1960s. This chapter suggests there were essentially two dominant schools of thought that formed regarding the
future direction of industrial arts. This section also explores factors (educational, social, political, etc.) that created inducement for, or resistance to, the change that was about to take place.

Chapter five, “The Process of Change and the Establishment of Technology Education,” details the internal processes that took place within the profession during the transition to technology education. This chapter also identifies the program and policy goals established for technology education and the progress made toward achieving those aims. It also describes federal initiatives relating to the field and international efforts in technology education.

The final chapter “Concerns and Projections for the Future of Technology Education” examines the present state of the profession and the perceived problems and challenges that it faces, especially from other disciplines.

**Historiography of Industrial Arts/Technology Education**

In discussions related to the history of technical instruction in America, Charles A. Bennett is commonly referenced. Two important books by Bennett, *History of Manual and Industrial Education up to 1870* and *History of Manual and Industrial Education: 1870-1917*, have generally been regarded as the standards of reference in measuring or judging the quality of historical research in industrial arts or technology education. These publications have been invaluable to the profession, since the wealth of facts and details that were compiled by Bennett provided a historical base upon which the profession could build.
Pannebecker has criticized Bennett's historiographical work as having no clear rationale for the content organizers selected and for the fact that Bennett hardly described the methodology he employed. Also, Bennett often presented extensive biographical information of individuals seemingly for no reason other than the interest in such details (1987, pp. 17-30). Yet, despite these shortcomings, the extensive utilization of these volumes has established that the history contained within has been considered significant.

In 1966, a series of five articles related to the evolution of industrial arts was run in sequential issues of the *Journal of Industrial Arts Education* beginning in the March-April, 1966 issue. This series by Henry Sredl took up from the point that Barlow left off -- around 1917. The period covered by these articles included the events leading to the philosophical polarization between industrial arts and vocational education. Sredl only briefly addressed the vocational perspective and continued by documenting the history of the branch of industrial education that maintained its position in general education -- industrial arts.

In 1967, Melvin L. Barlow authored a tremendous historiographical effort. Barlow, the Historian for the American Vocational Association (AVA), also planned for his book *History of Industrial Education in the United States* to begin from the point that Bennett had ended. This book is particularly useful for identifying the fundamental differences that existed between vocational and industrial arts. Despite Barlow's position on the vocational side of the split mentioned in the previous paragraph, he sustained a reasonable objectivity in his work related to the industrial arts. Of particular interest to this study was the manner in which Barlow identified the growing concern over technology in the industrial arts profession and his views of the direction industrial arts might take.
In 1971, the American Industrial Arts Association (AIAA) recognized the importance of maintaining a record of its activities by establishing a History and Archives Committee. In the first year of its existence, Committee Chairman Ervin A. Dennis was assisted by members Kenneth W. Brown, Henry Loats, Richard J. Vasek, and Wesley D. Stephens in the retrieval of materials and the search for a location to house the collection. In the second year, the library at Millersville State College in Pennsylvania was selected and approved to preserve the collection of written materials and artifacts that would tell the story of the Association. Robert Coley, was the archivist at Millersville State College who, along with his staff, organized and diligently maintained the collection.

Another aim of this standing committee was “to develop a recorded history of the association since its inception in 1939 to the present” (Dennis, 1972, p. 1). Prior to this statement, DeWitt Hunt had prepared a manuscript that included very detailed information regarding the history of the Association from 1939-1960. Several copies of Hunt's document remain on file in the Association Archives. This manuscript was never accepted for publication and several attempts to revise and update it have not reached fruition.

In 1979, the American Council on Industrial Arts Teacher Education (ACIATE) produced its 28th Yearbook titled *Industrial Arts Education: Retrospect, Prospect*. Edited by G. Eugene Martin, this collection of essays was particularly concerned with the background of industrial arts and its implications for the future of the profession. This volume provides nineteen chapters on a wide variety of topics relating to the profession.
Another ACIATE yearbook that included information related to the history of profession was published in 1981. *An Interpretive History of Industrial Arts*, edited by Richard Barella and R. Thomas Wright, was entirely dedicated to the topic and is perhaps the most complete compilation of historiographical essays assembled to clearly describe the evolution of industrial arts/technology education.

In 1988, Rupert N. Evans authored the *History of NAITTE*, an outstanding example of historiographic work within the profession. Published to mark the 50th anniversary of the National Association of Industrial and Technical Teacher Educators (NAITTE), this book provides a thorough account of the history of that organization.

This volume provides a wealth of information regarding the various organizations created for similar purposes and the relationships that existed between them. Although Evans claimed his “biases support close alliances between . . . vocational industrial education and industrial arts/technology education . . . and vocational education and general education” (1988, preface), the book may be considered biased simply by its objective. Still, Evans did well in presenting the information regarding the links with other organizations and differing philosophies in an objective manner. In many cases, he provided a point of view that was intriguing as well as revealing.

**Methodology**

Primary sources are invaluable to any historical research. An attempt was made to gather as much primary source material as possible and to interpret it in its proper context. Since much of the research involved recent history, personal interviews, telephone conversations, and letters to
individuals who were involved with the transition to technology education were very useful. Any information gathered by the review of secondary sources, such as the work of educational historiographers, was carefully considered so as to avoid bias or error of interpretation when examining the facts.

Another device used to gather information was a survey given to twenty highly-respected members in the profession. The aim of this poll was to learn what events were considered most influential to the transition to technology education. Participants were asked to prioritize a list of events thought to be significant, as well as add any other events to the list that may have been overlooked. The frequency with which each event was identified led to the conclusion that certain events were generally considered more significant. The response to this brief survey was excellent and the feedback was extremely useful.

This study generally employs a chronological approach for the organization of content. Occasionally, dates overlap between subject organizers in order to best accommodate the topic at hand. Throughout this study, an attempt was made to provide fundamental information that will help explain the background or environment relevant to the events, individuals, and creations considered significant to the topic.

Also regarding methodology, a most helpful and inspirational article was written by John R. Pannabecker, of McPherson College in Kansas, and published in the Fall, 1987 issue of the Journal of Industrial Teacher Education. That article, "Reinterpreting the Past: Historiography of Industrial Education," served as a review of industrial education historiography in the United States.
and a discussion of recent trends in historiography. Pannabecker once wrote "most historiography is specialized; this is also true of industrial education historiography. Appropriate general historical information is often not presented in an integrated context" (1986a, p. 20). Every effort was made to heed this caveat in the writing of this historical account.

However, due to the vast expanse of the time and topics covered in this study, a broad interpretive framework has been employed. Pannabecker (1986b) pointed out that such a broad context can "modify the perception of relative importance of specific historical influences," usually in a disparaging manner (p. 36). Of course, a great effort has been made to avoid reductionist tendencies that would make events or issues seem less complex or developed than might actually have been the case. In addition, the technological and industrial frame of reference will continually be updated throughout this study to provide a clear contextual basis for the content.

**Nomenclature**

The nomenclature involved in this study can become a hindrance since a wide variety of labels have been applied to systems for the instruction of technics throughout the past. Apprenticeship was the earliest such organized system and has lasted for millennia. Since the advent of civil control over education, mechanical schools, polytechnics, schools of industry, mechanics institutes, lyceums, manual labor academies, technical institutes, workingmen's schools, manual training schools, sloyd schools, public school manual and industrial arts, and vocational schools have all been systems established for the instruction of technics.
In 1918, Crawshaw and Varnum described in their book *Standards in Manual Arts, Drawing and Design* the following "point of view:"

Manual training as the term is used in this bulletin refers to the method by which industrial work is developed under school control. It signifies a plan by which hand, tool and machine work is made educative through a series of progressively developmental problems.

Manual arts as herein used indicates the content of the several subjects which are included in a division of the school dealing with industrial work.

Industrial education as used herein refers to the study of all or a branch of industry (a manual art) by means of the most approved pedagogical and industrial methods. It includes both information about and practice in industry. (p. 5)

The term *industrial education* has continued to be used as a broad heading which has more recently included all forms of technical education that, as a group, derived their content from industry, whether their focus was vocational or general education. Manual training gradually lapsed, evolving into manual arts which, in turn influenced the development of other forms of industrial education. There is no doubt that these areas of instruction contributed to the development of yet another system of instruction referred to as industrial arts. In 1934, Collicott and Skinner wrote:

Industrial Arts has had its greatest development on secondary school levels. Here it has passed through two somewhat well-defined periods of professional growth and is now in the midst of a third. The first was "manual training," where the emphasis was on hand skill, chiefly in woodworking. The second was "manual arts," where the emphasis, while still on skill, was extended to include the making of both useful and well-designed articles. The third is now "Industrial Arts," where the intent is to include all of the old that was good, but to broaden out from the limitation of an emphasis upon manual skill alone to an enriched conception where more of the child's interests and environment, and certainly many of the other school subjects, are involved. (State Committee on Coordination and Development, 1934, p. 5)
A similar passage, by Charles A. Bennett, has often been cited to clear up confusion regarding the three terms used to describe the slightly different approaches to technical instruction that chronologically overlapped during the early twentieth century. It reads: “In the term industrial arts, the ‘industrial’ is emphasized; while in manual arts, the ‘arts’ is historically the distinctive word and, in the term manual training, ‘manual’ is the important word” (Bennett, 1937, p. 455). Although there were subtle differences between these three methods, they all represented an ideal that promoted technical instruction as part of a broad educational experience rather than job-specific training.

**Terminology**

There are numerous definitions for the term *technology*. Etymologically, it is an adaption of the Greek word ἥχολογια which meant a “systematic treatment of grammar” and was formed from the root ἥχον, meaning “art,” or “craft.” Therefore, in the sense most closely related to its origin, the expression is used to signify “technical nomenclature.”

*The Compact Edition of the Oxford English Dictionary* identified a different use for the word, first applied as recently as 1615. This definition of technology is perhaps the most general: “a discourse or treatise on an art or arts; the scientific study of the practical or industrial arts” (1971, p. 3248). In this sense, technology is considered a body of knowledge just as sociology is considered a field of study. DeVore posited that technology is indeed a discipline defined as “the study of the creation and utilization of adaptive systems including tools, machines, materials, techniques, and technical means and the relation of the behavior of these elements and systems to human beings, society, and the civilization process” (1980, p. 4).
Webster's New World Dictionary of the American Language offers similar versions, as well as the following: "The system by which a society provides its members with those things needed or desired" (Guralnik, 1980, p. 1460). DeVore also recognized that technology exists as systems "ranging from tools and their use to the social impact and influence of tools, technics and products on the lives of particular individuals and groups" (1980, p. 4).

Specific artifacts developed by human beings for the advancement of material culture can also be thought of as technologies. J. R. Johnson wrote, "technology is best described as a process, but it is more commonly known by its products and their effects on society" (1989, p. 1). This observation is tenable and seems appropriate as an explanation for the prevalent modern perception of the term.

"Technology" is also used at times to mean "a method, process, etc. for handling a specific technical problem" (Guralnik, 1980, p. 1460). However, in this case the term technique, seems more appropriate. Technique refers to the methods of procedure, or way of using basic skills, in carrying out a technical or mechanical operation. In this study, the term technics will be employed to describe the basic skills necessary for the utilization of techniques. Devore defined technics as "specific technical skills associated with a particular technological act or behavior" (1980, p. 3). In 1989, Chant wrote:

The proposed technics/technology distinction has yet to find its way into much academic, let alone popular, discourse, even though it offers a way of tidying up some of the present confusion, and perhaps further a way of relating that confusion to the central historical relations of this volume. For if technics is identified with products and processes, this leaves technology as a form of knowledge. (p. 45)
Chant's application of the term “technics” is convenient to this study, although it seems an oversimplification to contrast technics and technology. Admittedly, technology can be considered a form of knowledge, as when defined as the study of practical or industrial arts. Yet, technology is also an active discipline that requires a familiarity with technics and their application through techniques. Essentially, technics can be distinguished as a separate but integral element within the realm of technology.

Language may, unfortunately, introduce an obstacle to the clear understanding of this distinction. The book *Man and Technics: A Contribution to a Philosophy of Life* was an early study of technology by Oswald Spengler (1932/1960). In the translation from German, by Atkinson, the word *technics* was employed to describe Spengler’s philosophical view of “technology.” The author was interpreted to say:

> Technics is the tactics of living, it is the inner form of which the procedure of conflict - the conflict that is identical with Life itself - is the outward expression. . . . Technics is not to be understood in terms of the implement. What matters is not how one fashions things, but what one does with them. . . . Always it is a matter of purposive activity, never of things. (p. 10-11)

Jacques Ellul’s *The Technological Society* (1954/1964), was originally published in 1954 under the French title *La Technique ou le jeu du siecle*. In the translator’s introduction, Wilkinson interpreted this phrase literally as “Technology: the stake of the century.” Wilkinson continued by stating:

> Technique, the reader discovers more or less quickly, must be distinguished from the several techniques which are its elements. It is more even than a generalized mechanical technique; it is, in fact, nothing less than the organized ensemble of all individual techniques which have been used to secure any end whatsoever. (extracted from Ellul, 1954/1964, p x)
The French have since attempted to distinguish between technics and technology. Daumas (1970/1976) wrote, however, “in French the word technologie has no absolute meaning. . . . It will nevertheless remain true that the equivalent English word, technology, embraces both the French words technique and technologie” (p. 93).

In concluding this discussion regarding the word “technology” and its related terms, it seems appropriate to offer one more tangible definition that is concise yet complete. “Technology is a body of knowledge and the systematic application of resources to produce outcomes in response to human needs and wants” (Savage & Sterry, 1990, p. 2). This passage contains critical elements necessary to accurately define technology.

The terms pure science and applied science have often been used as references to science and technology, respectively. Buchanan (1976) wrote the following:

Attempts to sharpen the definition with derivative terms such as ‘pure science’ and ‘applied science’ have tended only to convert imprecision into confusion. However, it can be agreed that there is a distinction between science and technology in present-day practice, coinciding in general with fairly discrete professional groups. (p. 76)

Price dedicated an entire chapter of his book Science Since Babylon to “The Difference Between Science and Technology” (1975, pp 117-135), and Chant summarized Price’s philosophical view of this concern when he wrote: “technology is not applied science, but rather science and technology are parallel structures in a symbiotic, weakly interacting relationship” (1989, p. 76).
The juxtaposition of science and technology is an issue that has been discussed for centuries. As a result, a great deal of confusion has transpired regarding the distinction between the terms. Daumas wrote, “weighing these words science and technology against one another in a rather scholastic manner each historian strives either to assimilate one to the other or on the contrary to oppose them in pretty muddled antitheses” (1970/1976, p. 93).

“Science” and “technology” have often incorrectly been used interchangeably, and fairly strong opinions have developed regarding the perception of these concepts as separate entities. Lisensky, Pfister, and Sweet wrote:

In discussions of technology, one finds the terms science and technology used in combination, as if the one cannot be considered without the other. Historically, however, technology developed without reference to science. The social process that is technology arose empirically, either by accident or as a matter of common experience. (1985, p. 8)

The science/technology dichotomy can be perceived in a variety of ways. Ellul thought technology was “autonomous” and that “science had become an instrument of technique” (1954/1964, p. 10). In his book, John Dewey’s Pragmatic Technology, Hickman contended that Dewey “viewed science as a type of technology” (1990, p. 11). Chant described what has been referred to as the linear sequential model of technical innovation stating, “science is on this account an independent variable, developing largely by way of its own internal intellectual dynamic; technology is a dependent variable, pushed by scientific discovery and/or pulled by public and private need” (1989, p. 42). Lisensky, Pfister, and Sweet promoted the view “that science is detached, concerned about knowledge for its own sake, while technology is more
directly involved in the social process and is concerned about the solution of problems and application of knowledge to that solution” (1985, p. 9). J. R. Johnson provided a sensible illustration of the relationship between science and technology in the following passage:

Technology is also a technical process. It is different from science, whose role is understanding. Technology’s role is doing, making, and implementing things. The principles of science, whether discovered or not, underlie technology. The results and actions of technology are subject to the laws of nature, even though technology has often preceded or even spawned the discovery of the science on which it is based. (1989, p. 1)

Although the previous statement is a rather broad generalization, and contradictory points of view have been exemplified, this study accepts the premise of science and technology as separate, yet interactive and dependent, entities.

The phrase “technological literacy” has been analyzed unrelentingly by technology educators, which is appropriate since the development of technological literacy has been identified as a major goal of the discipline. As early as 1968, DeVore wrote:

In today’s world, when there is a greater need than ever before for technological literacy, we discover the contemporary status of the industrial arts to be one of confusion and perhaps indecision, with a few notable exceptions. Teachers in the profession, however, are becoming increasingly aware that the confusion is the result of our heritage, and indecision the result of inadequate perspective. (p. 1)
In 1986, Loepp identified the need to increase the technological literacy of our citizenry as "an educational challenge." He described six characteristics that a technologically literate person should exhibit. These included the ability to recognize and use the appropriate technology in given situations; anticipate undesirable outcomes of the use of technologies; identify alternate courses of action if the technology fails; understand basic mechanical, thermal, fluidic, and electronic principles utilized by the technologies; gather and interpret data, or information; and use basic tools, materials, and processes of technology (pp. 38-39).

An individual who displays such capacities has not only managed to develop fundamental psychomotor skills but also the cognition of many academic disciplines. Values are also important when making decisions regarding the appropriateness and outcomes of the utilization of technologies. Hopefully, in the future, such judgments will be made from well-educated perspectives. Technology education aims to provide learners the opportunity to develop such capabilities as described above, and therefore contribute to the growth of a technologically literate society.

Summary

The instruction in schools has often been criticized for being unrealistic when compared to the manner of attainment and application of knowledge in the development of society. The traditional liberal arts approach of studying theories and established classical wisdom does indeed provide the student with an understanding of the knowledge that brought our world to
its present state. However, in the pursuit of “pure knowledge,” the useful and the relevant are often considered worldly distractions to be renounced by the true scholar. The theory and practice of education needs to recognize, and continue developing, the premise that mankind is essentially a tool-using animal with the ability to reason.

Technology education can provide a unique opportunity for coordinating these two characteristics, inherent to mankind, and enabling them to be readily integrated into the world at large. Technology education can enable students to apply knowledge and introduce new ideas and practices that prepare individuals for perpetuating the advancement and development of society. Also, by encouraging creativity, technology education can engender the academic ideal of independent thinking among students.

This study promotes the notion that technology is essential as a component of the education of all children. It is also important to note that technology education represents a markedly different approach than past, and present, forms of education related to technology.
CHAPTER 2

Educational Philosophies and the Instruction of Technics
Prior to the Industrial Revolution
Technology began with mankind's first attempt to transform natural materials into artifacts. Technology as a social process developed empirically and has contributed to science through the discovery of new objects, phenomena, and forces. Roy, has stated:

"From time immemorial, communicating 'techne' was the passing on from generation to generation of the most important stored up knowledge and wisdom about the most obvious, most common, most often encountered human contacts with those parts of reality which affect humans the most." (1990, p. 11)

However, the laws of nature as identified through science, while not always known to man, have always limited technology.

Technology education has grown from the tradition of teaching the application of knowledge through activities applying specific skills in the use and creation of material artifacts. Throughout history, the purpose and methods of these educational experiences have evolved and been subject to interpretation. There have also been many philosophies of education that have in some degree contributed to, or opposed, the instruction of technical means.

The Stone Age

Historians have typically divided the Stone Age into three periods (the paleolithic, mesolithic, and neolithic) according to the technologies developed by humans at that time. For example, crude tools made of clay, wood, stone, and bone were used to hunt, gather food, and basically improve upon the conditions of living during the paleolithic period. The
domestication of animals such as goats, pigs, and sheep, as well as the cultivation of certain edible plants, characterized the mesolithic, or middle, period. Agriculture developed further as more advanced techniques were employed during the neolithic period; stone tools were polished, pottery was used, and the unique qualities of metals were discovered. Perhaps the most important technological achievement of this time was the utilization of the wheel.

Technological advancement during this period often resulted from the realization of the usefulness of natural objects such as stones and bones, phenomena such as fire or ice, and forces like gravity and momentum. Occasionally, the new experiences and observations of mankind would lead to developments that extended or improved existing tools and systems to provide needed or desired material objects. These two actions, discovery and invention, have always "governed man's technical progress" (Forbes, 1968, pp. 5).

Perhaps the earliest form of education occurred in the social situations which developed through tribal and familial relationships during the Stone Age. In this scenario, the adults, or parents, would have passed on to children the primal skills they had acquired. Characteristically, learning of this type occurred as a result of imitating others without realizing, or intending to learn. This type of primitive learning was called "unconscious imitation" by Monroe (1905/1970, pp. 10-12), and Bennett classified this as "savage education" (1926, p. 11). Learning of this type continues to occur in modern times. Piaget identified a similar form of learning behavior as "deferred
imitation” (1962, pp. 66-70), which can begin within the first two years of life. This instinctive form of learning undoubtedly served to provide primeval beings the knowledge and capabilities that they needed to sustain themselves through the Stone Age.

**The Bronze Age**

The Bronze Age, roughly from 3500-1000 B.C., was so named due to mankind’s developed ability to smelt copper and tin, thus creating the alloy bronze used in making tools and weapons. As humans became civilized, they grew increasingly aware of their ability to affect the learning process. The main educational goal of the many ancient civilizations that existed, such as in Egypt, India, Sumeria, Assyria, Babylon, and Mesopotamia, was to prepare the younger generations for specific occupations. Eventually, the process of imitation became an intentional, conscious effort, resulting in a form of training. This training occurred most commonly between parent and child. Fathers often taught their sons the same craft, or trade, that they practiced, and mothers taught their daughters the same skills which they had developed.

This form of familial training eventually resulted in the development of social ranking within many civilizations. These hierarchies usually consisted of a professional or priestly class, a military class, and a working class. The Hindu caste system from India was an example of such an educational system which endured through modern times. According to this system, each caste was educated in the techniques of specific occupations.
considered fit for members of that group. The highest class, the Brahmanas, prepared for occupations in law, medicine, or other professional careers; the Kshatriyas practiced military and administrative duties; the Vaisyas were trained for professions such as merchants, craftsmen, or farmers; and the lowest class, the Sudras, were servants and laborers. The status of an individual was hereditary, rarely changed and, if so, then only to a lower caste (Graves, 1963, pp. 12-18).

It is not known exactly when formal apprenticeship began, but there is evidence that it existed during the Bronze Age. Apprenticeship was a legal agreement under which a person works a specified amount of time for a master craftsman in return for instruction, and often support. The Oldest Code of Laws in the World: The Code of Laws Promulgated by Hammurabi, King of Babylon B.C. 2285-2242 included the earliest known basis for a legal agreement related to the training and support of one person by another outside the immediate family. The following declaration of law referred to the rights of a child’s family after the child was sent to another home for training in some technical skill:

188. If an artisan has taken a son to bring up, and has caused him to learn his handicraft, no one has any claim.
189. If he has not caused him to learn his handicraft, that nursling shall return to his father’s house. (Hammurabi, circa 2250/1903, p. 41)

The ancient Jewish culture placed a strong emphasis on religion in their education and the methods they employed were often quite practical. The instruction of Jewish children during this period also took place in the home and almost always included family training in a trade. Even after
Jewish synagogue schools were established, around 550 B.C., the Jews considered the preparation for work on a similar level as intellectual ability, and valuable to the building of religious character (Bennett 1926, pp. 13-15). Perhaps the most important contribution of the ancient Jewish education system was its "broad interpretation of human responsibility" (Graves, 1963 pp. 27).

Long before the Jewish synagogue schools existed, temple schools were established in Egypt and Mesopotamia to provide education for priests and other officials. In the following passage, Forbes described a form of education offered in these ancient temples to prepare technicians:

Some of the mathematics taught in these schools dealt with very practical problems involving the conversion of standard measures or weights and the calculation of areas and volumes of various geometrical figures and solids . . . . Thus out of the temples came technicians who rose to the high estate of officials surveying great engineering works or responsible for the import of essential goods. (1968, p. 9)

Within these ancient civilizations a relatively high degree of technical development allowed accomplishments never before possible. In Egypt, achievements in engineering and architecture produced the great pyramids, and dams that allowed large scale irrigation. Various Asiatic civilizations that existed during the Bronze Age created and used artifacts such as ploughs, stone-working drills, copper and bronze tools, pottery, and manufactured glass products (Desmond, 1986, pp. 4-7).

Despite the advances made in technology, virtually nothing suggests that the people of these ancient civilizations understood the natural
phenomena that permitted such technologies to exist. "In Egypt and Babylon the control over nature exercised in the techniques threw little light on the processes of nature as a whole. Practice did not pass beyond the domain of practice" (Farrington, 1947, p. 3). Natural science was to emerge later, from within the Ancient Greek civilization.

The Iron Age

Sometime near 1500 B.C., man developed the ability to smelt iron and thus create iron tools and weapons, hence the Iron Age. Most civilizations during the Iron Age became more democratic than those of the Bronze Age yet maintained a somewhat structured social environment. Of the hierarchy that existed in the ancient Greek civilization, the lower classes were generally comprised of artisans. The ancient Greeks continued to use apprenticeship as a method of education directed primarily as training for a vocation. The Parmenon was a commonly used legal document at that time which, among other things, served "as a form suitable for framing contracts of apprenticeship between the boy's father and a craftsman" (Jones, 1977, p. 214).

Greek scientific thought during the Hellenic period has characteristically been considered to focus purely on knowledge rather than practical usefulness. Yet, early Greek science actually stemmed from an investigation of practical processes. Ellul wrote, "historically, technique preceded science; even primitive man was acquainted with certain techniques. The first techniques of Hellenistic civilization were Oriental; they were not derived from Greek science" (1954/1964, p. 7), which developed
sometime around 585-545 B.C. Thales, Anaximander, and Anaximenes of Miletus, an ancient Greek settlement of the Ionian region, are credited as the founders of European scientific thought. Even so, Anaxagoras, an Ionian philosopher and physicist who lived sometime around 500-428 B.C., identified the hand as the generator of man’s intelligence. Farrington stated:

The Ionian philosophers were not simply observers of nature but active interferers with nature, for the philosopher and man of action were yet one. They made a distinction between necessity and design - that is, between the spontaneous processes of nature and the action of man on nature. They attempted to understand the spontaneous processes of nature - the realm of necessity - in the light of the controlled processes - the realm of design. (1947, p. vii)

The distinction between the processes of nature and the action of man on nature that Farrington attributed to these early Greek philosophers could be viewed as the difference between natural science and technology. Considering that these intellectuals were the first to contemplate natural principles in explaining their environment, it should seem natural that they would describe their observations in terms relevant to the technical level of that time. This suggests that perhaps the earliest understanding of natural science was accomplished through a comprehension of technical developments. To Milesian philosophers, technical knowledge came to mean the understanding of the principles of natural science. This may have been mankind’s earliest realization that the development of his civilization rested in his own hands, and the first acceptance of his tremendous responsibility.
Philosophy from the Golden Age of Greece

As the practice of enslavement grew in ancient Greece, so did prejudice against technical knowledge. Skilled work was increasingly being performed by slaves. This social change was apparently in progress during the lifetime of Socrates (470? - 399 B.C.) and most likely his high regard for the attainment of knowledge contributed to an increased change in this direction. In The Economist of Xenophon, Socrates identified the growing disdain for the mechanical arts among citizens, or non-slave classes, of the ancient Greek city-states saying, “not only are the arts which we call mechanical held in bad repute, but States also have a very low opinion of them, . . . and there are States, . . . such as are most famous in war, in which not a single citizen is allowed to engage in mechanical arts” (Xenophon, circa 400 B.C./1971, pp. 22-23).

Socrates was himself a stonemason and carver, by default of class and not practice. He believed that little was gained from the instructional methods of the Sophists, who provided an authoritative delivery of information. So, he developed the conversational Socratic method of teaching. Rather than lecturing, the dialectical method employed by Socrates sought to examine ideas in a logical manner so as to determine their validity. To do so, Socrates would pose a problem and then illicit responses from the students thus forcing them to think about, and eventually solve, the problem on a theoretical level. Socrates chose not to instruct, but to cause others to think.

Throughout his dialogues, as recorded by Plato, Socrates created examples from the activities of common people. Although the Socratic method was not intended to teach the application of knowledge through
practical skills, in his dialogue with Ion, Socrates does prove that practical skills require specific knowledge (Plato, circa 375 B.C./1956). Monroe wrote, according to Socrates "knowledge is the prerequisite of free action, the basis of all right action in all the arts" (1905/1970, p. 126). In general, Socrates hoped to cultivate knowledge that was of practical value and which related to life directly.

The great philosopher Plato, a student of Socrates, employed the methods of his mentor but pursued different ideals related to the cultivation of knowledge. To Plato, true knowledge could only come from changeless ideas of the spiritual world. He believed that the intellect could recall this knowledge from the immortal soul within all human beings, but not through experiences of the bodily senses. His educational ideal was a liberal education based upon the study of theory. Even as it is viewed today, the idealistic educational philosophy places little value on the practical application of knowledge.

Plato's student Aristotle also valued a liberal education, but due to his personal interest in the sciences Aristotle recognized the value of both theory and practice. Aristotle's hierarchy of intellectual virtues placed the "cultivation of intellect" at the highest level. Although he dismissed the Presocratic theories of the Ionic philosophers as "material monism" (Farrington, 1947, p. 4), Aristotle did stress the value of sense experience as a path to knowledge. Butts stated, "educators, like everyone else, are selective in their use of the past. When they found Aristotle saying that the theoretical or speculative reason (theoria) was the highest virtue, they often neglected to notice that Aristotle also emphasized the practical reason by which wise moral decisions are made" (1955, p. 49).
The educational experiences that the Greeks actually afforded their youth were primarily aimed toward the upbringing of a responsible citizenry. The progressive system they developed for these ends has become known to us as *encyclios paideia*, a term roughly translated as “instruction in the circle of the arts and sciences” (Guralnik, 1980, p. 461). As Greece came under Roman control in about 147 B.C., the *encyclios paideia* had given way to the Roman *ars liberalis*.

*The Liberal Arts of Ancient Rome*

Until approximately 300 B.C., education in the ancient Roman Empire closely followed the Greek concept of acculturation. Children were usually prepared through practical training to serve whatever duties were required of the class and position of their parents. The education of the artisan classes continued to be of direct imitation, or “informal apprenticeship” (Martin & Luetkemeyer, 1979, p. 19), and occasionally formal, contracted apprenticeships.

After the rise of the Roman Empire, the children of privileged families could attend schools that borrowed heavily from the Hellenistic culture, yet were different in that the primary goal was preparation for professional life. The Romans refined the Greek bodies of knowledge to what were known as the *seven liberal arts* (logic, rhetoric, philosophy, arithmetic, geometry, astronomy, and music). Of the seven liberal arts, Butts stated:

They had come to be identified with those systematic studies of Greece which had been translated into Latin and which were thought to be suitable to spiritual and intellectual affairs rather than to material affairs. These are some of the historical reasons why a “liberal education” in its traditional form has so often been exclusively linguistic, literary, and mathematical in content and has so often been opposed to a “useful” or “practical” education. (1955, p. 101)
It was Cassiodorus (477-565 A.D.), founder of a Benedictine monastery, who had determined that the study of the seven liberal arts was necessary to prepare for the study of theology. However, Cassiodorus was also influential in creating the clear “distinction between the lowly arts and the liberal arts” (Lisensky, Pfister, & Sweet, 1985, p. 7).

Regarding the Roman contribution to technological advancement, Klemm stated, “although the Roman world showed more interest than the Greek in technical achievement, they attempted no transformation of technical accomplishment or specialization in the technical crafts” (1959, pp. 42). In fact, the Romans literally captured most of their technical knowledge from other cultures that they conquered. Although the Romans did not originate the use of semi-circular arches, concrete, and the concept of civil engineering, the extent to which they employed them was unprecedented (Smith, 1976, p. 48).

St. Augustine and the Early Christian Era

Some time very near the birth of Christ marked the end of the Iron Age. Forbes credits the rise of Christianity with opening “the door to the rational use of natural forces which was to produce the rapidly advancing technology of the Middle Ages” (1968, p. 15). While this statement is correct, it is also misleading. Over a millennium passed before any tremendous impact resulted due to the influence of Christianity.

The early Christian disposition towards the natural world grew to treat it as a sacred, mysterious realm symbolic of spiritual truths. Perhaps the most influential person in promoting this attitude was St. Augustine (354-430 A.D),
who lived to see the fall of the Roman Empire. Like Platonism, Augustinian philosophy supported a spiritual perception of truth found in the immortal soul, capable of being understood by only a few. However, St. Augustine believed that the highest standard of truth could only be discovered through the love of God.

As for education, St. Augustine and the early Christian leaders placed great emphasis on the study of Church doctrines and strived to separate faith and reason. The classical schools were criticized for overestimating man's rational power. Science became a method for dispelling superstition and other subjects were also taught so as to develop the student's Christian faith. For most men, technical knowledge was limited to one's trade and limited technological progress was made during this period.

The Dark Ages

During the portion of European history known as the Middle Ages, education fell into a state of disorder, particularly in the early medieval period often referred to as the Dark Ages. From roughly 476-1000 A.D., widespread ignorance, poverty, intellectual stagnation, and general cultural decline characterized the Dark Ages. The Church was the main provider of education at this time and the philosophies of the Christian Fathers, such as St. Augustine, shaped most of the educational thought of the Dark Ages.

Although the Dark Ages were typically bleak, they were not devoid of technological accomplishment. DeVore identified several developments such as:

31
Obviously, these technological developments were primarily of an agricultural nature due to the agrarian inclination of the feudalistic society. Feudalism was the economic and political system which prevailed during the Dark Ages.

In the Feudal system there were three general social classes: the nobility, the serfs, and the clergy. The nobility consisted of the lords and their vassals, the knights. The knights were landholders and served the kings by marshaling and managing the land. The education of the noble class consisted of practical training in chivalry. Actually, few members of the noble class could read or write. The serf class worked under the knights in return for protection, and was bound to the land. The serfs continued to learn technical skills related to agriculture, crafts, and other manual work through informal apprenticeship. The clergy were educated, expressly for moral and religious character, and either ministered to the other classes or were monks. Because of these social divisions of feudal society, it is often believed that any speculation about the natural world of the sciences had little impact on the improvement of life until the late Middle Ages. Rust stated:

It would be incorrect to suggest that Europe did not possess technical understanding prior to the eighteenth century, since the industrial era only signaled the blossoming of a long technical maturation period; it had been without decisive checks and had failed to thrive among peasants and low skilled labourers. For at least 750 years a slow fermentation had taken place in Europe with no immediate consequences. (1977, p. 105)
Cathedral schools often provided education mainly for those who intended to join the clergy. Yet, while the monastic schools were the strongest academic force through the Dark Ages, the Benedictine monks were also extremely industrious and developed great skill in agricultural and manual work to sustain themselves. “Monasticism in itself was in fact a system of education in which work with the hands played an important part” (Bennett, 1926, pp. 17-20).

Medieval Christian Theology

A great thinker who aided the emergence from out of the Dark Ages was Pierre (Peter) Abélard (1079-1142 A.D), a French philosopher, teacher, and theologian. Abélard rebelled against the Church by establishing doubt which opposed the orthodoxy of the Church. Abélard’s resistance was not against Christianity but against the manner in which it was being indoctrinated. The completion of his major work, Sic et Non (Yes and No), was a critical event of the medieval period. This work contributed to the rediscovery of Aristotle’s philosophies and eventually to the “reformulation of orthodox theology in the thirteenth century” (Mayer, 1973, p. 153).

St. Thomas Aquinas (1221-1274 A.D) was the Italian theologian and philosopher who was largely responsible for that reformulation, which consisted of combining Aristotelian philosophy with Christian tradition. The philosophy that Aquinas developed was based upon scientific principles although, according to Aquinas, the main objective of science was to explain the wonders of nature in order to reveal the glory of God. Aquinas defined man by his two distinguishing characteristics, his hand and his ability to
reason. Aquinas' book *De Veritate*, described his educational philosophy that all humans are capable of reasoning, a virtue given from God, and the greater mankind's use of this ability the greater the tribute to God.

The Church had previously denied that most human's were capable of reasoning. Like Plato, it held that the majority of mankind were guided by their senses and therefore were subject to illusion and falsehood. As a result of the authority of the Church, the technological advancements during the Dark Ages were limited. Now Abelard and Aquinas were conceding that individuals could think freely for themselves, although Aquinas was especially malevolent towards heresy.

*Apprenticeship during the Latter Middle Ages*

In the latter portion of the Middle Ages, the social structure began to change partially due to the growth of independent inquiry and also as a result of the Crusades that occurred during the eleventh through thirteenth centuries. A gradual shift from a feudalistic-agrarian society to one driven by a market economy caused cities to grow around many of the old castles. As the cities grew, the power of the nobility weakened and representative governments began establishing themselves.

Broadhurst and Harrison identified the prevailing method of production during the late Middle Ages as "handicraft technology." They described handicraft technology as "man's attempts in this era to control his physical environment . . . when manufacturing systems were relatively simple, being largely characterized by literal hand production and
uncomplicated methods of marketing and exchange” (1968, pp. 59-60).

Originally, the medieval craftsmen sold their products directly to the purchaser, however it did not take long for middlemen, the merchants, to step into this basic capitalistic system. Although “wholesale handicraft” began to develop during the medieval period it only reached its full capacity around approximately 1500-1750 A.D., beyond what is commonly considered the Middle Ages (Broadhurst & Harrison, 1968, p. 67).

Due to the prevalence of handicraft production, perhaps the most important form of education during the latter Middle Ages was apprenticeship. The system of apprenticeship used during this time was much more refined and formal than ever before practiced. The indenture was a commonly used formality represented by a contractual agreement between the master and the apprentice, usually a boy below ten years of age. This contract often determined the length of indenture, the compensation, and education that the apprentice would receive. The revamped system consisted of three levels of attainment: apprentice, journeyman, and master. A master craftsman could become a guild member and undertake the responsibilities of his own business, employing journeymen and educating apprentices in “the mysteries of a trade.”

This enhanced apprenticeship system was developed as a direct result of the establishment of guilds during this period. Artisans and merchants formed guilds primarily to uphold standards of quality and to protect the economic interests of members. Yet, they also had a significant influence on education during this time. The guilds provided for the education of apprentices, and they established schools primarily to educate the children of the members. As in the chantry schools of this time, teachers in the guild
schools were usually priests since they were the most highly educated, but the
guild schools were otherwise free from control of the Church. As
representative government grew these schools evolved into burgher schools
for the middle-class townspeople. Eventually, teachers from outside of the
church became more common and the content of the instruction began to

Medieval Science and Technology

The ancient Greeks and Romans are often criticized for the separation
of natural science and applied science, or technology, despite some exceptions
such as the engineering marvels of Archimedes, Hero, Appius Claudius, and
Marcus Vitruvius for example (Finch, 1960, pp. 38-78). During the latter
Middle Ages, however, the relationship between these two realms grew very
close and this period became one of great technical innovation.

Regarding science and technology during the medieval period Beck
stated:

There is little question that medieval competence in geometry
was far behind what had been achieved in Hellenistic times. This
could be said of scientific knowledge generally, but not of applied
science, the “mechanical arts,” or as they were commonly called,
the “fabrice arts.” Indeed, applied science and technology
stimulated a study of theoretical or basic science, not the reverse,
which became the case only after the seventeenth century (1965, pp. 28-29).

Roger Bacon (1214-1294 A.D.), of England, was one of the earliest
scholars who pursued science as a means to control nature but, due to
Aquinas and the power of the Church, his thinking would not be accepted for
almost three centuries. A friar of the Franciscan Order, Bacon conflicted with
the Church by distinguishing the differences between faith and the
knowledge of principles or facts (Easton, 1952, p. 6). Bacon’s experimental science was not the discovery of a unique form of science as much as the development of an essential part of the scientific method used in modern times. Bacon himself carried out few experiments although he did apply his method to inventions like the magnifying glass and designs for automatic carriages, ships, and a lighter-than-air machine (Desmond, 1986, p. 19).

Although a few highly educated people like Bacon pursued the study of science through experimentation, less-educated craftsmen probably made most of the technical discoveries. One such craftsman was German Johannes Gansfleisch (Gutenberg) who, sometime around the year 1451 A.D., was the first European to create, and print with, movable type, an innovation of such magnitude that its contribution to the revival of literature and learning is immeasurable. It was the general interest of such innovators to achieve “practical results that encouraged them to ask concrete and precise questions, to try to get answers by experiment and, with the aid of technics, to develop more accurate instruments and special apparatus” (Crombie, 1959, pp. 175-177).

**Humanism**

Humanism was an intellectual and cultural movement that began to develop in the latter Middle Ages. One of the earliest and most influential Humanists was Desiderius Erasmus (1466-1536 A.D.), a Dutch scholar and theologian (born Gerhard Gerhards). Erasmus sought to improve the Church by reviving scholarship in the Greek and Latin classics and thus gain insight to the ancient world from which Christianity grew. Italian Humanists such as Baldassare Castiglione (1478-1529 A.D.) desired an education to produce a well-cultured Christian citizen. They sought to reform education by teaching
Although it was hardly the primary intent of its proponents, Humanism became a somewhat powerful secular force. François Rabelais (1490?-1553 A.D.) was a French priest who later became a physician and satirist. Although he valued instruction in religion and morals, Rabelais preferred to use the Greek and Latin classics for the scientific knowledge that they contained. His writings often reflected his disdain for the literary approach of Humanistic education as it existed at that time. The curriculum that Rabelais proposed was much more diverse and revealed his interest in the natural sciences.

It is generally accepted that the humanist movement sought to glorify the past achievements of mankind. The weakness of Humanistic studies was that they eventually focused merely on grammar and style rather than content. The emphasis that the Humanists placed on classical studies has had a tremendous influence on the modern view of education and for those who espouse classical studies, technical education is usually of little interest. The Humanist Movement did, however, contribute to the advancement of technical instruction through the spirit of reform.

**Civil Control of Education**

The Reformation occurred during the sixteenth century, around the time of the humanist movement. Martin Luther (1483-1546 A.D.) led the Reformation in Germany and although his aim was to reform the Roman Catholic Church, the result was the establishment of the Protestant Churches. Luther opposed the Catholic Church regarding many issues including...
education which he believed should be controlled by the State, or nation. The notion of civil control over schools was a very important educational innovation during the Reformation. Grimm wrote:

Probably the most significant influence of Protestantism was its extension of education to a much larger segment of the population. Luther insisted that all the cities, towns, and villages of Germany should establish schools supported by public funds and compel the children to attend. He thus gave the first great impetus to free, compulsory education for all children. (1978, p.486)

Influenced by the humanist movement, Luther supported the study of Greek and Latin, and also Hebrew. Other content that he advocated included rhetoric, dialectic, history, natural science, music, and gymnastics. He promoted the value of method in instruction and the importance of good teaching. Although Luther's ideal system of education was quite well-rounded, the emphasis remained on religious study. To Luther, schools supported by all would create good citizens and provide common people an opportunity to combine the academic instruction provided through the schools with the learning of a trade, accomplished outside the school.

Another Protestant seeking reform at this time was John Calvin (1509-1564 A.D.), originally from France but, later, also of Switzerland. Calvin was more methodological in his approach to reform and was the first to develop an entire system of theology founded in Protestantism. Calvin's view of civil control centered around the church and this theocratic approach was used in Switzerland to benefit the Protestant Church. Like Luther, Calvin formed his educational theories around the classical studies which tended to de-emphasize technical knowledge. This proved to be consequential to the
educational growth in America since Calvin inspired many of the Protestants who settled there, particularly in New England. In 1636, the puritan leaders who founded the first college in America, Harvard, were highly influenced by Calvinism.

In Europe, the Protestant Reformation did by no means mark the end of the Catholic Church or its delivery of education. In fact, the Catholic Church still remained quite strong. The Inquisition and the Council of Trent were both efforts of the Catholic Counterreformation. Also, during the sixteenth century, Ignatius Loyola organized the Society of Jesus, which established the Jesuit schools, and in the seventeenth century, Jean Baptiste de la Salle founded the Brothers of the Christian Schools. These two institutions, which also focused on classical studies, have been extremely successful as educational facilitators and continue to exist as private liberal arts schools.

Materialism and Dualism during the Scientific Revolution

The Renaissance marked the transition, in Europe, from the medieval world to the modern world. During this period there was a great revival of literature and art which produced writing such as that of William Shakespeare and artwork from the likes of Michelangelo Buonarroti. In the realm of theoretical science, however, the transition represented a change from the theoretical sciences as they were developed by the Greeks. Natural science began to grow through new discoveries as Roger Bacon’s concept of experimental science was used more often and experimenters focused their inquiry on physical rather than metaphysical problems.
Leonardo da Vinci (1452-1519 A.D.) combined his vast knowledge of Greek mathematics and natural science to explore mechanics. In doing so, Leonardo developed many new theories and tools indispensable to the growth of science. Galileo Galilei (1564-1642 A.D.) used the telescope to demonstrate the truth of the theory developed by Mikolaj Kopernik (Copernicus) (1473-1543 A.D.) that planets revolved around the sun. This discovery was not readily accepted at the time and the Inquisition condemned Galileo for heresy. Although both the Catholic and Protestant Churches fought scientific progress, there were many other great scientific accomplishments at this time by individuals such as Brahe, Bruno, Huygens, and Kepler. Their achievements represented the beginning of what is known as the Scientific Revolution.

The Scientific Revolution occurred during a time of social and political upheaval in Europe. The Thirty Years War (1618-1648) was fought originally by German Catholics and Protestants but later involved the Swedish, French, and Spanish. The Civil War in England and the Glorious Revolution of 1688 increased the strength of the Parliament relative to the aristocracy, which was beneficial to the middle classes. In general, the rise of the Puritan merchant class promoted the doctrines of possessive individualism, emphasizing liberty, property rights, and toleration, and fostered early forms of capitalism. This growing population, and the small group of influential thinkers who supported them, were receptive to science, and viewed technology as a means for unlimited human progress. The Scientific Revolution introduced a new perspective of mankind and the universe. This worldly outlook eventually led to the increase of human powers of control over nature.
Another result of the growth of science and technology was the philosophy of materialism. Thomas Hobbes (1588-1679 A.D.) of England was one of the foremost materialists. According to Hobbes, the entire world consisted of matter, including the human mind, and learning occurred empirically, or as the result of experiences gained purely through the senses. This philosophy incensed the churches and did not gain many followers until the eighteenth century.

René Descartes (1596-1650 A.D.), a French philosopher and mathematician best known for his statement “I think, therefore I am,” developed a more acceptable philosophy for the times known as dualism. In *A Cultural History of Western Education*, Butts stated, “Western education has virtually been built upon the assumptions of dualism, many educators believing that education properly should devote itself to mental and spiritual activities rather than to material and practical activities” (1955, p. 220).

Dualism accepted the concept of matter and its relationship to the natural sciences, but the mind was to be a separate entity which set mankind apart from all else. This view accommodated the pursuits of both the theologians and the scientific methodologists.

**Francis Bacon and Sense Realism**

Another contributor to the Scientific Revolution was Francis Bacon (1561-1626 A.D.), an English philosopher, statesman, and dabbler in science. Chant wrote: “From the early seventeenth century, intellectual reformers like Francis Bacon and René Descartes perceived how the union of scholastic theory and craft technique promised human mastery over nature, and infinite material benefits” (1989, p. 46). According to Combie:
Bacon was of the opinion that technics or, as he called it, the mechanical arts, had flourished during the Middle Ages just because they were firmly founded in fact and modified in light of experience. Scientific thought, on the other hand, had failed to advance just because it was divorced from nature and kept remote from practical experiment. (1959, p. 123)

Bacon is most well known as a proponent of the philosophy of sense realism. Integral to this philosophy was the scientific method which he called "induction." Bacon, similar to the thought of his predecessor Roger Bacon, valued the method of experimentation and believed that there was a great deal of knowledge that mankind had yet to comprehend. During the Renaissance, people often equated an understanding of technics with knowledge of natural science. In his *Novum Organum*, Bacon wrote:

> The human understanding is perverted by observing the power of mechanical arts, in which bodies are very materially changed by composition or separation, and is induced to suppose that something similar takes place in the universal nature of things. (1911, p. 402)

This should not imply that Bacon did not value technical knowledge. His intention was to distinguish between natural science and applied science.

In 1605, Bacon published *The Twoo Bookes of the Proficience and Advancement of Learning* in which he declared that the scientific method was a process useful in education. In the following passage from those books, Bacon identified the trend toward the demise of the "art of invention" as an intellectual pursuit, and his opinion of the effect that this would have on theoretical science:
The ARTS INTELLECTUALL, are foure in number, divided according to the ends whereunto they are referred . . . ARTS of ENQUIRIE or INVENTION: ART of EXAMINATION or JUDGEMENT: ART of CUSTODIE or MEMORIE: and ART of ELOCUTION or TRADITION.

INVENTION is of two kindes much differing; The one of ARTS and SCIENCES, and the other of SPEECH and ARGUMENTS. The former of these, I doe report deficient: which seemeth to me to be such a deficience, as if in the making of an Inventorie, touching the State of a defunct, it should be set downe, That there is no readie money. For as money will fetch all other commodities, so this knowledge should purchase all the rest. . . . So it cannot be found strange, if Sciences bee no further disco[vered, if the Art itselfe of Invention and Discoverie, hath been passed over. (pp. 48-49)

While Bacon's philosophical contribution to education was quite significant, the work of Richard Mulcaster (1531-1611 A.D.), Samuel Hartlib (1600-1662 A.D.), John Dury (1596-1680 A.D.), and Jan Amos Komensky (Comenius) (1592-1670 A.D.) offered a more direct approach to educational reform based on sense realism.

Richard Mulcaster was one of the earliest sense realists. His experience as an English schoolmaster for 37 years lends practicality to his theories. Mulcaster mainly valued exercise and training of the body through sports. He felt that education should be more pleasurable for children and should follow a natural course. Mulcaster also made drawing a fundamental activity and mentioned its usefulness in his book The Training Up of Children (1561/1971, pp. 34-35). Mulcaster did not concern himself extensively with instruction in the experimental science being developed by Bacon, yet he did establish theories and methods critical to the growth of educational reform based on sense realism. One of his most valuable efforts was the promotion of teaching in the vernacular rather than Greek and Latin.
Hartlib and Dury often worked together. The system that these two Puritans proposed for England included three types of schools; “mechanical schools” to teach technical means according to local needs, “common schools” to serve the general public, and “noble schools” to provide education for the upper classes. Hartlib’s ideal plan of the mechanical school was posited in the manuscript *Some Proposalls Towards the Advancement of Learning* (credited to Hartlib but believed to be authored by Dury in 1653), as follows:

The Mechanicall Sciences fit men for Mechanicall employments. . . . And the sciences which fit men with necessary knowledge for such works, are comprehended under these Arts as we conceive.

1. The Art of Husbandrie, and what belongs thereunto.
4. The Art of Surveying of Lands, and what belongs thereunto.
5. The Art of Architecture, and what belongs thereunto.
6. The Art of Painting, and what belongs thereunto in the right use thereof.
7. The Arts of working in Metalls, whether by fire or by tooles, or both waies and what belongs thereunto.

In all which Mechanicall employments if those that are most intelligent therein could be obliged to communicate their skill doctrinally that it might be taught also unto others, to perfite [sic] (by the addition of Experiments from time to time) each art in its own kind, there is no doubt but that in few yeares we should prove more industrious to improve the gifts which nature hath bestowed upon us, then any of our Neighbours, wto through our negligence make use of them to our disadvantage. (Hartlib, 1970, pp. 175-180)
William Petty (1623-1687 A.D.), another Puritan reformer who maintained contact with Hartlib and Dury, proposed a network of “polytechnics”, or mechanical schools for inventors, and mechanics.

**Comenius' Science of Education**

Comenius was a Moravian (Czechoslovakia) bishop who was orphaned at an early age and lived most of his life in exile and poverty due to his evangelical faith. Perhaps the first to influence Comenius was John Henry Alsted, a young professor of the university which Comenius attended at Herborn in Nassau, a duchy in West-Central Germany. In the “Greeting to the Reader” of *The Great Didactic*, Comenius also identifies John Valentine Andrae as one who contributed to and encouraged his writing of that book. Finally, he was also influenced by a more obscure, but brilliant, German educator Wolfgang Ratke (1571-1635 A.D.). Ratke had read Bacon’s works and proved that his methods were successful in the teaching of languages. Although Ratke was very secretive about his methods of instruction, Comenius developed a general conception of his systematic approach to instruction and employed it in his textbooks for the study of Latin.

The series of textbooks that Comenius developed was one of his earliest achievements. His textbooks were unique in that they were sequenced according to the development of the child and they employed a method of association rather than pure memorization to learn language. He also included the vernacular alongside the Latin phrases to be learned and was the first to include illustrations in a reading book, *Orbus Pictus*, to further appeal to the senses of the child.
Sense realism was a critical part of the educational philosophy of Comenius. His methods relied on acquainting the student with actual objects and providing them the opportunity to “learn by doing” whenever possible. Still, the action-oriented learning was not enough and was to be reinforced by the child’s ability to reason. In his Great Didactic, Comenius proposed a system of education that was to provide “the whole art of teaching all things to all men” (1632/1967, p. 5). In this he posits his theory of education and a plan to reform schools that included an entire curriculum, methodology, and organization of the schools. Comenius envisioned four articulated schools as essential to education. The “school of the mother’s knee”, or infant school, would be for children up to six years of age and would be under the parents influence. The “vernacular school” would be for children ages six to twelve, and the classical school, or “Gymnasium” would prepare children ages twelve to eighteen for the the final stage of education, the university.

In Comenius’ infant school, children would be continually active and learning through play supervised by their parents. Comenius wrote in his School of Infancy (circa 1620/1901), “let them be like ants, continually occupied in doing something, carrying, drawing, construction and transporting, provided always that whatever they do be done prudently” (p. 44).

Comenius believed that the students of the vernacular school should learn religion, morals, reading, writing, arithmetic, history, economics, politics, singing, and mechanical arts. Although technics were not formally taught in his system, Comenius wrote in The Great Didactic:

Finally, they should learn the most important principles of the mechanical arts, both that they may not be too ignorant of what goes on in the world around them, and that any special inclination towards things of this kind may assert itself with greater ease later on. (1632/1967, p. 269)
This learning was not intended to be a preparation for vocation. In fact, Comenius stated, “when boys are only six years old, it is too early to determine their vocation in life, or whether they are more suited for learning or for manual labor” (1632/1967, p. 267). The vernacular school provided an opportunity for all to acquire fundamental skills such as reading and writing, but also be exposed to a wide variety of content including technical knowledge. Later, they could choose to continue studying in the classical school or leave the school and learn a trade.

Many factors contributed to the eventual acceptance of Comenius’ views on education. First of all, Comenius was an outstanding scholar and writer - of that there is little doubt. Also, the use of the vernacular had steadily increased throughout Europe, which influenced the establishment of civil states, or nations during the Renaissance. As nations developed with their distinctive languages, many countries became interested in forming national systems of education.

Most of the philosophers preceding Comenius had not focused their work entirely on education, but instead issued profound opinions regarding education. Comenius, however, was dedicated to the improvement of education and was the first to produce an entire science of education which would later fit the educational plans of many countries. Finally, education throughout the Renaissance period was primarily delivered for the aristocracy. The ambition of Comenius was to provide education for all children regardless of gender or social class.
Sredl pointed out that Comenius “is sometimes referred to as the father of industrial arts” (1966a, p. 22) because he is the first person known to accept technical knowledge as worthwhile for inclusion in a comprehensive plan for education. This was the earliest movement in such a direction and perhaps the most revolutionary idea involving the instruction of technical knowledge ever.

The Instruction of Technics in Colonial America

The practice of indentured servitude in colonial America is known to have originated from the English system of apprenticeship. The traditional methods used by the English were molded to the needs of early colonists in order to populate the New World. Early indentured servants were primarily laborers and particularly farm workers. Craven approximated the population of white indentured servants in seventeenth-century America to be perhaps three-fourths of the total population and quoted John Pory, a resident of Virginia in 1619, as stating “our principall wealth... consisteth in servants” (1971, p. 13). In general, the servants were not considered apprentices, since they already knew their trades and needed little training. The education of these early indentured servants was of little concern since they were mostly young adult laborers and the literacy rate for these servants was usually quite low.

By the turn of the eighteenth century, slave labor had developed in the Southern colonies, cities were growing in the North, and the need for indentured servants as farm laborers began to decline. The American system
of indentured servitude began to change back to a role similar to, but not exactly like, the traditional English system of apprenticeship established to train youths in technical skills to prepare them for a vocation.

There was also an increased desire to educate the indentured apprentices since, more often, they were the native-born children of the colonists. Some colonies added a few unique ideas to their system such as requiring, by law, basic educational skills as an integral part of the training that young apprentices received. The Massachusetts Bay General Court Order of 1642 “had originated a brand-new idea: there was nothing in English law or custom that could serve as a determining precedent for this scheme” (Seybolt, 1917, p. 104). In this plan, the master was to be the primary source of the information and education received.

The laws created for the education of apprentices had important implications for the education of all children. Common schools began to develop for the benefit of all children. Night schools were also offered for apprentices. Thus, as the American colonies neared their independence, the attitude and approach towards the education of apprentices had undergone another significant change. By the mid-eighteenth century the master was no longer the primary supplier of basic educational skills and was reduced to teaching the technical knowledge necessary for a vocation.

Quimby cited records of indentures from the American Philosophical Society Library to reveal that in 1773, “Edward Bartholomew’s mother paid for four quarters of night school while his master...paid for four quarters also” (1985, p. 71). In another example from the same source, the “father of Michael
Coats, apprentice to Samuel Loftis, chaisemaker, paid for all his son’s evening school expenses” (Quimby, 1985, p. 72). The relationship between master and apprentice had become much less personal and the education that apprentices received eventually became more centralized under the growing influence of common schools.

The concept of education for all began to spread into the United States during the colonial period. Benjamin Franklin, who actively supported education, established the Franklin Academy to promote his ideal of a practical education. According to Martin, “the Franklin Academy and the subsequent development of other privately supported academies in the United States made significant contributions to the development of universal, tax-supported public education” (p. 81). Martin also described the influence of Thomas Jefferson on the concept of universal education. He wrote: “While Jefferson believed in universal public-supported education, he also believed in a perpetuation of a natural aristocracy” (p. 81). Thus, according to Jefferson’s scheme, education would be offered at two levels based on the students ability.

John Locke

The idea of incorporating technical knowledge into educational curricula gained further momentum from the English empirical philosopher John Locke (1632-1704). Locke was a member of the Royal Society of London for the Improving of Natural Knowledge. Other distinguished members of this group included Robert Boyle, a physicist who established Boyle's Law and
invented the air pump; Sir Issac Newton, who formulated the laws of gravity and motion; Sir Christopher Wren, an astronomer and famed architect; and Sir William Petty, who, as mentioned previously, had a distinct interest in seeing "that all children, though of the highest rank, be taught 'some genteel manufacture in their minority' " (Bennett, 1926, p. 46).

Locke too believed that a good education ought to include the "manual arts," another term used for technical knowledge and skills. In Some Thoughts Concerning Education, Locke identified a few manual activities suitable for a "Country-Gentleman" such as "Gardening or Husbandry in general, and working in Wood, as a Carpenter, Joyner, or Turner" (1693/1989, p. 257). In this book of letters to a friend, Locke also wrote:

> Amongst the great variety there is of ingenious Manual Arts, 'twill be impossible that no one should be found to please and delight him, unless he be either idle or debauch'd, which is not to be supposed in a right way of Education. (p. 260)

In the opinion of Locke, the general intent of such learning was the improvement of dexterity, skills, and general health of an individual through constructive recreational activity. This reflects some part of Locke's educational philosophy that agreed with the sense-realists. However, Locke put more emphasis on the process of education than the specific content mastered. He felt that certain subjects, or disciplines, help a student develop a general ability that can be applied in a variety of ways and should be learned 'by all. Through his approach of disciplinary education, Locke opened the doors for the philosophy of naturalism that would have great influence in Europe and America during the period of the Industrial Revolution.
The Encouragement of Technology

During the mid-eighteenth century, a number of Societies emerged in Europe with the objective of cultivating the industrial arts. Perhaps the most successful of these has been the Royal Society of the Arts. William Shipley (c. 1714-1803) is credited with organizing this group originally founded as the “Society for the Encouragement of Arts, Manufactures, and Commerce in Great Britain.” Shipley and ten others, including two noblemen, Lord Romney and Lord Folkestone, and Stephen Hales, a Fellow of the Royal Society of London for the Improving of Natural Knowledge, chartered the Society in 1754.

The Royal Society of Arts, the title conferred in 1908, was conceived as an agency for stimulating and rewarding discovery, invention, improvement, and other valuable activities. Financed by the subscription of its members and by donations, it offered awards for the solution of specified problems or particular achievements. Shipley’s first proposal was to offer prizes for the discovery of cobalt and the production of madder, a source of red dye. He also proposed the organization of a drawing competition for children, with prizes to be awarded for the finest works.

The Society of Arts became involved with a wide range of industrial interests. Awards were made for numerous mechanical innovations for the production of textiles. The commercial production of chemicals and the development of tools such as chimney sweeping devices, screw-jacks, and harpoon gun was promoted. Agricultural accomplishments such as improved methods of cultivation, the invention of new implements, and new methods of caring for livestock were also encouraged by the Society.
Rousseau and the Philosophy of Naturalism

The Enlightenment, which occurred in the early eighteenth century, was a movement highly influenced by Hobbes' philosophy of materialism and Locke's views on government and learning. This movement was led by individuals such as François Marie Arouet de Voltaire (1694-1778), in France, and David Hume (1711-1776), in England. The aim of the Enlightenment was to establish, once and for all, mankind's ability to reason. While this movement led to the freedom of the intellect, it retained the system of classical education and supported the formation of an intellectual aristocracy. Jean Jacques Rousseau (1712-1778) opposed this narrow view and focused on democratic ideas in the development of the naturalistic movement during the latter portion of the eighteenth century.

Rousseau was born in Switzerland but lived most of his life in France. His mother died shortly after his birth and his upbringing was considered less than desirable. As an adult, he was characteristically irresponsible and his morals were questionable. In his book *Inteilectuals*, P. Johnson presents an eye-opening account of Rousseau's life and labeled him "an interesting madman" (1988, p. 1). Nevertheless, Rousseau, in time with the rise of the spirit of democracy, expressed philosophical views that have shaped modern politics, and education.

Politically, Rousseau was extremely radical and because of his ideas he was forced to leave France. He maintained that the common man was naturally good and that the advancement of aristocratic culture created greed and ill will. His political views were fuel for the French Revolution and he influenced Thomas Jefferson's views not only politically but also in regard to
education. He also encouraged the concept of nationalism, which was beneficial to educational reform.

In his book *Emile*, Rousseau set forth his philosophy of education, a natural and spontaneous process emanating from the child. "Central to Rousseau's philosophy of education was the idea that external intervention could not accelerate the process of natural development" (Rust, 1977, p. 107). Rousseau believed that all children learn best through experiences of family life in a rural setting. Another part of the educational experience was to learn a trade, no matter what the child's background. To Rousseau, all could benefit from learning "a purely mechanical art in which the hands work more than the head, one which does not lead to fortune but enables one to do without it" (Rousseau, 1762/1979, p. 196). Bennett said of Rousseau:

> His recognition of the fact that the manual arts may be a means of mental training marked the beginning of a new era in education . . . However, his was the vision of a seer, the voice of a prophet; he did not put his theory into practice" (1926, p. 81).

Rousseau also believed that industry was the best way to draw the students' attention to the usefulness of one individual to one another. Rousseau stated in *Emile*:

> The practice of the natural arts, for which a single man suffices, leads to the investigation of the arts of industry, which need the conjuction of many hands. The former can be exercised by solitaries, by savages, but the others can be born only in society and make it necessary. So long as one knows only physical need, each man suffices unto himself. The introduction of the superfluous makes division and distribution of labor indispensable; although one man working alone earns only subsistence for one man, a hundred men working in harmony will earn enough to give subsistence to two hundred. (1762/1979, p. 185)
The primary intention of this statement was to point out the mutual
dependence of mankind, yet it also served to identify the impending
Industrial Revolution.

Summary

Material artifacts have been used to provide for human needs and the
improvement of living conditions for ages. Technological advancement has
been the result of the discoveries and inventions of humans. The ever
increasing sophistication of artifacts, and the application of new techniques,
have helped mankind to evolve and become civilized.

The instruction of technics has always been an integral part of
mankind's existence. During the Stone Age, younger members of tribes or
families learned the skills they needed to survive through unconscious
imitation. Familial training in specific skills became a conscious effort during
the Bronze Age and an ancient form of apprenticeship existed. Class, or caste,
structures began to form in most cultures and the ancient Greeks refined the
concept of apprenticeship for training in specific trades.

The early Greek scientists based their studies around technology and
practical processes, however, during the so-called "Golden Age" of Greece
technical knowledge was denigrated. The great philosophers Socrates, Plato,
and Aristotle cultivated knowledge of what they considered a higher order.
Socrates hoped to cultivate knowledge of practical value which related to life
directly. Plato, however, believed that the intellect was separate and could not
benefit from the bodily senses. He promoted a liberal education based on the
study of theory that placed little value on the practical application of knowledge. Aristotle recognized the connection between theory and practice and valued sense experience as a path to knowledge.

The ancient Romans were great borrowers of both educational practices and technological developments. They used the established bodies of knowledge from the Greek system of education and refined them into the “seven liberal arts.” Education of artisans continued through apprenticeship.

Early Christian leaders such as St. Augustine further impeded education of a practical nature. The study of church doctrines became the primary goal of educated people, who were almost exclusively members of the clergy. The Church soon guided all educational practice and led the way into the Dark Ages. Theologians such as Abélard and Aquinas contributed to the emergence from the Dark Ages by reviving Aristotelian philosophies.

The latter Middle Ages witnessed a sudden change in political and economic structure. Representative governments were formed and handicraft technology became the prevailing method of production in a market economy. Guilds were formed and the apprenticeship system was further refined and improved. The experimental science that Roger Bacon practiced began to affect technology. An important innovation was the creation of movable type which led to the advent of the printed word.

Humanism was a cultural reform movement developed as a philosophy that glorified the achievements of mankind during ancient times. This movement introduced secular tendencies and Humanists such as Rabelais advocated classical studies such as Greek and Latin literature.
Although technical instruction was not considered in classical studies, the
spirit of reform would eventually have a positive influence on that area of
knowledge.

Martin Luther led the Reformation which caused the split of the
Protestants from the Catholic Church. One idea that Luther believed in was
the civil control of schools. This concept eventually took root, yet, the lower
classes generally received a less exemplary form of education in comparison
to the aristocracy. Luther envisioned education for common people combined
with instruction in a trade.

The Renaissance marked a time of original thought in literature, art,
and science. Great accomplishments were made in science and technology
during the Scientific Revolution. Descartes developed the philosophy of
dualism from which modern education has largely been founded. Dualism
favored an education that develops the intellect with little regard to practical
application. Chart wrote:

From the early seventeenth century, intellectual reformers like
Francis Bacon and René Descartes perceived how the union of
scholastic theory and craft technique promised human mastery
over nature, and infinite material benefits. The immediate fruit of
this union was a science based on experiment rather than
speculation; untutored craft skills and rule-of-thumb techniques
were sufficient for the mechanical innovations of the First
Industrial Revolution. (1989, p. 46)

The sense realists had a profound influence on the future of industrial
education through the incorporation of handwork as an important part of
their educational theories. As national languages and systems of education
were forming in Europe, Comenius, who has been described as “the father of
industrial arts," proposed an articulated system of education which included skill development and knowledge of technical processes. John Locke also believed that education should include "manual arts."

In colonial America apprenticeship was the primary method of technical instruction. The English system of apprenticeship was adapted to the needs of the Americans and changed significantly twice during the colonial period. The first change was from indentured servitude, necessary to populate the country and work the land, to a more traditional form of apprenticeship. The next change was a result of the desire to better educate young apprentices. In many colonies, master's became required by law to provide basic educational skills for their apprentices. As schools developed, basic education and technical instruction grew to be separate.

The philosophy of Naturalism expounded by Rousseau encouraged Democratic ideals and influenced the future of many nations, including America. In his book *Emile*, Rousseau described his philosophy of education which would include the experience of learning a purely mechanical art. Often, Rousseau's writing reflected the fact of the forthcoming Industrial Revolution.
CHAPTER 3

The Development of Industrial Education and the Establishment of Industrial Arts in the United States
Just as it aided the emergence from the Middle Ages, technology has repeatedly played a significant role in the actuation of societal change. Technological advancement contributed to the advent of the Industrial Revolution which caused significant societal change. While education contributed to the changes that occurred during this period, it was also undergoing a revolution of its own.

Spurred by the philosophy of Rousseau, many individuals promoted the concept of “learning by doing.” As a result, various forms of technical instruction became readily available throughout Europe. Soon, similar private technical instruction was adopted in the United States. The demand for technical instruction also grew within the system of public education emerging in the United States. Also, industrial school programs were developed for African-Americans freed following the Civil War.

Another period of technological growth contributed to the rise of the Machine Age which occurred toward the latter half of the nineteenth century. A great deal of social upheaval was evident around the turn of the century and, for the first time, manufacturing industries employed more workers than agricultural trades in the United States. The changes taking place in the United States apparently required some form of control. The federal government began to regulate growth and services. The social reform also found a place in the schools.
Various forms of industrial education were introduced during the Machine Age. Early programs such as manual training, American sloyd, and manual arts, were considered broad enough to contribute to the general education of all students. The first exception was the introduction of vocational education, which provided instruction in specific skills for occupational training.

Soon, the term “industrial arts” was conceived to distinguish a new form of instruction. In 1940, Albert F. Siepert described the evolution of industrial arts as follows:

The procedures and practices in education like those in government or industry are usually the result of various forces. The interaction of tradition, experiment, and analytical study of problems as they arise, bring about slow though not always uniform changes. Industrial arts has had a similar evolution. (p. 235)

The general education curriculum that became known as **industrial arts** emerged as a composite of the positive characteristics evident in early industrial education programs. With the establishment of a strong professional organization, industrial arts developed a unique identity within the realm of industrial education. The study of industrial arts has traditionally been presented through a variety of practical methods that would prepare learners to live in an industrial society. However, the introspective and transitive tendencies within the profession eventually caused considerable confusion.
As the nation moved into a post-industrial phase, eventually referred to as the Information Age, vast diversity among industrial arts courses offered across the nation became apparent. Then, what appeared to be a quest for the most appropriate and universal system for the study of modern industrial arts only seemed to contribute to the confusion. Householder stated:

... social, economic and educational events were clearly creating a dissonance between existing industrial arts courses and the demands of the sixties. The time was right for the most widespread efforts ever devoted to the reorganization of the content and activities in the industrial arts curriculum. (1972, p. 7)

These efforts provided a wealth of knowledge and each contributed a unique point of view. However, one major element was common throughout them all — that there was a perceived need for change in the profession.

*The Industrial Revolution*

The Industrial Revolution began in England roughly around 1750 and lasted into the mid or late nineteenth century. It started largely as a result of the many civil liberties that English citizens enjoyed, the favorable geographic location, and the stimulation of innovation. Certainly, many other factors contributed to the Industrial Revolution, but the overall process "transformed an agrarian society to an industrial one and involved a change from custom to mass production methods of manufacturing" (Tierney, 1968, p. 111). This change, in conjunction with growing international free trade, altered the course of economic history.
Inventions spurred a tremendous acceleration in technology during the Industrial Revolution. James Watt’s steam engine was perfected in 1775, the improved crucible process for smelting steel was developed in 1740 by inventor Benjamin Huntsman, and large-scale production was realized through the use of simple machines (Grun, 1982, pp. 341,357). Machines especially improved the textile industry and facilitated the establishment of the factory system.

Miller wrote:

Before the Industrial revolution, technology led science. Technologies were discovered or evolved without an understanding of the scientific principles on which they were based. After it began, technology became science based, i.e., scientific developments led to technological inventions. (1984, p. 54)

Most of these technological advances occurred first in England, but soon the spirit of innovation spread into Europe, and North America, causing dramatic changes in the social and economic structure of those regions. Education was influenced by the forces of the Industrial Revolution but it also served a reciprocal purpose.

Timmons conducted a study that focused exclusively on Great Britain and provided extensive evidence of the contribution that education made to the Industrial Revolution in that nation. From his article “Education and Technology in the Industrial Revolution,” Timmons is quoted:

... education must have played a part, both directly and indirectly, in the diffusion of scientific knowledge and it was certainly available in a wide variety of forms. Furthermore, that willingness to change which encouraged technical innovation, and which is so discernible in the second half of the eighteenth century, must have derived some of its impetus from education. (1983, p. 137)

64
Many German and Swiss educators, such as Johann Basedow, Joachim Campe, and Christian Salzmann, were employing the principles of Rousseau's educational philosophy in schools across Central Europe while another type of school, the school of industry, began to emerge (Bennett, 1926, p. 86-90). Around the time of the American Revolution, Ferdinand Kindermann (1740-1801), who supervised schools in Bohemia (Western Czechoslovakia), introduced industrial work in the folk schools for the poor. The main purpose for this was a practical one -- it was meant to help students afford the expense of attending the school. In this situation, the students would be instructed in the skills of some form of industry and would practice that art to earn their living during part of the school day. They would then learn reading, writing, and other fundamentals during the remainder of the day. These schools of industry were short-lived in Bohemia, although at the peak of this effort there were over one-hundred schools.

**Pestalozzi**

At almost the same time, in Switzerland, Johann Heinrich Pestalozzi (1746-1827) established an industrial school for orphans and children of poverty-stricken families. The altruistic ideals that guided the life work of Pestalozzi were undoubtedly formed during his childhood in Zurich, after his father's death. His mother's selflessness, and the piousness of his grandfather, the pastor for a small village nearby, motivated Pestalozzi to enter the ministry. He soon gave this up, however, in favor of studying law, which he also failed to conclude.
Pestalozzi then turned to the study of agriculture and purchased enough land to start a small farm which he called "Neuhof." Having valued the writings of Rousseau highly, Pestalozzi believed that agriculture was an admirable occupation that was close to nature. He set forth to provide an example of improved methods of farming that would allow the peasants of the region to prosper. Unfortunately, this effort also failed due to the infertile land on which Neuhof was established (Bennett, 1926, pp. 106-115).

In 1769, Pestalozzi was married and a few years later his son, Jacobli, had been born. Pestalozzi decided to raise him according to the methods set down in Rousseau's Emile. In doing so, Pestalozzi made some original observations that helped him develop new ideas and principles for education. It was also this experience that prompted him, in 1774, to establish his industrial school at Neuhof. In his school, Pestalozzi took on twenty needy children and through combined work and instruction he saw an immediate improvement in their physical, mental, and attitudinal demeanor. Inspired, he gained some financial support and expanded his school to include more children. While his intentions were of the utmost, his management techniques were miserable and within six years Neuhof was a financial failure (Bennett, 1926, pp. 106-115).

In 1781, Pestalozzi published the classic book Leonard and Gertrude, which was popular and provided some income. Unfortunately, his subsequent efforts at writing were not as successful and he began to struggle against poverty. Many years later Pestalozzi was given chances to apply his methods of instruction in Stanz and Burgdorf but finally settled at Yverdun in 1805.
Although it did not involve industrial training, he established another institute where, for twenty years, he refined his methods based on observation. Not surprisingly, by 1824, this endeavor also had to be closed for reasons of mismanagement (Bennett, 1926, pp. 115-118).

Despite the frequent financial failures of his schools, Pestalozzi proved that his instructional methods were successful. In general, his educational philosophy was highly influenced by Rousseau’s philosophy of naturalism, but fortunately, Pestalozzi developed a more positive approach to educational reform than Rousseau. Sense realism was also an important part in the method of Pestalozzi’s teaching. He developed an instructional method that used objects to motivate the student by first appealing to the senses and then stimulating the mind. Pestalozzi’s careful observation of the intellectual, physical, and moral development of children also stimulated the blossoming of educational psychology and elementary education.

Even though he was not the first to incorporate technics into a system of education, Pestalozzi has been referred to as the “father of manual training.” Yet, in 1926, Bennett stated: “to call Pestalozzi the ‘father of manual training’ is only a fraction of the truth and that such a phrase alone does not convey the big idea for which the name of Pestalozzi stands” (p. 107). Although it is difficult to pinpoint the exact moment that the evolution of industrial arts began, the extreme influence of Pestalozzi’s object oriented sense impressionism ensured that it would continue.
The Promotion of Pestalozzian Principles

At the beginning of the nineteenth century there were several other Europeans who became involved in educational reform as a result of Pestalozzi’s influence. In 1808, Emanuel von Fellenberg (1771-1844) established an institution at Hofwyl, near Burgdorf, in which he also combined education with agricultural and industrial training. Children of both affluent and destitute families studied together and worked side by side to support the school through their labor. Fellenberg’s successful management allowed the institute to prosper and grow, thus providing a good example of Pestalozzi’s model. This approach of industrial training quickly spread throughout Switzerland, then Europe, to England, and also the United States. The Boston Asylum and Farm School, founded in 1814, was an example of such a program in the United States (Barlow, 1967, p. 26).

The German, Johann Friedrich Herbart (1776-1841), studied Pestalozzi’s methods and expounded upon them in his book The Science of Education, published in 1806. Herbart achieved what both Comenius and Pestalozzi had aimed for — to establish education as a scholarly discipline. He used Pestalozzi’s observational method to delve into the psychology of education as a basis for instructional methodology.

Another German, Friedrich Froebel (1782-1852), who had worked with Pestalozzi at Yverdun, developed what is commonly known as the kindergarten. Froebel’s exposure to Pestalozzian methods accounts for the great use of sense impression in instruction at this level. In 1826, Froebel also published Education of Man.
Nicolai Grundtvig (1783-1872) was an educational reformer in Denmark who proposed “a school for life” in which students were “to be kept in close contact with the activities of practical life” (Davies, 1931, pp. 89-90). Also, Chavannes, of France, and Charles and Elizabeth Mayo, in England, worked to promote Pestalozzian principles in their respective countries (Graves, 1915/1963, p. 305).

Joseph Neef, who had assisted Pestalozzi in Switzerland, was persuaded to move to America in 1806 by William McClure, of Philadelphia. Upon his arrival, Neef began his Sketch of a Plan and Method of Education which he used in his school in Philadelphia. Neef was later involved in several other projects with American schools including the New Harmony (Indiana) experiment in 1825. During the 1840s, Horace Mann, a renowned statesman and educator from Massachusetts, promoted acceptance of the Pestalozzian methods being used in German schools.

The promotion of Pestalozzian principles continued in the United States still later when Dr. Edward A. Sheldon became familiar with the Mayos’ work through publications of the Home and Colonial School Society. In 1861, as the superintendent of schools in Oswego, New York, he retained a Pestalozzian educator to prepare his teachers. This practice of preparing teachers soon became systemized under the normal school model which became popular throughout many states. The “Oswego movement” encouraged an object-oriented approach to education which was easily applied to elementary and industrial education. “Within a decade the ‘Oswego system’ became a fad in American schools and teaching itself was to be significantly altered” (Rust, 1977, p. 118).
Mechanics' Institutes and Lyceums

Just as the Industrial Revolution got its start in Great Britain, so did the Mechanics' Institute Movement. This movement resulted from the efforts of the working class from the turn of the nineteenth century until about 1830. Mechanics' institutes were established primarily for the education of adults who were engaged in mechanical trades and never had the opportunity to receive instruction in the scientific principles that guided their practice. Bode (1968) deduced that the first mechanics' institute was most likely established in 1800 by Dr. George Birkbeck of the Andersonian University in Glasgow, Scotland. Birkbeck apparently offered a series of lectures enhanced with experiments “... and conducted with the greatest simplicity of expression and familiarity of illustration, solely for persons engaged in the practical exercise of the mechanic arts” (cited in Bode, 1968, p. 4). After Birkbeck moved to London in 1804, the concept continued to grow and in 1823 the Glasgow Mechanics' Institution and the London Mechanics' Institution were both formed. By 1841, with the additional support of Lord Henry Brougham, there were 216 mechanics institutes in Great Britain (Bennett, 1926, p. 306).

The first noteworthy mechanics' institute in the United States was established in 1820 by the General Society of Mechanics and Tradesmen of the City of New York. Other examples of mechanics' institutes include the Franklin Institute of Philadelphia, founded in 1824; the Maryland Institute for the Promotion of the Mechanic Arts was formed in 1826; the Boston Mechanics' Institute began in 1827; and the Ohio Mechanics' Institute was established in 1828.
Many mechanics’ institutes were also developed as continuation schools in the United States. They provided instruction in the applied sciences for young adults, most of whom were already apprentices in mechanical trades. Barlow said that in these institutes “practice and science were combined to the benefit of the mechanic and industry” (1967, p. 27). For a small fee, members of these institutes were often provided access to lectures, displays, models, and a library, all of a technical nature. Some institutes, such as the Franklin Institute, even offered to members a reward for “useful” innovations in the mechanical arts (Bennett, 1926, p. 319).

The term lyceum seems to have originated in the United States and was derived from the Greek word λύκειον; the grove at Athens where Aristotle taught. It was applied to an educational experience that was related to the approach of the mechanics’ institutes and can be defined generally as “an institution through which lectures, dramatic performances, debates, and the like are presented to a community” (Bode, 1968, p. x). Bode also said of the term lyceum: “unlike mechanics’ institute it had a universal -- and neutral -- quality” (p. xii). Thus, the unique quality of the American lyceum was the fact that it was not confined to any particular social class. Most often, however, lyceums were organized in small towns to present public lectures which dealt with topics of interest to adults in agricultural and technical professions.

The Manual Labor Movement in the United States

The Industrial Revolution continued to gain momentum and many more Americans began to recognize the opportunity that industrial education could provide. Several institutions modeled after Fellenberg’s school at Hofwyl were formed for American children, and the success that they experienced caused an increased demand for a more practical education. The
Society for the Promotion of Manual Labor in Literary Institutions was founded in 1831 to address the great demand for such schools. However, most schools established under the auspices of this organization focused primarily on academic learning. Coates commented:

The manual labor school was a self-supporting institution in a day when cash was hard to raise. It was not an institution concerned with craft instruction, except in so far as manual labor was necessary to the prosperity of the school. Education in the manual arts was a necessary evil, not an end in itself. (1923, p. 5)

A similar trend was the formation of manual labor academies such as the Rensselaer Institute in Troy, New York, which opened in 1825. This institution merged the study of science with practical experiences to help advanced students improve their understanding of scientific theories and, in turn, reveal the mysteries of mechanical principles. To facilitate this aim, the students would work in local businesses which would then pay the school for their labor (Barlow, 1967, p. 27).

The Influence of Public Education in the United States

The manual labor movement was rather short-lived, often due to the poor administrative practices of the institutions, but also as a result of strong social, political, and economic forces at work in the United States during this period. The general acceptance of the common school, and the Morrill Act, had a tremendous impact on industrial education.

Free schools got their start in Massachusetts as early as the seventeenth century through support by public taxation among districts. Education in Massachusetts continued to be provided in this democratic manner through
the period of the American Revolution and spread into other New England colonies. From 1837-1848, Horace Mann served as the secretary of the Massachusetts School Board where he advocated a change from small district schools to a state system of education. Henry Barnard in Connecticut and Thaddeus Stevens in Pennsylvania also led similar campaigns in their respective states. By the mid-nineteenth century most of the New England and the Mid-Atlantic states were adopting systems of education that were state-wide.

As Midwestern and Western states quickly adopted state systems of education, a distinctive concept of education was formed in the United States. By the late nineteenth century, most of the nation supported a compulsory, secular, and well-articulated educational system under democratic control. However, the school curriculum remained a point of controversy as it did not satisfy the desire of most people for a more practical education.

The Morrill Act of 1862 was a federal response to the public demand for practical education which resulted from the pressure of national economic development. The Morrill Act offered public land to states for the establishment of colleges that would teach science appropriate to agriculture, engineering, and other technical bodies of knowledge. Land-grant colleges, as they became known, also offered liberal subjects for the improved education of the industrial working class.

The Morrill Act provided a great stimulus for industrial education and would influence the future of technical instruction at levels below the college. The state colleges also provoked competition, and private "technical
institutes like Rensselaer, Massachusetts Institute of Technology, Purdue, and others responded to the growing technological demands of American society” (Butts, 1955, pp. 466-467). The result was a dramatic increase in the instruction of technics and the further demise of the traditional apprenticeship system in the United States.

**Industrial Education for African-Americans**

In the South, the movement toward public education was much slower because of political conflicts of interest. Even after the Civil War, progress towards the democratic ideal of equal educational opportunity was extremely slow. Wealthy whites continued to favor typically well-established private schools while common schools very slowly improved the educational situation for poor whites. Education for African-Americans was, however, most often segregated and inadequately funded.

The federally established Freedmen’s Bureau helped to improve the education of African-Americans through the establishment of a number of schools and institutes of higher learning. Among the various operations performed by the Freedmen’s Bureau, one of the most noteworthy was the coordination of the educational ventures of a number of societies, organizations, and other groups such as the American Missionary Association. Up until the abolition of the Freedman’s Bureau in 1872, according to Watson, it had “established 4,239 schools, employed 9,307 teachers, instructed 247,333 pupils and expended for education $3,521,936; the benevolent associations cooperating with the Bureau expended $1,572,287” (cited in Hall, 1973, p. 23).
Hall stated, “immediately after the Civil War when the movement for the education of African-American youth began, a great quarrel started as to whether African-Americans should be given ‘classical education’ or ‘industrial education’” (1973, p. 16). The question soon became a political issue. Conservative African-American leaders such as Frederick Douglass and Booker T. Washington advocated industrial education and were supported, to a small degree, by southern whites. They were, however, opposed by more radical African-American thinkers, such as W. E. B. DuBois, who believed that industrial education was insufficient for offering African-Americans the opportunity to achieve higher aims and acceptance by the American culture.

Nevertheless, Hall has identified that 10 private industrial schools of higher education, 17 private schools of higher education with industrial departments, 11 private industrial secondary schools, 16 public land-grant colleges, and 4 other public industrial schools, a total of 58 technical institutes for African-Americans, had been established during the period from 1865-1900 (1973, pp. 33-200).

One of the first and foremost of these schools was the Hampton Normal and Agricultural Institute of Virginia. The aim of Hampton Institute was declared by General Samuel C. Armstrong, the first principal of the institute, in the following statement:

The thing to be done was clear; to train selected negro youth who should go out and teach and lead their people, first by example, by getting land and homes; to give them not a dollar that they could earn for themselves; to teach respect for labor; to replace stupid drudgery with skilled hands; and to these ends to build up an industrial system, for the sake not only of self-support and intelligent labor, but also for the sake of character. (Gregg, 1923, p. 5)
Founded in 1868, Hampton Institute began receiving federal and state funds in 1870 until it returned to the status of a private foundation in 1920. President of the Hampton Institute Board of Trustees, and former President of the United States, William Howard Taft, wrote in his article "The Influence of Hampton": "it was one of the first great vocational and industrial training schools of this country and one of the first in the world" (Taft, 1923, p. 5).

The Russian Influence

As in the United States, apprenticeship was also being threatened as a method of technical instruction in Russia during the late-nineteenth century. The development of technical education in Imperial Russia has been traced to the reign of Czar Peter the Great (1672-1725). Schurter stated, "... historians concur that Russia's technical education system, as implemented during the last half of the nineteenth century, 'reflected its Petrine legacy.' Peter intended Russian schools to provide practical instruction" (1982, p. 33).

Even through the nineteenth century, the imprint of feudalism had endured in the socio-economic system of Imperial Russia. Nearing and Hardy wrote: "As lately as 1885, the industrial activity of the country was largely confined to the casual home industries engaged in by the peasantry during the winter months when agricultural labor was not possible" (1927, pp. 4-5). Although characteristic of the vast, primitive agrarian setting, serfdom was also extended into developing industries. This occurred as various regions of Russia developed expertise in particular industries, thus beginning Russian participation in the Industrial Revolution, albeit somewhat later than England and many other European nations.
Pannabecker described the environment of Russia during this period as one of great reform, particularly in industry. As the Machine Age emerged, "serfdom became an obstacle to industrial productivity" in Russia (1986a, p. 25). In 1861, the freedom of the serfs initiated the reform that was essential for national economic success. Though many small entrepreneurial industries existed in Russia, they often found it difficult to compete with the state-supported enterprises that became well known for their huge scale and advanced technical nature.

In 1830, the School of Trades and Industries had been formed in Moscow to educate engineers and technicians. During the reign of Czar Alexander II, the School became known as the Imperial Technical School and came under the direction of Victor Della Vos (1829-1890) in 1868. Amidst the industrial reform, Della Vos developed a unique method of instruction for the Imperial Technical School. Rather than relying on imitative learning, which had been the established means of learning through apprenticeship, this new method sought to create a disciplinary approach to the instruction of technics for the purpose of vocational preparation.

The mechanical arts were, for the first time, analyzed and arranged into sequential elements that could be taught to large groups of students together at one time. This was much more efficient and distinctly different than traditional methods. The Russian system that was devised required students to study the theories and processes of mechanical arts in an *instructional shop*. At this level, the students also practiced mundane manual exercises in woodwork and metalwork that usually produced abstract objects of little usefulness. However, only after completion of this instruction were students
allowed to enter the *construction shops* and partake in the technical work carried out there. This work was often contracted through outside sources and provided income for the school.

Bennett described the Russian system as a "more economical and more effective school substitute for apprenticeship" (1937, p. 46). Pannabecker stated that it was "precisely the clear articulation of an instructional system and efficient transfer of technical, manual skills" that stood "in contrast to the highly organized forms of apprenticeship in Western Europe" (1986a, p. 26). The competitive industrial environment within Russia and the lack of national organizations that would oppose systematic mass instruction, such as guilds, helped the Russian system become a success recognized throughout the world.

Following an exhibit in Vienna, Della Vos introduced the Russian system to the United States in 1876. Models for instruction and student work from the shops of the Imperial Technical School were displayed at the Centennial Exposition in Philadelphia.

The exhibits that were shown at this Exhibition were the full size tools, implements, and parts of machinery constructed at these shops by the pupils. They consisted of samples for imitation in learning wood-turning; collections of tools for turning in wood and turning in iron; tools for joiner work and models for imitation in learning joining; collections of blacksmiths' tools and models for imitation in learning blacksmiths' manipulations. Several cases contained parts of large engines and machines. (Ingram, c. 1876, p.31)

Golovin wrote, "educators paid studious attention to the exhibits sent by the highly developed schools for training mechanics and engineers in Moscow and St. Petersburg" (1976, p. 183). John D. Runkle (1822-1902),
President of the Massachusetts Institute of Technology (MIT), was exhilarated by this Russian exhibit and the pedagogical methods that the Russians had used. Inspired, he quickly acted to revise the instructional approach of the engineering program at MIT to include student experiences in a workshop environment.

Runkle soon established a series of shops to facilitate the combination of practical ability with the theoretical knowledge acquired by engineering students at MIT. Luetkemeyer posited that engineering schools in America had commonly borrowed the best aspects of other systems. He stated:

The organizational patterns and methods of teaching were derived from the English, curriculum models and the concept of a professional engineering school were French in origin, the teaching of the mechanic arts was adapted from Russia, and the research ideal came from Germany. (1986, p.35)

Schurter explained that especially in “the 1860s and 70s, U.S. educators intensified their search for an efficient way to offer practical training to prospective engineers” (1982, p. 3).

However, Runkle also saw potential for such practical instruction beyond the realm of the engineering program at MIT. The year following the exposition, in 1877, the School of Mechanic Arts of MIT was established “for those who wish[ed] to enter upon industrial pursuits, rather than to become scientific engineers” (Stombaugh, 1936, p. 25). The manual instruction was planned as an integrated part of an otherwise liberal education for students below the college level. The work accomplished by these students was not intended to provide income to the student or the school, a clear distinction from the Russian Imperial Technical School and the earlier manual labor academies.
Runkle and John M. Ordway, the vice-president of MIT, also discussed the inclusion of training in the mechanic arts for boys in public schools, and even the establishment of special mechanic-arts high schools. Runkle has been credited with stating "...I believed that this discipline could be made a part of general education, just as we make the sciences available for the same end through laboratory instruction" (Bennett, 1937, p. 321).

Workingmen's Schools

Although all states had declared education compulsory for all children, this goal was far from being realized by the late nineteenth century. A vast number of students were still deterred from the benefits of an education by the financial status of their family. For this reason, in 1879, Felix Adler of the Ethical and Cultural Society of New York City founded the Workman's School for children of working class families who would otherwise not send their children to school. Influenced to a great extent by Froebel's style, Adler employed industrial activities in such a manner as to correlate them with the more fundamental subjects such as mathematics, reading, and writing. Adler's goal was to provide rudimentary academic instruction along with domestic and mechanical arts education.

In 1907, Adler authored the book The Workingman's School and Free Kindergarten, describing the Workman's School and other schools in the United States modeled after this institution. Usually located in destitute areas of larger cities, the majority of workingmen's schools that developed were supported by early promoters of social reform. Evidence of this prompted Herschbach to write, "the earliest advocates of industrial education were not
educators, but social reformers” (1981, p. 4). It is true that many social reformers did in fact contribute to the growth of industrial education. However, much evidence has already been provided regarding earlier forms of industrial education that existed in the United States prior to the rise of social reform. It would also be implausible to assume that all early advocates of industrial education considered themselves to be social reformers.

**American Manual Training**

Another person who influenced the development of industrial education in the United States was Calvin M. Woodward (1837-1914), Supervisor of the Polytechnic Department of Washington University in St. Louis, Missouri. Although Barlow suggested that Woodward had “overlooked” the Russian exhibit (1967, p. 38) at the Centennial Exposition, immediately following that event Woodward conducted a study of the Russian system, relying somewhat on corroboration from Runkle. Also, in 1904, Woodward stated: “when I went to the exhibition in Philadelphia in 1876, there was not a school exhibit from any place in the United States that had any manual training in it” (p. 46). It might be inferred from this statement that Woodward did witness exhibits from other nations, such as Russia, that were on display and did involve manual training.

For several years Woodward had promoted a form of industrial education that he referred to as “manual training.” Woodward defined manual training as “…the systematic study of the theory and use of common tools, and the nature of common materials, elementary and typical processes of construction, and the execution and reading of working drawings” (Woodward, 1905, p. 1019).
Bennett provided an interesting account of the conditions that first motivated Woodward to become involved in the instruction of technics. Bennett wrote:

As a professor of mathematics in the University, he [Woodward] taught a class in applied mechanics. Because some of his students found difficulty in visualizing some of the forms under consideration, he asked them to work out these forms in wood. (1937, p. 318)

Woodward had taken for granted that the young men in his classes could carry out such instructions. He soon discovered, however, that many of the students were incapable, and in 1871, made plans to furnish a workshop for the instruction of such fundamental manual skills.

This new diversion had also been influenced by the Boston Whittling School, started in 1871, which merged into the Industrial School Association in 1876. The purpose of the Industrial School in Boston was to give boys, aged twelve to sixteen, “... an acquaintance with certain manipulations which would be equally useful in many different trades” (Stombaugh, 1936, p. 22).

It was Woodward’s firm belief that manual training was worthwhile for all students, including those below the college level. In 1877, Woodward acted on his beliefs as indicated by this account:

In the shops of the polytechnic department of Washington University a class of some 30 boys from Smith Academy, a preparatory school of the university, were given systematic instruction in the care and use of tools, in addition to the usual high-school curriculum. We may fairly say that for the first time in the history of America manual training becomes a part of general secondary education. (Coates, 1923, p. 15)
In 1880, Woodward established the first manual training high school in the United States, admitting fifty boys selected by examination. This school did not teach specific trades or prepare its students for any specific vocation but it did provide an appropriate foundation for further industrial education by delivering a broad, fundamental training in the elements of industrial trades. The manner in which students achieved this goal was through drafting exercises and shopwork in metal and woodworking, presented through tool instruction methods much like those employed in the Russian system. Activities generally consisted of rote exercises designed to give practice using tools.

In 1889, Woodward declared, “the atmosphere of the shops is that of a school, where it is the sole business of an educated teacher to illustrate the principles of mechanics, to analyze tools and processes, and to give scientific explanations and instructions” (Coates, 1923, p. 75). Indeed, the teacher was the hub of all activity in the classroom. Also, the education of “... the whole boy...” was Woodward’s ideal (1887, p. 897), so the combination of classical education with manual training, in equal parts, was essential to the St. Louis Manual Training School.

In her article titled “The St. Louis Manual Training School - A Future Oriented School,” Zuga wrote:

Not only did Woodward recognize the social-economic aspect of manual training, but he argued that all educational efforts should have this value. By stating this he strengthened the position of manual training in the curriculum and gave himself a basis for citing the unique contributions of manual training. (1980, p. 94)
The model of Woodward's manual training program was in fact duplicated by other privately-supported endeavors such as the Chicago Manual Training School. This school was opened in 1884 as the first manual training school established with no connection to an institute of higher education.

However, it was in the public schools that manual training would have the greatest impact on the destiny of industrial education. The Baltimore Manual Training School, also formed in 1884, "was the first institution of this type to become an integral part of a city public school system, tax supported and free to the residents of the city" (Stombaugh, 1936, p. 50). Manual training was developed in many public schools under the sponsorship of individuals such as Jessup W. Scott of Toledo, Ohio, Mrs. Lucy Boardman of New Haven Connecticut, and James H. Stout of Menomonie, Wisconsin. Organizations, such as the Industrial School Associations of the Boston area, also served to sponsor programs.

The eventual weakness of manual training as a form of technical instruction was in the strong influence of the Russian system. According to R. Lee Hornbake: "Manual Training was foreign in its place of birth, in its educational, social and political medium, and in its economic outlook" (1947, p. 5). Although Woodward and many others worked diligently to mold manual training into a program unique to American education, the fact remained that its roots were from a system that had much different aims. As a result, manual training was prone to further modification.
The Sloyd System

Another foreign concept embraced by Americans was the sloyd system. The term *sloyd* was derived from the Swedish word "Slojd" meaning dexterity, manual skill, or artistic skill (Martin & Luetkemeyer, 1979, p. 27). Sloyd was first introduced as a form of instruction in schools that were similar to the "schools of industry" in Germany. The student work produced in sloyd schools was sold and often there was little consideration given to the educational value of such technical knowledge.

According to Feirer and Lindbeck, Uno Cygnaeus (1810-1888) of Finland "was the first to draw a sharp distinction between the sloyd schools and the idea of sloyd instruction for elementary schools" (1964, p. 9). During Cygnaeus' lifetime, Finland was largely an agricultural state under the rule of Czarist Russia. Following the end of the Crimean War, marked by the Treaty of Paris in 1856, Finland was prompted by Czar Alexander II to undergo a National reform. This reform was to include the development of a state educational system. By the year 1867, a complete system of primary level folk schools had been established in Finland under the direction of Cygnaeus (Nurmi, 1991, pp. 5-8).

In doing so, from the Autumn of 1858 to the Autumn of 1859, Cygnaeus had traveled through Europe where he became familiar with the philosophy of Pestalozzi and witnessed the pedagogy of Froebel. Their ideas were beneficial to Cygnaeus, who in 1861, was appointed the chief inspector of primary schools by the Czar. Cygnaeus' major concern was the establishment of the elementary school as "the foundation of all further schooling, whether
general education or vocational training” (Nurmi, 1991, p. 12). In 1863, Cygnaeus was instrumental in the establishment of a normal school to prepare teachers for the elementary schools.

Woodworking as a school subject, or sloyd, was an essential element of the four-year instructional program for the teachers who, in turn, carried it into the elementary schools. Thus, “Finland was first in the world to introduce handicraft in the syllabus of [the] elementary school” (Nurmi, 1991, p. 14). This practical aspect of Cygnaeus’ ideology rose from the growing industrial development of Finland and the desire to improve the welfare of the lower classes during the period.

Around 1872, in nearby Sweden, a gentleman named August Abrahamson supported the establishment of an industrial school in Naas, Sweden, by his nephew, Otto Salomon (1849-1907). This school was intended primarily to provide boys of working class families with skills that would allow them to enter a wide variety of trades. Two years later, a school for girls was added that offered instruction in crafts considered typical for women. In 1875, Abrahamson and Salomon, like Cygnaeus, also established a normal school to prepare teachers of sloyd.

As the demand for sloyd instruction spread to Sweden, the general feeling among educators at that time was that sloyd would be most effective as part of the education delivered in folk schools rather than the German industrial school model. In 1877, Salomon traveled to Finland where he visited with Cygnaeus and learned of the system that Cygnaeus had developed. Salomon then set out to conduct a scientific study of sloyd in order to establish a specific body of knowledge that he called educational sloyd.
In order to achieve this objective, Salomon conducted an analysis of the processes involved in sloyd instruction. This analysis was similar to the analytical approach that Della Vos used to arrange the elements of mechanical instruction in Russia. However, as Bennett clearly stated:

In no respect was there a greater contrast between the Russian system and the Swedish system as developed by Salomon than in the aim of the work. The Russian system was definitely devised to train skillful, intelligent mechanics. In modern terms, its purpose was purely vocational. The Swedish, on the contrary, was for purposes of general education; it was considered valuable for every child. (1937, p. 67)

In devising the system, Salomon concluded that educational sloyd would necessarily be limited to one specific form of sloyd. He settled on wood-sloyd since the material was readily available and commonly used throughout Scandinavia. He also recognized that the variety of tools and techniques employed in woodworking would lend versatility and generality to the instruction. The work that students executed was project-oriented and involved the duplication of a model. Each model that they duplicated became increasingly more complex in construction. Intrinsically, the models were useful and aesthetically pleasing.

The instructional methods used in educational sloyd were also unique because they were carried out on an individual basis. Students were encouraged to work at their own pace within a rigid sequence of instruction. The aims that Salomon set forth in The Theory of Educational Sloyd were mostly affective, formative goals. In general, he hoped that educational sloyd would instill a firm work ethic, an independent outlook, good habits, a sense of aesthetics, and physical ability.
American Sloyd

In 1884, Sloyd was first introduced in the United States by Lars Erikson, who initiated a sloyd school in Minneapolis, Minnesota. However, the Sloyd Movement in the United States really began in 1888, under the leadership of Gustaff Larsson (1861-1919). Upon his arrival in Boston, Larsson immediately became involved in teaching sloyd to children in a private school. He quickly won the favor of Mrs. Quincy A. Shaw, a Boston philanthropist who founded the Sloyd Training School in which Larsson then taught. This school soon became a training center for teachers of sloyd. Initially, Larsson taught according to the well-organized system established by Salomon. However, as he became acquainted with American manual training, he realized the emphasis placed on mechanical drawing and combined it with his methods to form what he called American sloyd.

Larsson was confident that the methods of the sloyd system were inherently better than the existing practices in manual training. An experiment soon began in the public schools of Boston to determine whether sloyd or Russian methods were more effective for the instruction of manual training. The result was a compromise between systems. Regarding this, Bennett wrote:

It was recognized that by accepting some of the so-called principles of the Swedish sloyd while continuing to apply some fundamental practices of the Russian system and harmonizing these with the best American practice in the use of wood working tools, Boston had produced an American system of manual training that was pedagogically sound and practical. (1937, p. 434)
In 1893, three Boston schools sent exhibits to the Columbian Exposition in Chicago. They were so well received that manual training experienced a sudden resurgence, and spread more readily into elementary schools due to the sloyd influence. Many schools throughout the nation started new manual training classes, particularly in the seventh, eighth, and ninth grades of the grammar school. There were, however, many critics of manual training around the turn of the century.

Manual Arts

As manual training made a place for itself in American public education, there was a growing concern regarding the utilitarian tendencies of this instruction. Sloyd had introduced the study of form, and the appreciation of aesthetics, to manual training. Also, the Arts and Crafts Movement had been growing for several years, with the principle of design central to its philosophy. It had started in England primarily through the initiative of individuals such as John Ruskin (1819-1900), a writer, art critic, and social reformer, and William Morris (1834-1896), a poet, artist, and craftsman. These men were concerned over the poor design and lack of craftsmanship that had become characteristic of the Machine Age. “Similar groups, such as the Werkbund in Germany, the Art Nouveau in France, and de Stijl in Holland dedicated themselves not so much to a preservation of craft traditions as to a search for a rationale for Machine Age design” (Lindbeck, 1972, p. 29).

In the United States, the Arts and Crafts Movement received encouragement from people such as Charles Leland, a former student of Morris. In 1880, Leland proposed to the Committee on Industrial Education of
Philadelphia a system of manual training similar to the *Home Arts Movement* that he had helped to promote in English schools. The same year, his proposal was approved and funded, thus aiding the establishment of the Philadelphia Public Industrial Art School. Leland taught in the school for three years before returning to England, and then J. Liberty Tadd carried on the emphasis of design in manual training. Tadd devised an original program consisting of four areas: drawing, designing, clay modeling; and woodcarving. Another unique feature of his method was that students would rotate through these activities (Stombaugh, 1936, pp. 103-107).

The term *manual arts* was first used in 1893 at the New York College for the Training of Teachers, a part of Columbia University. It was used to describe the newly formed Manual Arts Department of that school and the building in which it was housed, the Macy Manual Arts Building. Charles A. Bennett (1864-1942), served as the director of “the first two-year program for the training of manual arts teachers in the United States” (Barlow, 1967, p. 173). Following this example, Dr. James P. Haney promptly used the title for such programs as taught by those teachers in the New York City public elementary schools.

The instructional methods used by advocates of manual arts were not based on an analysis of industry and tool processes, but received most of their directive from a study of materials, or media, and craft-oriented processes. The project became the basis of instruction. Students involved themselves in the design process of a project that they would then manufacture. Skill development and knowledge of technical processes were considered the means to an end; they were secondary to the primary goal, appreciation for aesthetics and quality craftsmanship.
Bennett and Robert W. Selvidge (1872-1941), of the University of Missouri, in seeking to improve the preparation of teachers in manual arts, scheduled a meeting of Midwestern leaders of manual arts teacher training in November, 1909. They organized another conference in 1913 and from then on it became an annual occurrence. The Mississippi Valley Manual Arts Conference, as it is known, served for several years as the primary venue for the advancement of manual arts through the sharing of ideas and discussion of issues. In recent years, the Conference has continued to carry on this rich tradition.

Although the existence of manual training and manual arts programs overlapped, Barlow estimated the duration of the Manual Arts Movement as ranging roughly from the year 1894 to 1910 (1967, p. 240). Yet, the term “manual arts” continued in use for many years. For instance, as late as 1917, Bennett (who was then the “Dean of Technology” at Bradley Institute in Peoria, Illinois) authored a book titled *The Manual Arts* In this book, Bennett held firm in support of the term “manual arts.” Bennett also proposed a program for public schools that would “be regarded as both subject and method” (p. 27). Although the name “manual arts” became obsolete, the system that Bennett proposed had merit. Many of Bennett's ideas came to fruition through the advent of industrial arts, which had just been conceived about the time of his book. However, the emergence of vocational education had attracted greater attention during this period, and it would have a significant effect on the development of industrial arts.
Advocates of the Arts and Crafts Movement were not the only critics of manual training. During this formative period of industrial education, there were several who believed that the public schools should offer specific occupational training to students, and there were several good reasons to support such a view. First of all, there was a constant increase in the number of students enrolling in the public schools. Attendance by children of the working class and the poor meant that some distinctive changes would need to be made in providing instruction. Second, there was a growing demand from industry for trained mechanics, or factory workers. Third, the apprenticeship system was in decline and was not appropriate for industry. Also, a small number of private trade schools had endured for several years and successfully turned out young trained mechanics. Finally, many youngsters dropped out of public schools to enter the workplace before they reached the manual training high schools. As a result, these youth were poorly educated and certainly not well prepared before entering the labor market.

At the turn of the century, many of those involved in manual training instruction thought it was a good idea to offer specific training. Often, efforts were made to provide vocational training through evening classes utilizing the public school shops. Some manual training schools began to focus primarily on vocational preparation and molded the curriculum around specific trades. Bennett classified these as technical high schools and gives several examples such as the Technical High School at Springfield,
Massachusetts (called the Mechanic Arts High School after 1898); Stuyvesant High School in New York City established in 1904, and the Lane Technical High School in Chicago, founded in 1908 (1937, pp. 384-386).

In 1905, the Governor of Massachusetts, William L. Douglas, created a Commission on Industrial and Technical Education for the Commonwealth of Massachusetts, which is now commonly referred to as the “Douglas Commission” (Barlow, 1967, p. 48). The Douglas Commission, chaired by former U.S. Commissioner of Labor Carroll D. Wright, investigated the needs of industry in regard to education by means of public hearings accommodating 143 witnesses. Susan M. Kingsbury also conducted a special investigation into the relationship of children to school and industry.

In 1906, the Douglas Commission reported that there was a need for skilled workers who also had a capacity for “industrial intelligence,” defined as the “... power to take in the whole process, knowledge of materials, ideas of cost, ideas of organization, business sense, and a conscience which recognizes obligations” (Bennett, 1967, p. 513). The report also questioned the position of the United States on the competitive world market. Kingsbury reported that there had been approximately, “25,000 children in Massachusetts who were fourteen and fifteen years of age and not in school, five-sixths of whom had not been graduated from the grammar schools and one-half of whom had not gone beyond the seventh grade” (Krug, 1964, p. 221). Kingsbury argued that technical education could keep these students enrolled in school while providing them with skills needed in specific occupations.
To address the needs of educating the masses, the Douglas Commission recommended that all elementary schools in Massachusetts should develop an appropriate form of industrial education, and that high school mathematics, sciences, and drawing courses attempt to relate more directly to applications in local industries. Also, and most importantly, it recommended the formation of a second commission to establish an industrial-school system intended to be the separate counterpart to the comprehensive public school system.

In the President's "Annual Message, December 3, 1907," Theodore Roosevelt declared "our school system is gravely defective in so far as it puts a premium on mere literacy training and tends therefore to train the boy away from the farm and the workshop" (Roosevelt, 1907, pp. 30-31). This Congressional address brought the issue of vocational education to the level of national prominence. In 1909, Dr. David Snedden became the new State Commissioner of Education and hired Charles A. Prosser, who was qualified in law and educational administration, for the position of State Director of Vocational Education. Together, they worked with the members of this commission to develop the first state-supported network of vocational schools operating in conjunction with the comprehensive public schools.

John Dewey

Once referred to as "America's philosopher" (Eastman, 1953, p. 38), John Dewey (1859-1952) has become well known as a devout pragmatist. Dewey's prominence transpired primarily due to his considerable influence on education in the United States. One of the many educational issues that Dewey contemplated was the social aspect of the educational experience, that
is to say, how well children were prepared as members of society within and beyond the realm of the school. In 1889, Dewey proposed an educational system which would reflect that inclination.

Dewey’s plan placed the study of industrial occupations at the center of the elementary school curriculum (Land, 1979, p. 255). In context, the term occupation was not intended by Dewey to mean “vocation.” Dewey wrote, “by occupation I mean a mode of activity on the part of the child which reproduces, or runs parallel to, some form of work carried on in social life” (1899, p. 131). Around this theme, all other subjects would be learned and then applied. Above all, Dewey believed that education should relate directly to experience. This study of industry was to be a part of general education. Colelli stated, “John Dewey’s ‘Psychology of Occupations’ identified industry (rather than selected trade skills) as a unique social institution that should be studied from a liberal arts perspective by all individuals” (1989, p. 2).

Regarding educational psychology and instructional methods, in an article for The Second Supplement to the Herbart Yearbook of 1895, Dewey stated, “Herbartianism seems to me essentially a schoolmaster’s psychology, not the psychology of a child” (1899a, p. 29). This comment reflected Dewey’s pointed opposition to teacher-centered and content-centered instruction since he firmly believed that the learner should be the center of instruction. From the same source, Dewey stated “... we need a pedagogy which shall lay more emphasis upon securing in the school the conditions of direct experience and the gradual evolution of ideas in and through the constructive activities...” (1899a, p. 29).
Thus, it is not surprising that Dewey was an enthusiastic supporter of manual arts and contributed to the improvement of the project method of instruction. His direct relationship with this field became evident through his work in the Experimental School of the University of Chicago. Here, Dewey encouraged tactile learning and the use of hand-tools while putting into practice the curriculum that he had proposed. In 1899, Dewey authored The School and Society, in which he pointed out the industrial nature of society at that time and described the successes of his school. Undoubtedly, Dewey's pragmatic ideals laid the foundation for the content and methods of the emerging industrial arts.

The Inception of Industrial Arts

Around the turn of the century, several leaders in industrial education began to recognize that the varied emphases placed on programs across the United States were causing the field to digress. Ira S. Griffith (1874-1924), who was well known for the development of a number of textbooks specific to the instruction of industrial education, wrote the following in 1912:

It is hoped that of our past experiences with the joint-making Russian system with its admitted disciplinary value, the Swedish modelmaking with its effort to utilize the energy of the worker toward useful products, and the self-expression of the pedagogical movement with its attendant elements of interest and initiative, there may come a manual training practice that shall be marked by a combination of the best of these elements, with a consequent elimination of the weaknesses of each. (cited in Bawden, 1950, p. 61)
Also during this period, dissatisfaction arose regarding both the titles and the content of manual training and/or manual arts. Charles R. Richards (1865-1936) is commonly recognized as the first to suggest that the term “industrial arts” replace these terms. His editorial, “A New Name” was published in the October, 1904 issue of Manual Training Magazine. In this feature, Richards made it clear that he considered the title “manual training” a misnomer by the following statement:

> Behind every other subject in the curriculum is a body of ideas of fundamental meaning and importance. The industrial arts which stand for one of the most vital phases of modern civilization, throw away their claim to recognition by masquerading under a term at once inappropriate and misleading. Such a term is both an obstacle to the full and free development of our work and to its recognition and appreciation on the part of the public. (p. 32-33)

However, Richards ought not be considered the “inventor” of the term “industrial arts,” as Olson has referred to him (1963, p. 8), since there is evidence of its prior use in a variety of contexts. In the same source, Olson himself recognized that “the terms industrial art and industrial arts had been used much earlier than 1904 in connection with schools for teaching art as applied to industry in England, France, and Germany” (1963, p. 6). Martin and Leutkemeyer identified the use of the term in 1901 by Clara Mitchell, a teacher in Dewey’s Laboratory School (1979, p. 30). She no doubt adopted this directly from Dewey who had earlier used the term in his book The School and Society. An even earlier use of the term in a related context occurred in December, 1885, when Calvin Woodward delivered an address before the Social Science Association of Philadelphia. An excerpt of that address is as follows:
In industrial art, we are continually stimulated by the presence of the object, and the operations we are performing; and our perceptions are clear, positive, and exact. The concentrated attention, the close observation, the ingenuity, invention, and judgment in use in art are far superior as mental discipline to any that literature can give. (Woodward, 1887, p. 219)

However, Bennett, in an article titled "What’s in a Name?," traced the term to as far back as 1882. In proposing a new course to a committee of seven prominent New England educators, a gentleman named John Clark was said to have used the name "industrial arts" (1934, p. 239).

While Richards' article did indeed contribute to the eventual acceptance of the term "industrial arts," it was the entire practice of manual training/manual arts that he had wished to alter. Richards, influenced by Dewey, dismissed the restrictive and formalized methods of these programs as inappropriate for general education. Unfortunately, Richards left the field of education prior to contributing markedly to any change in the substance of industrial arts education.

Soon, however, the title "industrial arts" was used to describe a new educational approach made popular through the efforts of Frederick G. Bonser (1875-1931), referred to by McPherson (1981) as "the founder of industrial arts education," and James E. Russell (1864-1945), Dean of the Teachers College at Columbia University. Bonser and Russell's new approach would address the "life needs" of young learners. McPherson stated: "This philosophy was an evident rejection of both the traditionalists' approach to education and of the manual training movement" (1976, p. 350). McPherson later added: "They denounced manual training and clearly distinguished between vocational and industrial arts education" (1981, p. 39).
It is clear that Bonser and Russell, like Richards, were highly influenced by Dewey, but also by the social efficiency movement that took place in the United States at the turn of the century. During this period of American history, the rapid modernization of such a massive industrial nation was causing some growing pains. In order to prevent political and economic chaos, some form of order was required. As a result, the government stepped in to provide services and regulations that would carefully guide the progress of American society. This widespread social reform movement also found a place in the schools. For such matters as the "Americanization" of immigrants, the reduction of crime, and the abolishment of alcoholic beverages during the Prohibition, schools were discovered to be useful agents of social control. David Snedden, a supporter of vocational education, was one of the leading advocates of social control. Dewey, who was more moderate, preferred to view the school as an agent of social service, in which the school served the interests of the people in the community rather than determining their interests.

By 1910, education for social efficiency had become the popular trend, encompassing both major aspects of reform: control and service. Krug stated:

In the end, social efficiency conquered all, and it absorbed even industrial education, the topic that had so long dominated pedagogical discourse. It was largely under the banner of social efficiency that school men began to talk of industrial education as only one part of a comprehensive school program. Social efficiency reinforced the growing dislike of separate high schools of commerce or manual training. (1964, p. 276)
The inclusion of industrial education in the comprehensive school clearly reflected the doctrines of the social efficiency movement, however, it did create some antipathy. Krug continued:

There was nothing inherently antiacademic in the development of these practical subjects. Neither was there in the idea of social efficiency itself. As it happened with industrial education, however, the discussion of social efficiency set up in the minds of many educators and others who wrote and talked on the subject a sharp conflict between the academic and the practical. (1964, p. 278)

In 1910, Bonser was hired by Russell as a Professor of teacher education in the Teachers College at Columbia University. These two men combined the best of the theories and methods that had previously existed with some new ideas and hypotheses to form a curriculum for public schools that was representative of the arts of industry. This became known as The Industrial-Social Theory, or The Russell-Bonser Plan. Bonser applied this plan in the Speyer demonstration and experimental school of the Teacher’s College and published The Speyer School Curriculum in 1913, one of the earliest attempts to form a course of study for industrial arts.

The general shop was another spin-off from Bonser’s experiments in the Speyer School. Snedden and Warner recognized that “... there was created a new type of shop known as a general or composite industrial shop or laboratory. This type of shop was designed because it more nearly answered the needs and demands of the new theory of organization...” (1927, p. 8). Bennett, who typically favored the traditional approach of manual arts, commented on the general shop in 1923 by stating: “someone said that the general shop is at its best, a scheme for relieving the teacher of the necessity of
organized class instruction, and, at its worst, a chaos of confusion which we should not tolerate" (p. 35). The general shop was designed to permit a single teacher to simultaneously supervise student activities related to a variety of technical areas. The issue apparently thrived at the Mississippi Valley Conferences and Lemons wrote “discussions about the general shop began in 1923 and were still raging in 1930” (1988, p. 55).

Bonser originally became involved with industrial arts because he considered it a good way to improve elementary education. His background, and the emphasis of his work, had been based in elementary education. Over a period of several years, he contemplated and issued a number of definitions for industrial arts. Then, in 1924, Bonser, and his colleague Lois Coffey Mossman, published what is now considered a classic definition of industrial arts in their book *Industrial Arts for Elementary Education*. It declared the following:

*The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to those changes.* (Bonser & Mossman, 1924, p. 5)

The Bonser-Mossman definition is recognized as the inceptive standard description for all levels of industrial arts. However, in 1924 it added somewhat to the confusion caused by the various related programs that existed. The term “industrial arts” was not immediately accepted throughout the profession. Lemons noted “… that while the term industrial arts did not appear in the MVC [Mississippi Valley Conference] program in 1930, in 1931
the term was included in two topic titles, and in 1932 it dominated the Conference" (1988, p. 55). The titles “manual arts” and the nearly obsolete “manual training” were often used interchangeably with “industrial arts” even though they actually represented subtle philosophical differences.

Many people also failed to distinguish between the different aims of industrial arts and vocational education. However, vocational education was receiving support in ever-increasing proportions, which became abundantly clear through the Smith Hughes Act of 1917.

**The Smith-Hughes Act**

In 1906, James Haney and Charles Richards organized meetings that resulted in the founding of the National Society for the Promotion of Industrial Education (NSPIE). The primary objective of the NSPIE was to gain federal support for industrial education. Although both Haney and Richards had been proponents of manual arts, the NSPIE sought aid primarily for vocational education, following the trend started in Massachusetts by members Prosser and Snedden. The first President of the Society was Henry S. Pritchett, also President of Massachusetts Institute of Technology.

After several attempts to shape a bill satisfactory to both the Society and Congress, in 1914, the Commission on National Aid to Vocational Education was formed by appointment of President Woodrow Wilson. The commission consisted of nine members, mostly representative of government and business or labor organizations, but also included Charles Prosser, who rose to become the principal author of the forthcoming legislation. The Commission utilized a widely distributed questionnaire, heard several speakers, and deliberated on the issue over a period of two months.
The report of the Commission was understandably delayed on the Congressional agenda due to the impact of the war in Europe. However, in 1915, the Commission presented its report to Congress. The report essentially described the need for vocational education, the types of vocational education that ought to receive assistance, and the extent of the support required. Following the report, Senator Hoke Smith presented Senate Bill 703, and Representative Dudley Hughes introduced House Bill 11250, requesting aid for vocational education (Barlow, 1967, pp. 61-62). Since both Smith and Hughes were from Georgia, they were undoubtedly interested in this legislation primarily for funding that would become available for instruction in the area of agriculture, one of the major vocations in that state.

In 1916, President Wilson was re-elected on a campaign for peace, however, American involvement in the war was nearing. In July of that year, the Senate passed Bill 703 and, in December, President Wilson encouraged the House to act in a similar fashion. They did, and on February 23, 1917 President Wilson signed the “vocational education bill.” A few months later, Charles Prosser, the Director of the newly established Federal Board for Vocational Education, announced the policies for the distribution of $1,860,000 in grants for that fiscal year. Any program that provided trade and industrial education, agriculture, or home economics was eligible to receive funding.

Luetkemeyer substantiated that the Smith-Hughes Act was based on the philosophy of social control, and attributed this to the extensive influence of Prosser and his mentor, Snedden. According to the Snedden/Prosser paradigm, vocational education would provide an occupation, and therefore a place in society, for those students deemed the “rank and file” by Snedden.
This was to be accomplished through an entirely separate educational system supported by federal and state funding. Luetkemeyer wrote: "Although many in the industrial education movement were opposed to the Snedden/Prosser model of vocational education, the passage of the Smith-Hughes Act established this form of vocational education in the public school system" (1987, p. 38).

There were now two similar, yet distinctly different, forms of industrial education provided for by the American public educational system. Traditional general education programs, whether they were called manual arts or industrial arts, were now in company with the new vocational education program. Despite the educational aims of either program, however, all student efforts suddenly turned to support the needs of World War I. Less than six weeks after the signing of the Smith-Hughes Act, Congress had declared war against Germany. Although the Smith-Hughes Act was initially overshadowed by World War I, the ramifications of this Act were soon to be realized.

Expansion of Industrial Arts following World War I

Although vocational education drew some secondary students away from general education programs related to industry, the growth of manual and industrial arts curricula actually increased during the 1920s. This can be attributed to the increasing acceptance of public education and the effective enforcement of compulsory education laws which increased the number of students attending public schools. "By 1920, fully 78 percent of all children between ages five and seventeen were enrolled in public elementary and high schools; another 8 percent were in private and parochial schools" (Norton et al., 1986, p. 598).
The junior high, or intermediate, school was a critical area of growth during this period. At first, intermediate schools were created to appeal to the popular political position of the vocational education movement and offered vocational education to students as early as possible. In 1910, "a subcommittee of the NEA Committee on the Place of Industries in General Education, deploring what it called a tendency in school administration to deflect vocational education 'toward general or liberal ends,' recommended intermediate industrial schools" (Krug, 1964, p. 239). Several of these schools existed, but the majority of educators preferred the idea of offering vocational courses to children fourteen years of age and younger in a general educational setting.

Also around 1910, "introductory high schools" began to emerge. This concept caught on quickly, and spurred the junior high school movement. As the influence of the progressive education movement reached most schools, vocational preparation was no longer considered appropriate at the junior high level. As Sredl stated, "the weakness of this philosophy soon became evident and by the 1920s most of the junior high schools had abandoned purely vocational programs" (1966b, p. 34).

The aim of progressive education, fostered by Dewey and John W. Eliot (1834-1926), was "to develop initiative and resourcefulness in the pupil and to make him master of his environment, rather than to cram him with undigested information, in order that he may pass examinations and acquire degrees, while his soul is fettered by the many demands of the system" (Association for the Advancement of Progressive Education, 1919, p. 353). By the 1930s, manual and industrial arts programs had become firmly established.
in the junior high school setting and were growing increasingly popular at all levels of general education.

**Content and Methods of the 1920s and ’30s**

Barlow identified the 1920s as “the bird house era” of manual and industrial arts and carried on a somewhat lengthy discussion of the bird house “obsession” during this period (1967, pp. 257-265). Initially, this activity emphasized the design aspect of constructing different houses for different types of birds. The preoccupation with bird houses was inspired by the Audubon Society and became representative of the popular project method of instruction used at this time. Projects were indeed a dominant method in the 1920s and continued as such for several decades; however, interest in the bird house slackened during and after the Great Depression.

Despite this economic disaster, enrollment in manual and industrial arts programs continued to grow, but their focus began to change. *Household mechanics* became yet another popular approach to the instruction of technical knowledge in general education. Although some actually started in the 1920s, many household mechanics programs thrived during the hard times that occurred from around 1929 to 1932.

In 1934, Albert F. Siepert, the Dean of the Department of Education at Bradley Polytechnic Institute, identified three primary instructional methods which included the demonstration (or imitative) method, the project method, and problem solving methods (Bennett et al., 1934, pp. 87-94). He also mentioned tendencies related to facilities including the general shop concept, introduced by Bonser and further developed by Griffith prior to World War I.

In the early 1930s, a modified general shop approach was introduced by
William E. Warner (1897-1971), who as a student had been exposed to such eminent personalities as Bonser, Dewey, Griffith, Russell, and Snedden. Warner, an assistant professor of industrial arts education at The Ohio State University since 1925, referred to his system as the laboratory of industries and, although it was not immediately considered a great success, it served as the harbinger of future programs that emphasized the technological nature of society. In 1969, Warner reflected:

```
About this idea of where the curriculum should go, that worried us. It first came with the concept of the general shop which was an enrichment device. It had more than one media. The general shop is four or five media. And, a general shop involved different types of treatment organizationally, management-wise, that we never had in the old days. (Blankenbaker & Erekson, 1991a)
```

Warner also contributed to the major curriculum development project undertaken by the Ohio State Committee on Coordination and Development of Industrial Arts Professional Interests in Ohio completed in 1934 and titled *A Prospectus for Industrial Arts in Ohio*. This document included a review of the principal bases upon which industrial arts programs stood and introduced an interpretation of industrial arts based on the needs of children according to their manipulative impulses, investigative impulses, art impulses, and social impulses (State Committee on Coordination and Development, 1934, p. 33). The *Prospectus* organized content and activities for secondary school programs from a much wider range of industrial processes than had been typical of that period.
This curriculum provided Warner the opportunity to fully utilize the laboratory of industries. With the financial assistance of the State Department of Education, as well as some local and Federal aid, Warner established a number of demonstration programs that would showcase the new type of instruction and facility. Latimer proclaimed:

These programs were successful and influential. They demonstrated that a broad, comprehensive program of industrial arts as general education could be carried out in a variety of situations. Many people from Ohio and other states came to observe at these centers. (1981, p. 46)

By design, the instructional methods used in most of these model programs promoted exploratory experiences with materials, processes and products of industry rather than stressing prevocational training.

A Growing Image Problem

Unfortunately, the problem regarding the overlapping images of vocational programs and a number of related general education offerings persisted. During the 1920s and 1930s, there were several attempts made to determine and publicize the exact aims and methods that best defined industrial arts programs. The most significant effort was conducted in 1928 when the American Vocational Association (AVA) (formerly the National Society for Vocational Education, and earlier the NSPIE), formed a committee on Standards of Attainment in Industrial Arts Teaching. The purpose of this Committee was to clear up the problem of how industrial arts should be presented in the public schools.
Around the same time, Robert Selvidge was in the process of forming a unique plan for industrial arts. Essentially, Selvidge had broken industrial arts into psychomotor, cognitive, and affective elements or, as he described them “the things you should be able to do”, “the things you should know,” and “the things you should be” (Selvidge, 1923, pp. 3-5). Regarding methods, in 1926, Selvidge wrote the book Individual Instruction Sheets, promoting a system that used “an ordered series of problem-solving tasks based on job analyses consisting of unit operations” (Sredl, 1966c, p. 31). This system involved the analysis of materials and processes more than the development of technical skills. In 1931, Industrial Education Magazine published the article “A Cooperative Analysis of Trade and Industrial Arts Subjects” in which Selvidge identified characteristic differences between the goals of industrial arts and those of vocational education.

Selvidge also became involved in the AVA. Evans wrote:

All of the other divisions of AVA included both the vocational and general education aspects of their discipline, so it was natural for the vocational industrial educators to assume that same structure. Unfortunately they did little about building an AVA program for industrial arts. (1987, p. 79)

Finally, in 1932, due to intense pressure from industrial arts teachers, the AVA approved an industrial arts division. Selvidge, who had spoken on behalf of the profession became the AVA vice-president in charge of the industrial arts division, a position he held until 1939 (Evans, 1988, p. 79). In retrospect, it seems ironic that the AVA formed an Industrial Arts Division which took such an active role in developing standards of attainment for industrial arts teaching since, philosophically, there was a conflict of interests
between proponents of vocational education and those who supported technical instruction in general education. In 1934, Selvidge and the Committee on Standards of Attainment in Industrial Arts Teaching presented the report published under the title *Standards of Attainment in Industrial Arts Teaching* (American Vocational Association, Industrial Arts Section, 1934). Between 1934 and 1941, 11,000 copies of six different issues were printed to meet the demand for this publication which outlined twelve primary objectives for industrial arts. In 1946, a revised version of the report was published with the title *Improving Instruction in Industrial Arts* (American Vocational Association, Industrial Arts Section, 1946).

Prior to the *Standards of Attainment in Industrial Arts Teaching*, Selvidge, along with Verne C. Fryklund, had authored a book titled *Principles of Trade and Industrial Teaching*. In this text was a passage which refers to the purpose of industrial arts that clearly distinguished it from vocational preparation. It reads:

> In this field [industrial arts] we seek to give the youth the information and experiences which will interest him in industrial life and enable him to do effectively the things that most boys and men are called upon to do without respect to their vocation. (1930, p. 35)

Soon, there were several other efforts to clarify the issue of general vs. vocational education. *The Terminological Investigation of Professional and Scientific Terms From the Literature of Vocational and Practical Arts Education* conducted by Warner, Bollinger, and Hutchinson of the Western Arts Association was published in 1933. In 1934, a publication celebrating the 25th anniversary of the Manual Arts Conference of the Mississippi Valley was issued, titled
Industrial Arts in Modern Education. This book intended to provide “an adequate statement of the present philosophy, objectives, methods, trends, and administrative problems of the industrial arts in education” (Bennett, et al., 1934, p. 8). Another report, organized by Maris M. Profitt and called Industrial Arts: Its Interpretation in American Schools, was put forth in 1937 by the United States Department of the Interior, Office of Education. This report stressed the value of industrial arts to general education and identified subject matter and activities that were appropriate for the technological level of society at that time.

New Professional Organizations Established for Industrial Arts

On March 13, 1929, the first initiation ceremonies were held for Epsilon Pi Tau, an honorary fraternity formed by William E. Warner for industrial arts professionals. Warner felt that strong leadership was needed and that this fraternity could invoke such initiative in industrial arts education. Latimer said of Epsilon Pi Tau: “Its main purpose is to recognize and promote leadership by emphasizing skill, social efficiency, and research” (1981, p. 48). In a 1969 interview, Warner recalled the conception of Epsilon Pi Tau stating: “The precepts we set up as representing the base of our profession were technical, we agreed that that was important, but they were also professional, and of course research, to carry us forward . . . .” (Blankenbaker & Erekson, 1991a).

Warner also developed a firm conviction that industrial arts ought to replace its trade-oriented curricula with a system that would promote the analysis of industry. Warner tried, unsuccessfully, to gain support for his
views from several organizations. The Industrial Arts Division of the AVA was not receptive to Warner’s idea. The Mississippi Valley Conference also rejected Warner’s views and opted instead to maintain the established manual arts approach. Finally, Warner set out to establish another organization that would more accurately represent his convictions and those of many industrial arts educators.

On February 29, 1939, the American Industrial Arts Association (AIAA) was founded primarily under the auspices of Warner. Prior to the creation of the AIAA, it was difficult for industrial arts teachers to conduct professional meetings that were specific to their field. “These conditions caused industrial arts teachers to consider the formation of a national association dedicated solely to the improvement of the teaching of industrial arts in American schools” (Hunt-Hiser, 1960, p. 5). The establishment of the AIAA provided not only a venue for the improvement of industrial arts teachers; more importantly, it promoted the objectives of industrial arts as a part of general education.

The creation of the AIAA occurred on the 10th anniversary of Epsilon Pi Tau, in Cleveland, Ohio, at a two-day industrial arts teacher education conference that was “held in conjunction with the annual convention of the American Association of School Administrators” (Evans, 1988, p. 90). Warner was host to a program that was intended only for college presidents and professors titled the “Derivation, Definition, and Projection of an American [industrial arts teacher education] Program Leading to the Baccalaureate Degree” (Evans, 1988, p. 91). However, the program was suddenly altered from
its original agenda and, by the end of the conference, the result was the newly-organized American Industrial Arts Association complete with elected officers and a draft of a constitution. A “Constitutional Convention” of the AIAA was held in Atlantic City, New Jersey, February 21-25, 1941, at which the main body of the constitution was established, and by-laws were adopted in April 1943 thus completing the constitution.

In November 1941, four Executive Committee members, Warner, Louis V. Newkirk, Elmer W. Christy, and John A. Whitesel, met at Turkey Run Park in Indiana for a week-end conference. At this meeting, they discussed the possibility of a professional bulletin to be issued by the association. In April 1942, the AIAA printed its first professional publication titled *The Industrial Arts Teacher*. On the first page of the premier issue was the following statement: “In establishing this publication we hope to gain for our members and friends a closer professional relationship in the job of developing industrial arts education in the United States” (AIAA, 1942, p.1). Within the same year, Allen D. Backus assumed leadership of the newly formed Editorial and Publications Board.

Virtually since the beginning of the Association, efforts were made to gain acceptance as a department of the National Education Association (NEA). In 1942, the Association was officially approved for departmental status in the NEA. Of course, the participation of many key members in World War II significantly slowed the progress of the Association, but it was revived in 1946 through a conference in Oak Park, Illinois sponsored by Epsilon Pi Tau. The following year a large national conference for the AIAA was held in Cleveland, Ohio.
After several years of growth, it became evident that some changes were necessary in the structure of the AIAA. "Besides the administrative staff, departmental directors were identified in the tenth year [1948]. Three years later, this special group of people . . . became known as committee chairmen and members of the administrative staff" (Dennis, 1989, p. 20).

The original constitution of the AIAA had remained intact until 1950 when a number of significant changes were made. DeWitt Hunt, the eighth president of the AIAA, orchestrated a revision of the constitution which took place during the annual convention held in Cincinnati in 1950. Hunt's goal was:

To maintain the AIAA as a completely democratic organization in which every member will be kept informed concerning professional activities of its officers and about all business transactions of the Association and in which every member will have the opportunity to make nominations by mail and to vote by mail for all elected officers of the governing body and to vote by mail on all changes to the constitution. (Hunt-Hiser, 1960, p. 25)

Evans has implied that this constitutional change was necessary in order to neutralize the amount of authority that Warner retained, and on occasion used to control the Association. (Evans, 1988, p. 92).

Essentially, there were three additions made to the original constitution. First, mention was made of maintaining departmental status within the NEA. Second, the officers would consist of a president, a first vice-president, three second vice-presidents, and an executive secretary-treasurer. Third, amendments to the constitution would be approved by the executive committee following a membership vote by mail. This final alteration to the constitution made the association more flexible and would prove fruitful in future change-making processes.
Originally, the Association membership had been intended for teacher educators primarily; however, the majority of participants had soon become secondary industrial arts teachers. As the AIAA redirected its efforts to the audience at the secondary level, the need to provide for the continued participation of teacher educators was addressed by initiating the American Council on Industrial Arts Teacher Education (ACIATE) in 1950. This affiliated Council quickly grew in membership and served industrial arts teacher educators throughout the country. Since 1952, this Council has published a thematic yearbook delving into prevalent issues.

In 1951, a similar affiliation known as the American Council of Industrial Arts Supervisors (ACIAS) was formed. This Council attracted the membership of state and local supervisors of industrial arts. A few years later, yet another affiliate was formed to represent state industrial arts associations. This was designated The American Council of Industrial Arts State Association Officers.

The appointment of the first Executive Secretary for the Association was described as follows:

In the autumn of 1953, a system of operation was formalized, a means of permanent recordkeeping was instituted, and Dr. Kenneth Brown, the first executive secretary, was appointed by the Executive Committee to direct the day-to-day operations of the Association. Two men had served as secretary-treasurer prior to that time, but more or less on an impromptu basis. (Brown, 1976, p. 228)

Brown served as the Executive Secretary for eight years until 1961. He was not paid for his services as were his successors. Since Brown, only five others have served as the Executive Secretary/Director including Kenneth E.
Dawson, Howard S. Decker, Edward Kabakjian, Donald L. Rathbun, and Kendall N. Starkweather. During the summer of 1962, the AIAA, under the direction of Dawson, was moved to Washington, D.C.

In the mid-70s, Willis E. Ray suggested that the Association adopt a system of rotating the presidency among teacher educators, supervisors and teachers. This system allowed for equal representation across the major groups that the Association served. Ray, a teacher educator from The Ohio State University, began the cycle, serving as President in 1978 (Blankenbaker & Erekson, 1991b).

Influence of Technology on Industrial Arts Content

During World War II, industrial arts programs again turned towards the support of a war effort. Although many teachers were needed to serve in the war, industrial arts programs continued to grow and enrollments actually increased. One explanation for the widespread growth was the participation of more female students in industrial arts classes. The prevocational preparation that industrial arts could provide was emphasized to help young men and women adapt to technical fields in the armed forces or work in defense industries.

After World War II, the content and instructional methods that had been developed based on job analyses continued to be employed and the prevocational aspect of industrial arts continued to be stressed. Immediately, a number of industrial arts educators questioned whether this was the path that the profession ought to follow.
Warner was one of the first individuals to take action. In April, 1947, the first postwar AIAA conference was held at Columbus, Ohio. The title of the feature presentation for this conference was “The New Industrial Arts Curriculum.” Warner, along with six doctorate students at The Ohio State University, had devised this curriculum plan with the intention of “providing experiences that will help persons of all ages and both sexes to profit by the technology, because all are involved as consumers, many as producers, and there are countless recreational opportunities for all” (Warner et al., 1965, p. 41). This curriculum plan was also disseminated to members of the profession through the 1947 AIAA publication *The New Industrial Arts Curriculum*.

By the 1950s, it had become apparent that most industries were quickly applying and improving technological advancements made during the war. However, the actual augmentation of industrial arts programs was meager in comparison. The content of industrial arts slowly started to reflect some of the industrial technologies that were indicative of the times. The traditional content areas such as drawing, woodworking, and metalworking started to mix with other programs. DeVore, Maughan, and Griscom, in their article “Influence of Technology on Industrial Arts Subject Matter,” identified popular content during the 1950s stating:

Courses in electricity, automotive, and power mechanics became established offerings in some programs at both the public school and college level. New courses in plastics, photography, aviation, electronics, and transportation were created along with courses related to industrial production. (1979, p. 197)
A reemerging concept for industrial arts at this time was that of mass production. LaPorte showed that "evidence of the promotion and use of mass production in industrial arts ran consistently, though sporadically, through the literature from 1913 to World War II" (1987, p. 44). However, the redoubled interest in this process gave rise to the unresolved issue of whether mass production (including automation) was best approached as a unit of study or as a teaching method.

The fact that content areas were becoming so specific during the 1950's usually meant that unit shops were more commonly found than general shops for the facilitation of instruction, particularly in the high schools. An ACIAS publication titled Industrial Arts Education discussed, among other topics, industrial arts facilities. According to this booklet:

A \textit{unit shop/laboratory} is organized and equipped to provide instruction in a single subarea of industrial arts. . . . A \textit{limited general shop/laboratory} is organized and equipped to provide instruction in two or more subareas of industrial arts. A \textit{comprehensive general shop/laboratory} is organized and equipped to provide instruction in two or more areas of industrial arts. (ACIAS, 1969, p. 2)

Programs delivered through unit shops began to add the term "technology" to their titles, creating such designations as wood technology, metal technology in order to affirm that the latest industrial techniques were being taught. Publishing companies such as McKnight and McKnight offered textbooks with similar titles (\textit{Metalwork Technology and Practice}, \textit{Woodworking Technology}) to accommodate this trend. A fine example of this usage can be observed in the March-April, 1958 issue of \textit{The Industrial Arts Teacher}. An article titled "The Significance of Selected Aspects of Wood Technology for Western Culture" summarized the doctoral thesis completed in 1956 by Gerhardt W.
Neubauer. Among the recommendations made by Neubauer were the study of the historical significance of wooden artifacts, the incorporation of modern technological developments in woodworking courses, and placing an emphasis on functional design. He also felt that “wood technology should be taught as the applied science into which it has evolved” (Neubauer, 1958, pp. 12-21).

Problem Solving

Influenced by the popular Gestalt psychology during the 1950s, teaching methods generally began to move away from prevocational training and project-oriented methods to focus more on problem-solving activities. In 1959, Donald G. Lux, of the University of Illinois, published an article titled “Teach Them How to Solve Problems,” which included the following:

Greater recognition still needs to be given to the fact that the teaching of problem solving with contemporary materials, tools, and processes of industry, rather than with imaginary academic problems, is one of the valid justifications for the requirement of industrial arts as general education. (p. 147)

Problem solving was at the center of much discussion during the 1950s. Delmar Olson, of Kent State University, was not convinced that problem solving was separable from the project. In Technology and Industrial Arts, Olson stated:

To this writer there is little, if any, conflict in terminology, since he sees the project as composed of innumerable problems, and the value of the project as relative to the significances and to the solutions of the involved problems. To him the project is greater than a problem. (1957, p. 327)
In 1961, Ken Phillips, of San Diego State College made a comparison of "The Project Approach vs. the Problem Approach in Industrial Arts Education." In his analysis of the two methods, he described the problem solving approach as if it were superior to the project method. However, his final suggestion was to compromise and borrow "the best of both as a sound educational approach" (p. 10).

During the late 1950's, a sort of extension of the problem-solving approach was fostered by Donald Maley, a Professor and the Head of the Industrial Arts Department at the University of Maryland. Maley focused mainly on instructional methods and encouraged industrial arts teachers in Maryland to have students become more involved in activities related to research and experimentation. This learner-centered form of instruction was to utilize activities based more on the testing, analysis, and investigation of tools, materials, and processes rather than the completion of a product or project.

Accreditation of Industrial Arts Teacher Education

Frycklund and Helton stated: "the historical development of standards and accreditation for the improvement of industrial arts teacher education began with reports of relevant studies carried on by graduate students" (1958, p. 11). The first study to develop evaluative criteria for industrial arts teacher education programs was accomplished in 1939, by Elliott Charles Hutton, a student pursuing a master's degree at Oregon State College. This study, titled "A Suggested Plan of Accreditation for Industrial Arts Teacher Education."
Departments," addressed the diversity of programs across the nation by proposing a means for accreditation through the National Education Association, the AIAA, and the National Accreditation Associations, in order to provide more uniformity among institutions.

In 1947, another study, "Teacher Education in Industrial Arts with Special Emphasis on Evaluative Criteria," compared twenty outstanding programs in order to determine appropriate methodologies, objectives, organization, and professional preparation. Ralph O. Gallington, a doctoral student at George Washington University, conducted this research.

In 1953, Bernard Shaw Procter, a graduate student at The Ohio State University, conducted "A Study to Develop the Purposes, Criteria, Policies, and Procedures for the Accreditation of Industrial Arts Teacher Education Programs for the Baccalaureate" for the requirements of his doctoral dissertation. The study, approved by William E. Warner, identified a need to formulate a set of criteria and procedures that would be useful in the evaluation of industrial arts teacher education programs. Procter stated that his study,

... should stimulate thinking and self-evaluation on the part of the constituencies of individual programs and should raise the problem of the accreditation of industrial arts teacher education programs into view so that its significance as a problem may be considered throughout teacher education. (1953, p. 453)

Procter established evaluative criteria to measure the purposes, staff, curriculum, instruction, physical setting, libraries, student personnel services, professional and public relations, and administration of any industrial arts teacher education program. He recommended that these criteria, based
somewhat on accreditation materials that existed for other content areas at that existed time, be further tested and the results carefully analyzed. He also suggested that a manual of accreditation and a manual of instructions for evaluation committee members be prepared. He further challenged each industrial arts teacher education program in the nation to conduct a self-evaluation using the criteria he developed.

Proctor's study voiced the opinions of many leaders in the profession at that time and, in fact, rehashed an issue that had been raised in 1950 at the annual meetings of the AIAA, the Industrial Arts Division of the AVA, and the Mississippi Valley Industrial Arts Conference. Based on information exchanged at these meetings, M. R. Trabue, Secretary of the Accreditation Committee of the American Association of Colleges for Teacher Education (AACTE), appointed a sub-committee for the accreditation of industrial arts teacher education, consisting of individuals to represent each of the various industrial arts associations that existed. Verne C. Fryklund, President of Stout State University, chaired this committee and Gerald Baysinger, of Wayne University (in Detroit, MI), served as the Secretary. Other members of the original committee included Dewey Barich, E. E. Ericson, John Friese, DeWitt Hunt, John Ludington, Gordon O. Wilber, and Walter Williams.

This group of outstanding leaders established an index of standards, from a list prepared by Baysinger, that were specific to industrial arts programs. In 1954, M. Ray Karnes, Chairman of Industrial Education at the University of Illinois, was the first to apply these standards for the evaluation of an industrial arts teacher education program. Unfortunately, further headway was delayed when the AACTE discontinued its accreditation
function, giving way to the National Council for Accreditation of Teacher Education (NCATE). The NCATE was formed in 1952 and, in 1956, was approved by the National Commission on Accrediting as the national accrediting agency for teacher education.

As a result of this change, the committee formed under the AACTE was reorganized, with some changes in personnel, under the direction of W. Earl Armstrong, the Director of the NCATE. Fryklund remained as the Chairman of the new committee, The National Committee on Accreditation of Industrial Arts Teacher Education, sponsored by the ACIATE. Ericson, Friese, Hunt, Wilber, and Williams also returned from the original committee. Five other individuals added to this committee included H. L. Helton, who served as the second Secretary to the Committee, R. Lee Hornbake, M. Ray Karnes, Bernard Proctor, and John A. Whitesel. Ray A. Wigen, Chairman of the Stout State Accreditation Committee, and Marshall Schmitt, Specialist for Industrial Arts in the U. S. Office of Education, each served as consultants to the Committee (Fryklund & Helsel, 1958, pp. 13-18).

In 1955, Helton took on the responsibility of conducting a nationwide survey of industrial arts teacher education programs in order to obtain suggestions for the deletion, alteration, or addition of evaluative measures to be included in the standards that were under development. Upon completion of the survey, the National Commission on Accreditation of Industrial Arts Teacher Education Programs deliberated over the tentative standards and criteria established. In 1957, they settled on an instrument to be used for self-evaluation within interested departments. A supplementary guide was also prepared for use by the NCATE visiting teams for program evaluation.
National Defense Education Act

In 1957, the Soviet Union launched the first Sputnik, an earth-orbiting satellite in space. This Soviet action challenged the technological superiority of the United States and so, in response, the National Defense Education Act (NDEA) of 1958 was passed by Congress. The NDEA provided millions of dollars to elementary and secondary programs in math, science, and foreign languages.

Through the lobbying efforts of the AIAA, a subsequent amendment was made to the NDEA in 1966. Under Title XI of the Act, "industrial arts was included with history, civics, geography, English, reading, mathematics, and modern foreign language as critical subjects" (U.S. Office of Education, 1966, p. 24). Lux felt that little was gained from the NDEA. He wrote:

> The National Defense Education Act specifically earmarked monies for industrial arts but this caused little program impact. It is true that much new equipment was purchased that otherwise would not have been. However, these purchases were often at individual whims, with little regard for related programmatic reconceptualization and redirection, with the expectable result that little change came about as a result of this legislation. (1979, p. 222)

Yet, regarding the contributions from the NDEA towards professional development of industrial arts teacher educators during this period, Rokusek and Israel reported:

> During the late 1960s, summer institutes were designed and implemented by a number of universities in cooperation with the U.S. Office of Education to provide advanced study for industrial arts personnel under the auspices of the National Defense Education Act and the Education Personnel Development Act. (1988, p. 227)
Through this legislation, the federal government provided funding for five pilot institutes for industrial arts. The original five institutes were held at Eastern Michigan University, Northern Illinois University, the State University College of New York at Oswego, the University of North Dakota, and the University of Maryland. According to Manchak: "One hundred and forty-four industrial arts teachers attended the five 1966 institutes," each of which varied in content (1966, p. 27). These institutes attracted so many applicants (approximately 2,000 combined) that NDEA funds were approved to support 29 summer institutes held at universities across the nation in 1967.

A Survey of the Profession

In 1966, Schmitt and Albert L. Pelley, from the United States Office of Education, published Industrial Arts Education: A Survey of Programs, Teachers, Students and Curriculum. This report was one of the most comprehensive overviews of secondary industrial arts education ever attempted and provided valuable information for the improvement of industrial arts programs nationwide. Dugger stated "... the Schmitt-Pelley study was a landmark effort which provided the industrial arts profession with its first detailed look at the programs, teachers, curriculums and students in public secondary schools in the United States" (1988, p. 96). Based on data collected from an extensive survey instrument administered during the 1962-'63 school year, the Schmitt-Pelley study made several interesting findings.

At that time, approximately 75% of the public secondary schools in the United States included industrial arts programs. The national enrollment of
male and female industrial arts students in grades 7-12 was estimated at nearly four million and was “... concentrated in the junior high school and schools whose enrollment size was over 1,000 .... The highest percentage of students is found in the 9th grade, where 24 percent of the enrollment is reported” (Schmitt & Pelley, 1966, p. 29).

Secondary level industrial arts teachers and principals agreed that the four most valuable purposes (of ten possible options given) of industrial arts were ranked in order of importance as follows:

1. To develop in each student a skill in the use of common tools and machines
2. To discover and to develop creative technical talents in students
3. To provide general all-around technical knowledge and skills
4. To develop problem-solving skills related to materials and processes (Schmitt & Pelley, 1966, p. 28)

Schmitt and Pelley discovered that of over 40,000 teachers who responded to the survey, 94.4% held valid teaching certificates. Industrial arts teachers also averaged 9.5 years of teaching experience and 5.6 years of industrial experience. Regarding instruction, generally 25-30% of class time was utilized in a theory-centered approach while 70-75% of the class time involved hands-on activities. The majority of teachers started their introductory classes with an “assigned project,” while in other courses a “... series of sequential jobs or activities ...” were assigned. In more advanced classes, instruction tended to be more individualized. The authors wrote:
Although this study did not deal with the depth of instructional content, it does cast some light on the background of the teacher. More industrial arts teachers need to strengthen their science and mathematics backgrounds and, keep up with advances in technology. (Schmitt & Pelley, 1966, p. 30)

During the 1962-‘63 school year, almost 40% of the participating teachers had made significant alterations to their programs, such as providing more and/or new instructional areas within industrial arts. “They also added new courses to meet the needs of upper ability students and to correlate industrial arts more closely with science instruction” (Schmitt and Pelley, 1966, p. 29). Approximately 4% of the public secondary schools accepted industrial arts course credits as reciprocal for credits in the content area of science.

In determining instructional content, most industrial arts teachers prepared their own curriculum guides. Popular course titles included General Industrial Arts, General Woods, General Metals, Drafting, Graphic Arts, Electricity/Electronics, Crafts, Power Mechanics, Home Mechanics, Photography, Ceramics, Industrial Arts Mathematics and Science, Plastics, Textiles, and Transportation. Despite this wide range of program titles, the content of instruction for the majority of industrial arts programs was centered around the traditional Woodworking, Drafting, and Metalworking courses.

In conclusion, Schmitt and Pelley stated:

Massive efforts need to be taken before the new industrial arts curriculum or any other new approach to teaching the industrial arts can make much of an impact on the current program and eventually improve the technological literacy of the American public. (1966, p. 30)
To improve upon the narrow focus of industrial arts programs, Schmitt and Pelley recommended a broader approach to the industrial arts curriculum. The new curriculum that they suggested was intended to correspond more accurately with modern technological achievements in manufacturing, communications, power and transportation, electricity/electronics, and research and development.

The Focus on Curriculum

Between 1954 and 1963 there was a national increase in the compulsory enrollment of students in industrial arts courses. Schmitt and Pelley discussed this issue in the summary of their report by stating:

One of the most interesting facts uncovered by this study was the increased compulsory requirements for students (both boys and girls) to take industrial arts instruction during the period from 1954-55 through 1962-63. Although the increases were not large, they are significant because the national concern at that period of time was focused on meeting the needs of the academic-type student. (1966, p. 29)

This indicated a strong belief that industrial arts courses were an important part of general education at this time. However, as education became linked with national security and the children of the “baby boom” generation were filling the schools, the industrial arts profession began to suffer a minor identity crisis. During the mid-1960s, schools were beginning to increase the required number of academic courses, based on theoretical content, that were to be completed by students.
The prosperity of the post-World War II years had enabled more parents to send their children to colleges and universities. In the tradition of the Western exaltation of the liberal arts, industrial arts programs were generally considered less important as college preparatory courses. As a result, many bright students at the secondary level were guided away from industrial arts programs. The junior high remained a stronghold for industrial arts, but elementary industrial arts was offered in only a few states. Despite the waning emphasis on industrial arts in the public schools, college and university industrial teacher programs experienced a period of growth during the 1960s. Influenced by the Vietnam conflict, the enrollment in undergraduate industrial arts programs increased and the focus of the courses expanded.

The Vocational Education Act of 1963 also proved to have a significant impact on the future of the profession. Philosophically, industrial arts had always been considered a part of general education and, therefore, separate from vocational education as established through the Smith-Hughes Act. Despite opposition from the AIAA, the industrial arts were considered a form of vocational education according to the new Act. In so doing, the Vocational Education Act of 1963 interpreted the role of industrial arts much differently than had ever been intended.

In the universities, curriculum development quickly became the most conspicuous characteristic of industrial arts programs during the 1960s. Funding for curriculum projects came from a variety of sources. Many states created legislation to support such efforts. The National Science Foundation and the National Defense Education Act were considerable federal sources for
funding. Private sources also supplied millions of dollars to a variety of industrial arts curriculum projects throughout the country. Starting in 1963, the Ford Foundation began to fund curriculum development efforts and “while the projects were nominally ‘vocational’ in intent, several of them included basic material and approaches of interest to industrial arts educators” (Householder, 1972, p. 10).

Although industrial arts was not specifically mentioned in the Vocational Education Act of 1963, or its subsequent amendment in 1968, small portions of this funding were used for industrial arts curriculum projects that emphasized prevocational training. Due to the lobbying of the AIAA and the Industrial Arts Division of the AVA, industrial arts was finally included in the Education Amendments of 1972 and 1976. In the article “Finance for Industrial Arts Education,” Young and Pesce wrote the following:

Prior to 1972, Industrial Arts (IA) received almost no federal vocational funding. Programs were funded through local or state agencies. On 20 December 1973, IA became eligible for funding under the amendments of the Vocational Education Act of 1963. The passage of Public Law 94-482 provided legal authority for the administration of funds to IA programs that met the specific criteria of the Act. (1980, p. 69)

The stipulation for funding was that industrial arts programs were required to be included in state plans for vocational education, thus stripping participating programs of their general education ideal. Although the Amendments to the Vocational Education Act of 1963 provided some small financial benefits for industrial arts, these were hardly compensatory for the damage inflicted upon the image of industrial arts.
The emphasis on curriculum constituted a fundamental review of the motives and content of industrial arts. Since industrial arts had developed such a diverse self-image, there was a growing need for more general agreement on the direction of the profession. Since many professionals within the field believed that they knew what industrial arts programs should be offering, several independent groups organized to develop curricula that also differed extensively.

Due to the considerable number of curriculum projects that were conducted, and the wide variety of approaches, it may be worthwhile to review methods that have been used to categorize industrial arts curriculum projects have in the past. In 1965, Robert Swanson published an article titled “Industrial Arts - What is its Body of Knowledge?,” in which he grouped industrial arts programs under the following four headings:

1. The study of common life needs created by or related to industrial and technological advance.
2. The study of crafts or trades, processes, tools, machines, materials, and products.
3. The study of applications of mathematics and the sciences.
4. The study of industry. (p. 47)

Cochran also used four categories to classify the curriculum efforts that occurred during the 1960s. These categories were labeled according to the approach of the program and included integrative, interpretation of industry, occupational family, and technology-oriented programs. Cochran wrote: “Although such a breakdown has limitations, it does suggest possible points of emphasis in various contemporary secondary school programs” (1970, p. 21).
Householder organized the following outline listing a number of the specific curriculum projects developed during the 1960's under headings that he believed were appropriate for each:

I. Industry and Technology as Bases for Industrial Arts
   A. Industry-Centered Approaches
      1. Alberta Plan
      2. American Industry Project
      3. Enterprise: Man and Technology
      4. Functions of Industry
      5. The Industrial Arts Curriculum Project
      6. The Orchestrated Systems Approach
   B. Technology-Centered Approaches
      1. Industrial Arts as the Study of Technology
      2. Technology as a Discipline

II. Alternative Strategies
   A. Individual Development Emphasis
      1. Maryland Plan
      2. Technology for Children Project
   B. Career-Occupation Emphasis
      1. Partnership Project
      2. Galaxy Plan
      3. Pre-Technical Programs
      4. Introduction to Vocations
      5. Career Development for Children Project
   C. Evolutionary Approaches
      1. Industriology Project
      2. Georgia Plan
      3. Others

(Adapted from Householder, 1972, pp. 13-37)

All of the previous classification schemes were appropriate accounts of the focus of industrial arts curriculum projects during the 1960s. Also, each one seems to improve upon the prior model. As for the curriculum projects themselves, they were met with mixed success. The majority of them had limited impact, usually restricted to the region in which they were developed.
Each of the industrial arts curriculum projects that emerged during the 1960's was undeniably unique in its own way. A wide variety of approaches for teaching industrial arts was explored and different ways of analyzing the content of this subject were devised. Yet, it was evident from these efforts that change was considered necessary for the future success of the profession.

Summary

Industrial education in the United States has been molded by many circumstances, conditions, and individual views since the beginning of the Industrial Revolution. Individuals such as Pestalozzi, Fellenberg, Herbart, Froebel, and others developed the concept of “learning by doing.” Mechanics’ institutes, lyceums, and manual labor schools, based on European models, were adopted as venues for providing technical knowledge and developing skills.

As the public school system was forming in the United States, several philosophies and trends from around the world contributed to the development of a system of handwork viable as a part of general education. The Russian system of mechanical arts, workingmen’s schools, manual training, sloyd, and manual arts were each early forms of industrial education for all students. In 1862, the Morrill Act provided for land-grant colleges offering education in agricultural and mechanical arts.

One goal of many early systems of technical instruction was to prepare individuals for specific occupations. Around 1910, Massachusetts became the first state to provide publicly-supported vocational education in conjunction with general education. This new form of industrial education was a
significant departure from those programs that were intended as part of the general education curriculum. In 1917, the Smith-Hughes Act provided federal support for vocational education.

As the trend towards social efficiency gained momentum in the early twentieth century, the educational philosophies of John Dewey became popular. Dewey, who believed that education should relate directly to experience, laid the foundation for a study of industry as part of general education. Industrial arts represented the best of the past forms of industrial education while introducing some new ideas related to content and instructional methods. With the establishment of the American Industrial Arts Association in 1939, the profession grew rapidly. Since World War II, the inclusion of female students boosted the industrial arts enrollment considerably. In 1947, the AIAA published a document authored in part by its founder, William E. Warner, titled The New Industrial Arts Curriculum, which reflected an interest in helping students profit from technology.

During the 1950s, technology began to alter the makeup of course content in industrial arts. Alternative instructional methods, such as problem solving and research and development, were also becoming popular. In the mid-1950s industrial arts teacher education programs were accredited by the National Council for Accreditation of Teacher Education, and the National Defense Education Act (NDEA) was passed primarily to improve science and math programs. The NDEA was later amended to include industrial arts, thus providing funding for a number of teacher institutes throughout the nation during the mid-1960s.
The first significant survey of the profession, authored by Schmitt and Pelley in 1963, recommended a broader approach to industrial arts curriculum that would contain content in manufacturing, communications, power and transportation, electricity/electronics, and research and development. A number of curriculum development projects during the 1960s also attempted to interpret the aims of the profession. Classification schemes were developed to identify these projects and technology was identified as one of many potential methods for organizing the industrial arts curriculum. The vast number of curriculum projects served as evidence that a change was needed within the profession.
CHAPTER 4

Factors that Influenced the Movement Toward Technology Education
There were many factors that contributed to the growing interest in the study of technology within the industrial arts profession. The influence of economic, environmental, political, regional, psychological, societal, and a wide range of additional concerns helped to shape this interest in technology, just as technology has influenced these concerns. Still, the advancement of technology itself has been the primary factor that has undergirded the introspection of the industrial arts profession. Indeed, throughout the history of industrial arts, there have been many attempts to adequately interpret its purpose.

A number of early leaders in the profession speculated on the implications of technology as it related to the study of industry. Especially during the period of economic growth that followed World War II, many leaders considered the study of technology a vital concern in the curriculum of industrial arts. Increased foreign competition, characterized by events such as the launching of the first Soviet “Sputnik,” resulted in private support and government initiatives for improvement in education, particularly math and science, but eventually in other content areas including industrial arts. Much of these resources were used for industrial arts curriculum development during the 1960s as many leaders of the profession began to look for new ways of organizing the content, often compounding the problem by making the field increasingly divergent. Gradually, two broad schools of thought emerged. Proponents of each view recognized that change was necessary for the future success of the profession, but the direction and the extent of that change was at issue.
The Influence of Technology Identified within the Profession

As early as 1917, Charles Bennett referred to the effects of technology on people in his book Manual Arts, containing this excerpt:

... industrial development has been so rapid and so varied in our country - it has affected every man’s life to such an extent that if he is to retain sufficient mastery of his environment to make it serve his needs, he is forced to acquire considerable practical knowledge of the materials, principles, and processes of industry. (1917, pp. 14-15)

This rationale for the study of industry was based upon the observed need for people to adapt to the changes caused by society’s industrial growth. Bennett’s reference to mankind’s “mastery of his environment to make it serve his needs” could be considered plausible as an explanation for technology. Although the term “technology” is not actually used here, it might very well fit into the context of Bennett’s argument.

John Dewey undoubtedly contributed a great deal to the establishment and growth of industrial arts throughout his lifetime, during which the United States entered the Machine Age. At that time (the latter portion of the nineteenth century), coal and steel replaced wood as the major sources of fuel and material for construction, respectively. Transportation was considerably improved with locomotives, automobiles, and the accomplishment of human flight. Electricity was used for myriad purposes such as lights, telephones, phonographs, and radios. The tremendous acceleration of technology that Dewey witnessed undoubtedly had a decided impact upon his educational philosophy. In Democracy and Education, Dewey stated:
Industry has ceased to be essentially an empirical, rule-of-thumb procedure, handed down by custom. Its technique is now technological: that is to say based upon machinery resulting from discoveries in mathematics, physics, chemistry, bacteriology, etc. As a consequence, industrial occupations have infinitely greater intellectual content and infinitely larger cultural possibilities than they used to possess. The demand for such education as will acquaint workers with the scientific and social bases and bearings of their pursuits becomes imperative, since those who are without it inevitably sink to the role of appendages to the machines they operate. (1916, p. 314)

In the book, *John Dewey's Pragmatic Technology*, Hickman said of Dewey: ". . . he sought to demonstrate that the methods and means by which technological inquiry take place are the methods and means by which all knowing, in its 'honorable' sense, is generated" (1990, p. 4).

The "industrial-social theory," influenced by Dewey and posited by James Russell and Gordon Bonser, was intended to provide intellectual investigation of, and manual experiences in, a wide range of endeavors typifying the industrial processes that provided for basic human needs and were thus technological in nature. In fact, the following passage from the 1924 Bonser-Mossman definition of industrial arts is very similar to the manner in which some have more recently defined technology: "... a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to those changes" (Bonser & Mossman, 1924, p. 5). Lemons wrote, "this definition may be the first documented reference to the technological society as a purpose for teaching industrial arts" (1988, p. 59).

In 1934, Maris M. Proffitt, in a committee report for the Commissioner of Education, described what he considered essential "functions of industrial arts." Among the functions suggested by Proffitt was the study of material cultures as described here:
A study of material cultures of American society in a perspective of great world civilizations will reveal a fundamental origin of industrial arts. This origin refers to elements of utility, efficiency, and beauty in things that have been developed and used by man throughout history. This origin more than any other distinguishes industrial arts as a broad subject of study. (cited in Anderson, 1940, p. 234)

Any study of the advancement of material cultures would inevitably reveal that growth is at least partially consequential of the development of technologies. Proffitt's reference to a "fundamental origin of industrial arts" seems to be a search for a professional motive and the second sentence of this passage is comparable to modern definitions of technology as physical elements. The final sentence appears to serve as an early rationale for considering industrial arts as a discipline.

Also in 1934, papers were presented at the annual Mississippi Valley Conference, by A. Newell and D. Crowley, that addressed the separate questions of how the curriculum could meet the demands of societal changes and technological improvements. The following year, in 1935, A. Swope presented a paper that included the following comment: "industrial arts in general took its name from the substance or the materials which were first taught in the course. There is some evidence that we are about to change that substance and still retain the name." Swope viewed industry as incidental to the principles of science. He reasoned that "it is conceivable that we may as a nation depart on some other avenue of adventure than the application of scientific principles which were formulated two or three generations ago to industrial life primarily." Swope also believed that we would progress
beyond industrialization and he felt that “our training in school might be the means of adapting the child to see beyond these horizons” (cited in Lemons, 1988, p. 56). Swope was confident that technological advancement would occur and he suggested that we could address the needs of students related to such change.

In January, 1940, The Phi Delta Kappan, a journal for the promotion of research, service, and leadership in education, printed a special issue dedicated entirely to the topic “Industrial Arts in General Education.” The editors of this reputable journal were assisted by Albert F. Siepert, William E. Warner, and other leaders of industrial arts education in the planning of this publication which attempted to clarify the mission of industrial arts. For this particular issue, Siepert, the Dean of Education for the Bradley Polytechnic Institute in Peoria, Illinois, authored the initial article titled “Philosophy” in which he stated:

If industrial arts teaching is to acquaint the school pupil with the products of industry, if the purpose is to orient the individual whose life is to be spent in a world so much dependent upon technology, then first-hand experience appears to be essential. (p. 235)

Here again, Siepert identified the substantial influence that technology can have on society and the individual. Yet, the major point of interest made by the author was that by providing “hands-on” experiences, industrial arts readily facilitates learning that will prepare students for life in a technological society. Still, the industrial arts curriculum continued to be based on a narrow view of industry.
The Curriculum to Reflect Technology

The impact of World War II, followed by the rapid economic growth and advancement of technology caused by that event, not only provided many new opportunities but, for most Americans, it inspired a more hopeful outlook on the future. It also contributed to a new perspective on the instruction of industrial arts. For several years following World War II, various leaders in the profession encouraged teachers to modify their programs by, as Meyer put it, “grasping the technological bull by his educational horns” (1951, p. 16). Discourse of this nature was largely motivated by a momentous effort that not only introduced the concept, but also provided a means to develop programs with an emphasis on technology -- within the context of industry.

In April, 1947, a new interpretation of industrial arts, referred to initially as the “The New Industrial Arts Curriculum,” was imparted by Warner, Joseph E. Gary, Carlton Gerbracht, Harold G. Gilbert, John F. Lisack, Paul L. Kleintjes, & Kenneth Phillips. Warner, who had served in the war along with many other industrial arts professionals, introduced this new plan at the fourth session of the eighth annual American Industrial Arts Association (AIAA) convention held in Columbus, Ohio. For Warner it was the next logical step in the advancement of his philosophy and practices. Warner and his protégés defined industrial arts as follows:

*Functionally, industrial arts as a general and fundamental school subject in a free society is concerned with providing experiences that will help persons of all ages and both sexes to profit by the technology, because all are involved as consumers, many as producers, and there are countless recreational opportunities for all.* (Warner, Gary, Gerbracht, Gilbert, Lisack, Kleintjes, & Phillips, 1965, p. 41)
Dwight Curtis wrote a review of Warner's conference presentation that was printed in the June, 1947 issue of The Industrial Arts Teacher. He commented, “the presentation by Dr. Warner, and the interpretations that followed, completely redefined the position of industrial arts in general education in the public school, and solicited both re-evaluation of the present program and consideration of the implementation of the new” (p. 1).

Olson said of this effort, “it was too far ahead of the times to gain general acceptance, but like all advance thinking it has had its impact on the profession” (1963, p. 15). Warner, himself, had a slightly different feeling about the acceptance of the project as evidenced by the following which he wrote retrospectively:

The result, as herein reported, was featured at the AIAA Convention of 1947 which I revived in Columbus, Ohio, following World War II, and where we were fearful of the outcome until the discussions which followed, when our findings were not only accepted, but praised on all sides. (Warner et al., 1965, p. 5)

Eventually, “The New Industrial Arts Curriculum” became known as A Curriculum to Reflect Technology, with content that was “derived via a socio-economic analysis of the technology and not by job or trade analysis as of old...” (Warner et al., 1965, p. 41). It included six subject matter classifications; Power, Transportation, Manufacturing, Construction, Communication, and Management. “Implementing the New Curriculum” was the topic of the fifth session of the Columbus convention and the teaching methods recommended for use with this curriculum were varied by design including “research, planning, work experience as a means to an end, field study, personnel and physical organization, illustrative aids, conferences, [and] creative expression, ...” (Warner et al., 1965, p. 42).
Latimer summarized:

For the most part, it remained a proposal, probably because Warner did not have the funds to promote and enhance it nationally. The plan was probably too far ahead of its time.

Even though the curriculum was never totally implemented, today there are many elements of The Curriculum to Reflect Technology present in educational systems throughout the United States. (1981, p. 48)

Indeed, there is evidence of the influence of Warner’s Curriculum in the content of many recent programs. However, the question of timing is arguable since there were many other efforts to identify technology as integral to industrial arts during the late 1940s and through the 1950s.

Appeals for a New Approach to Industrial Arts

In 1948, at the ninth annual AIAA conference held in Washington DC, a resolution on “The Impact of Technology” was authorized by the Association. From that resolution comes the following excerpt:

Whereas, certain of the school subjects such as industrial arts have not kept pace through adequately orienting all Americans to cope with the problems involved, now therefore be it

RESOLVED, that the industrial arts profession as represented by the AMERICAN INDUSTRIAL ARTS ASSOCIATION and its affiliates, as well as all the federal, state, and local agencies concerned, be stimulated to interpret and implement the issues, the subject matter, and the means involved, in order that all Americans may more readily adjust to and enjoy the potentialities of a good life made possible through an ever-expanding technology. (AIAA, 1948, p. 2)
Also in 1948, Walter R. Williams, Jr., a Professor of Education at the University of Florida as well as the Vice President of the AIAA, declared that "Industrial Arts Faces a New Era." In an article by that title for the *The Industrial Arts Teacher*, Williams wrote the following:

For a time the true educational concept of industrial arts was lost, and its position was relegated to a secondary place in the scheme of general education. Now, under the pressure of a complex technological society the narrow view of the manual arts concept is fast giving way to a more comprehensive and flexible interpretation of industrial arts or technology. That a crucial need exists for technological literacy is apparent. . . . (p. 1)

Gordon O. Wilber, the ninth President of the AIAA, was another effective industrial arts educator with timely insight. He referred to the influence of technology in his book *Industrial Arts in General Education*, when he defined industrial arts as "... those phases of general education which deal with industry - its organization, materials, occupations, processes, and products - and with the problems resulting from the industrial and technological nature of society" (Wilber, 1948, p. 2). Wilber also expressed the conviction that education was critical to the development of technology by stating: "if society did nothing more than transmit its culture there would be no progress or improvement. Education has the further objective, therefore, to provide for extending and improving the way of life" (p. 6). This could be accomplished, he believed, through instruction that challenged the critical thinking skills of students.

In 1951, Harvey K. Meyer, an Associate Professor of Industrial Arts and Vocational Education at the University of Florida, Gainesville asked of his peers, "Industrial Arts - What Next?" Meyer knew that "every boy and girl, regardless of present interest or future occupation, is forced to an
acquaintanceship with the products of technology." As a result he felt that, "work with materials and toward a grasp of technology needs to be a part of the experience of every boy and girl" (p. 15).

In suggesting one course of action, Meyer recognized that "as teachers of industrial arts, a field yet young in education, we have groped for truth and sought our role in leading youth toward a real and functioning technological literacy." Meyer continued by stating:

Our problem is not that of substituting something new for something old. It is not to discard the classics in the interest of the technics - for this will destroy both. Our task is to provide the cultural matrix of the arts, the sciences, and the humanities so that the equally cultural technologies can find their rightful place and make their vast and vital contribution. (Meyer, 1951, p. 16)

Perhaps the most revealing statement made by Meyer, however, was his view of the function of technology. He remarked: "industrialism itself, and the technology which is its major expression, have developed in a cultural matrix. They may not be understood without an adequate knowledge of the matrix." Since Meyer's impressions merited publication in the bulletin of the AIAA, it would appear that his view of technology as being a manifestation of industrialism was being endorsed by the Association.

Through the 1950's, Meyer maintained an interest in the role of technology in industrial arts and, as the President of the Florida Industrial Arts Association in 1959, he did a great deal to promote, in the schools, an awareness of technology. It seems that in the latter part of the decade, Meyer had begun to consider technology as fundamental to the profession. This was
a change from his opinion, in 1951, of technology as being incidental to industry and the study of industrial arts. The following passage from his article, titled “Creed, Deed and Need,” is an example of how his thought had progressed:

As has been pointed out in these pages before, basic science can do a great deal in the initial stages of any development; but in the final analysis, it is technology that puts the findings of basic science to work. Unless the children in our schools and the young people entering college have a real and vibrant grasp of what is involved in technology, it is indeed doubtful if they can take full advantage of the technological progress now so imminent and so necessary. (p. 17)

Meyer then concluded this article with the following, almost prophetic, statement:

If we have any creed, it must be broadly that of technological orientation for all children of all the people. If we have any need, it is to expand our understandings of curriculum and to interpret adequately to all who will listen this amazing field in which we labor. (p. 18)

In 1954, John A. Whitesel, a former president of the AIAA, was elected president of the American Council on Industrial Arts Teacher Education (ACIATE). As the newly-elected president of this affiliated group, he expressed hope that industrial arts professionals could redefine “the contributions of industrial arts in a modern program of education, and redesigning the program of industrial arts in an effort to make the fullest contributions possible in the light of present day technological needs” (1954, p. 9). The following year, Burl N. Osburn, the twelfth President of the AIAA and Head of the Department of Industrial Arts at the State Teachers College in Millersville, Pennsylvania, addressed a luncheon group during the NEA
National Assembly sessions held in Chicago on July 4, 1955. His speech was titled “Industrial Arts in Modern Education” and it served to clarify the status of Industrial Arts for members of other NEA organizations.

We can begin to see, therefore, that as method industrial arts education is the directing of experiences in the transmission and improvement of man's control of forces and materials for the enhancement of personal-social living. As a subject it is concerned with the processes of producing goods and their personal and technological effects. (p. 8)

Here, as in descriptions of technology, the method of industrial arts was identified as an effort to guide learners towards bettering their lives and their environment. Regarding subject matter, Osburn posited the continued emphasis on industry-oriented processes (for the production of goods) with an interest in the implications of such practices.

On February 20, 1958, at the annual meeting of the National Society of College Teachers of Education and the American Association of Colleges for Teacher Education, the ACIATE sponsored a symposium titled “Industrial Arts Teacher Education for a Technological Era.” This symposium occurred shortly after the Soviet Union launched its “Sputnik” satellite program. Many well-respected individuals participated in the symposium which was described as “a spirited discussion of curricular reorganization with examples of experimentation on both the secondary level and teacher education level . . . .” The symposium consisted of two sessions; the first on the topic of “Curricular Innovations for an Age of Technology”; and the second regarded “Implications for Teaching: Materials, Facilities, and Techniques.” The dialogue of the first session dealt with “such concepts as quality control, mass
production, and group experiment, and the idea of providing service to science and other subject areas . . . ." An interesting outcome of the second session was that "the group rejected the thesis that only manipulative activities should be included in industrial arts and rejected also the stereotype projects which have sometimes characterized the work in the past" (Hutchcroft, 1958, p. 18).

Another event that occurred in 1958 was the publication of *The Minnesota Plan for Industrial Arts Teacher Education*. This proposal, developed by William J. Michels and Wesley S. Somers at the University of Minnesota, contained recommendations for improving the preparation of industrial arts teachers. Changes in the general and professional education of future teachers was suggested, as well as a revision of the industrial arts subject matter. Regarding content, the authors promoted individualized instruction in three "cores of experience:" science-mathematics, technology, and design. Undergraduate students could take these core courses simultaneously in order to best integrate learning across content areas. Meyer expressed a highly favorable opinion of *The Minnesota Plan* as follows:

They develop in this curriculum such items as industrial orientation, materials, a great deal of design, studies of power, studies of wave motion, chemistry and metallurgy, and in general depart rather radically yet apparently quite soundly from the normal and traditional industrial arts program. This is something we need to explore. (1959, p. 17)

Also, Olson said that this plan "should be considered as one of the significant contributions to teacher-education curriculum development in the second half of the century" (1963, p. 16). *The Minnesota Plan* contributed dramatically to the revision of industrial arts teacher education programs throughout the nation.
Divergent Paths

It appears that, by 1960, two broad schools of thought had very gradually formed from the wide range of approaches to industrial arts instruction that had developed throughout the past. A number of assertions by members of the profession have served to identify this dichotomy.

As early as 1960, Carlton E. Bauer, of the State University of New York in Buffalo, recognized an apparent trend in industrial arts to “indicate the existence of two schools of thought concerning how the subject should be approached” (p. 110). In his outlook for “Needed Research in Industrial Arts Teacher Education,” Bauer perceived the relationship between the two perspectives as “the theoretical vs. the pragmatic approach.” According to him, the theoretical approach could be characterized by an emphasis on building a body of content more aligned with the so-called academic areas of study. To Bauer, the pragmatic approach was concerned with practical applications and served the needs of students less motivated towards academic study. Bauer proposed, “whether this dichotomy could be best dealt with by a single all-embracing program or by the development of two frankly different programs might be worth further exploration” (pp. 110-111).

In a paper presented to the AIAA Convention at Pittsburgh, on April 19, 1962, Kenneth W. Brown, former Executive Secretary of the AIAA and the Director of the Industrial Arts Education Division at the State University College in Buffalo, New York, clearly identified the disparity within the profession. His presentation, titled “Establishment of a Philosophy: A Key to Excellence,” conveyed the philosophical state of the profession at that time.
Brown determined that, due to the contradictory influence of the "manual training-vocational tradition," no program of study ever truly reflected the aims of the industrial arts envisioned by individuals such as Dewey, Richards, and Bonser. According to Brown, these men viewed industrial arts as a broad "interpretation of industry" and felt that "no significant progress has been made toward devising a program of instruction from this point of view" (1962, p. 12).

Brown added that the rapid development of science, referred to by him as the "scientific revolution," was well underway and had recently sparked a new idea for an instructional program within the industrial arts concept.

Brown commented:

Thus, two ideas for an instructional program have been advanced within the industrial arts concept. The first sees the function of industrial arts as the interpretation of industry. The second identifies industrial arts as the study of the technology of man. While the two ideas are similar in character and intent, they are not identical in what they propose to accomplish. The interpretation of industry idea is what Dewey, Richards and Bonser attempted to convey as the function of industrial arts in their time. The second idea - the study of technology - is a natural outgrowth of the former but centers upon the nature of the production enterprise of man today. (1962, p. 13)

Brown continued by stating: "In one or the other, perhaps the latter, lays the future for industrial arts" (1962, p. 13). He then issued a challenge to the profession to consider this option and suggested that the process of change may be difficult.

In 1971, Anderson and Olstadt expressed their view that,
For many years we have seen a growing gap between the various schools of thought in industrial arts, as to which body of knowledge should be transmitted by this portion of the school curriculum. These two schools of thought can be broadly categorized into those who feel that industrial arts should develop an understanding of technology, and those who feel that industrial arts should focus upon an understanding of industry. (p. 247)

The following year, from his Review and Evaluation of Curriculum Development in Industrial Arts Education, Householder reiterated, “the largest number of curriculum efforts in industrial arts education during the past decade [the 1960s] have drawn their content from industry and/or technology” (1972, p. 13). For the purposes of this study, these two approaches will hereafter be described as the industry-based and technology-based approaches to the instruction of industrial arts.

Logically, the industry-based curriculum efforts continued to derive their content from the analysis of industry. Differing analyses of industry resulted in an array of such programs. Those who favored this approach often leaned towards the prevocational aims and project-oriented methods that were reinforced during the efforts of World War II. The acceptance of vocational funding and career education during the 1970s further bolstered what had now become routine in the instruction of industrial arts.

On the other hand, those who supported a technology-based view were more concerned with the place of the student in the contemporary technological society. They embraced problem solving, research and experimentation, and the integration of math and science as approaches for instruction. In Brown’s words from 1962, “to them industrial arts is the study of technology for citizenship literacy and instructional content has the full range from scientific principles to finished products” (pp. 12-13).
New Industrial-based Programs

The apparent advantage that the industry-based collective had over the technology-based theorists was that a majority of the industrial arts programs across the nation contained content related to industry and were located in facilities built to accommodate that type of approach. All that remained for the industry-based proponents was to organize the curriculum into an acceptable standard derived from the extensive assortment of goals and objectives used to shape the direction of industrial arts in the past.

Two significant industry-based curriculum efforts during the 1960s were the American Industry Project (AIP) and the Industrial Arts Curriculum Project (IACP). The AIP began in 1962 and was developed at Stout State University, in Wisconsin. The IACP was directed by Edward R. Towers and Willis E. Ray of The Ohio State University, and Donald G. Lux from the University of Illinois.

The AIP was intended to provide an integrated body of content specific to industry. Wesley Face, co-director of the AIP with Eugene Flug, stated directly: “The source of the content for this program is industry and not technology” (1967, p. 18), thus serving to identify the alternate approach. Funded by grants from The Ford Foundation and the United States Department of Education, this project utilized an analysis of industry to organize the content of industrial arts. Thirteen essential components of industry were identified: communication, energy, processes, materials, production, management, marketing, transportation, finance, property, research, procurement, and relationships.
The AIP was articulated through three levels designed to move from teacher-directed activities to student-directed activities through the course of the program. The first level presented a broad view of the concepts of industry to eighth grade students. The second level served as an in-depth study of industry and the interrelationship of the components of industry for ninth or tenth grade students. The third level allowed twelfth grade students to select industrial concepts to study independently. A significant body of instructional materials was developed and employed in schools, however published curriculum materials were limited. A number of studies which attempted to determine changes in the attitudes and achievement of students enrolled in AIP programs indicated that the program had positive influences in such aspects of student development.

The curriculum structure developed by Towers, Lux, and Ray was based on an analysis of society and economy. From that analysis, the content was categorized into management, production, and personnel systems within two broad instructional areas: construction and manufacturing.

In their effort to define industrial arts, Towers, Lux, and Ray stated:

"Industrial arts is an organized study of the knowledge of practice within that subcategory of the economic institution of society which is known as industry. Industrial arts cannot be equated with industrial praxiology (technology). Industrial praxiology (technology) is a body of knowledge which provides subject matter for the studies of the industrial-vocational student, the industrial technician, and the industrial engineer, as well as the industrial arts student, the college student of industrial psychology, and many others. (1966, p. 43)"
Indeed, the IACP did focus on student needs created by, or related to, technological advancements in industry. However, it is clear from the first sentence of this passage that the foundation upon which they based their curriculum project was the study of industry and not a study of technology. Moreover, the stated purpose of the IACP was to “develop a rationale to guide the conceptualization of a more adequate structure or framework for the study of industry” (Towers, Lux, & Ray, 1966, p. iv). Another point of interest is that the body of knowledge is referred to as industrial praxiology. Note that the authors devised the somewhat obscure term “praxiology,” and then added “technology” as a possible interpretation for it. This locution, industrial technology, was later adopted as the descriptor for an entirely separate form of industrial education found in universities to prepare individuals for careers in industrial supervision. That program is described more thoroughly in Chapter 6.

Years later, as the argument over the redirection of the profession intensified, some considered the proponents of industrial technology education as a moderate “third group” worthy of consideration (R. T. Wright, 1985, p. 21). In 1983, Lux attended to this tripartite scheme through an article which asked, “What Represents the Future for the Field: Technology Education, Industrial Technology Education, Industrial Arts?” (1983). And in 1985, R. T. Wright said of the industrial technology advocates: “These people suggest that a study of all technology, including medical, educational, agricultural, and office technologies, is too broad.” He added: “They suggest we should limit our ambitions to match our competence” (1985, p. 21). By this R. T. Wright meant...
we should limit our concern of technology to that which is used in industry. Thus, again it is evident that the primary focus of this plan was industry, with technology as a subordinate component.

Yet above all else, the American Industries Project and the Industrial Arts Curriculum Project, selected as just two examples from a number of industry-based curriculum projects, were representative of the growing dissatisfaction within the field at this time and contributed to the climate for change that had developed.

**Original Technology-based Programs**

During the 1960s, the focus on technology as a theme for curriculum development in industrial arts was guided primarily by two men. Delmar W. Olson and Paul DeVore each based his identification of content for industrial arts, to some degree, on separate analyses of technology.

In 1957, Olson, a native of Minnesota who graduated with a B.S. degree from Iowa State University, completed his graduate studies at The Ohio State University. His dissertation, titled *Technology and Industrial Arts: Derivation of Subject Matter from Technology with Implications for Industrial Arts* included a proposal for an industrial arts curriculum “derived from an analysis of contemporary industry and reflective of technology . . .” Published through the backing of the honor society Epsilon Pi Tau, this proposal was considered as a plan, for the first time, by participants in the 1959 Virginia Industrial Arts Association conference (Olson, 1963, pp. 15-16).

A few years later, Olson, then a professor of industrial arts at Kent State University, authored the book *Industrial Arts and Technology*, which made a
significant contribution to the profession as it received national distribution. Published in 1963, this book improved upon his dissertation and effectively focused on the need for a major change in the curriculum.

In *Industrial Arts and Technology*, Olson specified six functions of industrial arts derived from the technological culture and man as the creator and user of technology. Olson identified the sources that influenced the selection of his functions, likening them “to the outcomes of industrial arts as seen by Bonser and Mossman” and “the purposes of industrial arts as expressed in the *Ohio Prospectus*” (p. 165). In his article “Curriculum Movements in the 1960’s,” Householder (1979) said of Olson’s plan: “his six functions for industrial arts: technical competence, occupational orientation, consumer competence, recreational liberation, cultural appreciation, and social competence, required a thorough understanding of technology” (p. 120).

Todd has stated: “Olson was the first to grapple with the difficult problem of identifying the new content structure of industrial arts if it were, indeed, to reflect technology” (1991, p. 20). Olson’s analysis of technology, in *Industrial Arts and Technology*, was particularly noteworthy for its explanation of the relationship between industry and technology which included the following:

Now study is defined as careful examination, investigation, inquiry, research in order to determine the facts. A science is defined as systematized knowledge derived from study, observation, experiment, and test. A broad interpretation of industry considers it as the system of enterprises for the development, production, and utilization of material goods and services by which a people gain control over their physical environment. Through rather logical deduction, then, technology becomes the science of industry. (p. 55)
Although Olson did base his perceived functions of industrial arts primarily on an analysis of technological culture, they were used as only one of three major sources for deriving subject matter for this curriculum proposal. The primary source of subject matter, the industries analysis, revealed a classification of industries as follows: the manufacturing industries, the construction industries, the power industries, the transportation industries, the electronic industries, industrial research, the service industries, and industrial management. The other source used to derive subject matter consisted of a long list of common elements among industries. Olson stated, "possible combinations of subject matter drawn from the three sources are probably unlimited" (1963, p. 259). Olson believed that a fixed body of content was inappropriate for industrial arts.

It is evident that Olson's consideration of technology was rational and quite thorough. Yet, as unique as this approach was, Olson maintained the model of industrial arts as a study of industry. His own words were as follows: "consequently, we study industry to learn about technology, its techniques, skills, processes, products, services, and occupations" (Olson, 1963, p. 55).

Olson's early reasoning was revolutionary, but it did not break the mold that was the basis for traditional industrial arts programs.

Later in his career, Olson made it clear that he did consider technology as a body of knowledge equal to other content areas in general education. In 1971, he authored an article titled "Technology, Environment, and Industrial Arts" in which he stated:
In 1973, Olson, then the Coordinator for Graduate Study in Industrial Arts at North Carolina State University, authored a publication titled *Techno-gee*. In it he stated that "industrial arts, a discipline in general education, is the study of the technology" (1973, p. 1). He also wrote: "industrial arts being a discipline serves a multi-faceted role among the academics as it functions within the context of general education with its body of knowledge representing the technology. It has its own identity, integrity, and responsibility" (1973, p. 6).

While Olson originated the concept of analyzing technology to determine the functions of industrial arts, it is evident that his early analysis of technology was to be utilized primarily within the context of a study of industry. However, Paul W. DeVore, a former student of Olson's, contemplated the role of technology in industrial arts on a much broader scale.

DeVore earned his bachelors degree from Ohio University, his masters degree from Kent State University, and his doctorate degree from Pennsylvania State University. He had taught industrial arts at the secondary level, later joined the faculty of Grove City College, and in 1956 was hired by the State University College, Oswego, New York. By 1960, he had become the director of the reputable industrial arts division at Oswego.
While at Oswego, DeVore's thinking about technology began to intensify. In 1964, the first annual report on the national convention of the AIAA, titled *New Directions for Industrial Arts*, was published. The content of this volume included the addresses and proceedings that comprised the 26th annual convention, held in Washington, DC. At that conference, DeVore made a presentation titled *Technology: A Structure for Industrial Arts Content*. In this address, he stated his belief that "the efforts of the profession have failed to establish this area of education as an intellectual discipline" (DeVore, 1964b, p. 78). This statement was backed by his earlier effort to determine exactly what comprised an intellectual discipline. In *Technology: An Intellectual Discipline*, also published by the AIAA in 1964, DeVore posited the following:

An intellectual discipline:

1. has a recognizable and significant tradition, an identifiable history,
2. has an organized body of knowledge which has a structure with unity among the parts . . .
3. is related to man's activities and aspirations and becomes essential to man by addressing itself to the solution of problems of paramount significance to man and his society,
4. identifies as a part of its tradition and history a considerable achievement in both eminent men and their ideas, and
5. relates to the future of man by providing the stimulation and inspiration for man to further his ideals and to reach his goals. (DeVore, 1964a, p. 10)

Based on his analysis, DeVore found that technology fit the criteria to be considered an intellectual discipline in all but one aspect. The exception was that, to this point, no structure had been established for the organization.
of the content, or body of knowledge, for the study of technology. In regard to this, he proposed that technology be organized into seven general areas including construction, communication, manufacturing, transportation, research and development, organization and management, and craft and service industries (DeVore, 1964, p. 15). These organizers were very similar to the classification scheme by Olson in the industries analysis from Industrial Arts and Technology. As discussed earlier, Olson had used the industries analysis in conjunction with an analysis of technological culture and a long list of common elements among industries to identify content for industrial arts.

On the final page of Technology: An Intellectual Discipline, DeVore issued a challenge to his colleagues in the profession. He wrote:

Those engaged in industrial arts education face a challenge. The challenge is simply stated. Educate the youth of today for a culture dominated by technology. This is the challenge and the opportunity. To accept the challenge and to take advantage of the opportunity industrial arts educators need only address themselves to the study of the organized body of technological knowledge. (1964, p. 15)

Also, DeVore’s perception of technology as a discipline was not without its critics. Anderson and Olstad commented:

Those in industrial arts who feel that technology is the more appropriate body of knowledge have not analyzed all of the knowledge associated with technology. They have not structured the understanding necessary to understand technology. They have, rather, categorized different types of technology. This is not an unnecessary step or an unimportant activity. It is, in fact, one of the first steps necessary in the development of a body of knowledge. What has been developed is a vertical approach to the study of technology. (1971, p. 248)
Amidst the nationwide development of curriculum projects that provided, or intended to provide, the procedures for carrying out their ideas, DeVore’s proposal also came under fire for not supplying a clear means to implement his new schema. In response to this criticism, he proceeded by preparing taxonometric principles to determine the areas of technology that could be applied to the structure of industrial arts. DeVore also explored methods for implementing the study of technology in public schools. Much of that work was accomplished during the 1965-66 academic year, when he took a sabbatical which he spent at the University of Maryland.

The following year, DeVore moved on to West Virginia University, where he was allowed a great deal of freedom to explore the study of technology. In 1968, he authored an AIAA monograph, titled Structure and Content: Foundations for Curriculum Development, based on his work while at the University of Maryland. DeVore claimed, “it was the first publication in the field to lay the groundwork for a totally new curriculum, not just a few new courses” (P. W. DeVore, personal communication, September 30, 1990). In his taxonomy, DeVore broke the study of technology into two broad elements, technical and cultural-social, that each led further into a series of hierarchical elements. The second level of the hierarchy for technical elements consisted of production, communication, and transportation.

In Structure and Content: Foundations for Curriculum Development, DeVore clearly voiced his support of the study of “man and technology” as an alternative foundation for the industrial arts curriculum. He believed that “a study of Man and technology provides a better base from which to implement the purposes and objectives of general education” (1968, p. 2). The author also
explained that technology should not limit itself by the geographic boundaries that seemed to fragment industrial arts. The study of man and technology was to be primarily “concerned with man as the creator of technology regardless of national origin” (1968, p. 2).

This new approach was also expected to provide a meaningful relation between technology and the historical, anthropological, social, and economic aspects of our culture. DeVore pointed out that technology studies would be suitable to the goals of general education and would be an area of knowledge readily addressed as a discipline. In this treatise he further established that a discipline is essentially a body of knowledge that meets the following criteria: it must be dynamic, cumulative, theoretical, structural, and integrative (1968, pp. 4-5). Overall, he presented ideas that were developed in a logical, consistent, and attainable manner although they did introduce a radically different way of thinking for the profession.

DeVore finally declared:

The study of the creation and utilization of adaptive means, including tools, machines, materials, techniques, and technical systems, and the relation of the behavior of these elements and systems to human beings, society, and the civilization process is the field of study known as technology (1980, p. xi).

It is necessary to point out that this entire schema relied on the assumption that society would accept the premise of three bodies of knowledge (the humanities, the sciences, and the technologies) being integral to the development of general education programs (DeVore, 1968, p. 16). Perhaps even more importantly, it first depended upon the acceptance of other professionals in the field of industrial arts.
A Unique Approach Toward Curriculum and Instruction

A native of western Pennsylvania, Donald Maley was a vocational student in high school during the Great Depression. He worked for five years in a steel foundry before becoming a student of industrial education at California State College in Pennsylvania. Maley graduated and then served in the Navy during World War II. Following the war, he accepted an opportunity to continue his education at the University of Maryland. Studying under the direction of R. Lee Hornbake, Maley completed his doctorate in 1949. Maley decided to remain in Maryland where he became heavily involved with the school systems of that state.

In the late 1950s, Maley began organizing what has become well-known as The Maryland Plan. This plan initially concerned itself with instructional methods, for industrial arts, developed through an analysis of human needs. By the 1960s this plan had grown into a major curriculum project based on three assumptions:

1. Industrial arts is a cultural experience dealing with a comprehensive and in-depth study of one of the most dominant forces (technology) in the contemporary society.
2. Many of the content items for industrial arts have persisted throughout the history of mankind as matters of vital importance and primary cultural focus in the evolving societies.
3. There is an increasing void in education with respect to the understanding of industry and technology as dominant cultural factors. (cited in Cochran, 1970, pp. 80-81)

The critical focus on the development of the learner continued to be the primary instructional emphasis of The Maryland Plan; however, the content base was to be drawn from both industry and technology. According to this plan, the study of the organization, materials, occupations, processes, and
products of industry would remain constant in the subject matter. Yet, technology was considered the core around which industry had grown. Regarding the *Maryland Plan*, Cochran stated:

The rationale for such a program was based upon the fact that the secondary school curriculum was dominated by mathematics and science, and the significant role of technology in the society was being overlooked. As a result, a concerted effort was made to develop a program based upon the integration and application of mathematical, scientific, creative, and manipulative abilities of youth. (1970, p. 80)

The appreciation of past technologies was to be enhanced through activities utilizing an anthropological approach. Students would also identify and confront the problems of living in an industrial and technological society.

Essentially, *The Maryland Plan* blended the positive aspects of both the industry-based and the technology-based positions. That this was intended is apparent in Maley’s definition of industrial arts published in 1973:

Those phases of general education which deal with technology, its evolution, utilization, and significance; with industry, its organization, materials, occupations, processes, and products; and with the problems and benefits resulting from the technological nature of society. (Maley, 1973, pp. 2-3)

The instructional approach that Maley developed around this definition emphasized the importance of technology within the realm of industry and served as a model that found its way into many classrooms. This venerable member of the profession stated his viewpoint as follows: “I don’t think it’s possible to study industry without studying technology. And again, you must also say that there is a strong linkage between the technology of a nation and the industry of a nation” (D. Maley personal communication, January 27, 1990).
Literature Supportive of the Technology-based Approach

In late 1963, a consequential change took place within the AIAA. The leaders of the Association were reorganized into an "Executive Committee." This reorganization extended to the professional journal The Industrial Arts Teacher which, since 1942, had "been edited and produced by members as a contribution to industrial arts" (Dawson, 1963, p. 21). The responsibility for the publication of the magazine had grown so tremendously that it was necessary to establish a staff of publications specialists to prepare the journal sent to members in January, 1964. With a new name and format, The Journal of Industrial Arts Education, proceeded to build upon the tradition of the periodical which had served industrial arts educators for so long, however, it focused more on issues, philosophy, and curriculum than had its predecessor.

Under the new arrangement, Kenneth E. Dawson, the first salaried Executive Secretary of the AIAA, also served as the director of the editorial staff of The Journal of Industrial Arts Education. While pursuing his doctorate at the University of Maryland, Dawson, who had taught industrial arts in Virginia public schools and industrial arts education at Virginia Polytechnic Institute, developed a keen interest in trying to improve the profession through political activity. As a result, The Journal of Industrial Arts Education began to reflect the activity on Capitol Hill by inviting many influential leaders from outside the profession to express their ideas about industrial arts and technology.

For example, the two major candidates for the presidency of the United States in 1964 were invited to prepare a statement "on education and technological literacy." In response to this request, Senator Barry M.
Goldwater offered a brief statement sharing his views, representative of the Republican Platform. This commentary included the following:

... technological literacy is dependent upon a desire to learn. Recognition of the significance of technology to our society is bringing about increasing respect for the skilled technician and craftsman. Within this atmosphere, encouragement must be given to the development of human resources by enhancing incentives for individual creativity and achievement. . . . (Goldwater, 1964, p. 14)

President Lyndon B. Johnson did not respond personally; however a broad interpretation of the official viewpoint of the Democratic Administration was presented based largely on the President’s Manpower Report to Congress, from March, 1964. Among the concerns expressed were the impacts of automation and meeting the educational needs of potential dropouts. A blanket statement generalized, “strengthening of education at all levels is one of the keys to full development of the country’s human resources. . . and to the reduction of unemployment and poverty” (AIAA, 1964, p. 15).

Another issue of The Journal of Industrial Arts Education, in 1965, showed “How Congress Views Industrial Arts.” Representative Tim Lee Carter, a Republican from Kentucky, stated, “for a long time I have been interested in seeing industrial arts become an integral part of the curriculum of each of our high schools.” Senator William Proxmire, a Democrat from Wisconsin, commented, “there is no doubt that in this day of increasing technological advances industrial arts is assuming more and more importance” (AIAA, 1965, pp. 22-23). These were but two excerpts of many letters from members of Congress who were showing support for the inclusion of industrial arts in the amendments of the National Defense Education Act.
Technology also became a topic of serious interest during the 1960s. Books analyzing society and forecasting the future soon became popular. One of the earliest was the classic *The Technological Society* by Jacques Ellul. Published first in France in 1954, it did not receive great acclaim until translated to the English language and republished in America in 1964. Ellul’s philosophical examination of technology and its role in modern society had a great influence on the way people thought about technology. Ellul posited that technology, in and of itself, progresses without a plan. He made it clear that the development of technology without consideration for the human condition could become a threat to humanity itself. His careful examination of the influence of technology on society heightened people’s awareness that technology needs to be understood and kept in check.

In 1963, *The Industrial Arts Teacher* magazine published a brief item promoting The Society for the History of Technology and its official journal *Technology and Culture*. The Society was created in 1958 as an affiliate of the American Association for the Advancement of Science, yet its intention was to study technology from an interdisciplinary perspective. The journal *Technology and Culture*, as well as a number of monographs published by the Society, was initially edited by Melvin Kranzberg, Cyril Stanley Smith, and R. J. Forbes (AIAA, 1963, p. 9).

Kranzberg, the author of *Technology in Western Society* and a professor at the Case Institute of Technology (in Ohio), made an address at the State University College at Oswego. In 1964, his presentation was adapted as an article published in *The Journal of Industrial Arts Education*. In this article, titled "Technology and Culture: Dimensions for Exploration," Kranzberg wrote the following about industrial arts teachers:
Yours is not simply training your students to live in a changing world, a world which is being transformed by dynamic technological advance. Hence, it is incumbent upon you to realize the social significance of the industrial arts in our society, and to transmit to your students a sense of the value and worth of participation in the technological process which is so vital a part of our civilization. (p. 28)

Kranzberg also offered an article to the Journal of Industrial Arts Education titled “Technology is Important - Really it is” that was published in 1967. This article again addressed industrial arts teachers specifically by identifying that they had been unaware of the importance of their subject matter from a historical standpoint. He felt that, in general, they taught skills without offering explanations of the scientific principles involved, the historical development of technologies, or a rationale for the future use of such skills. Kranzberg stated:

The great opportunity for the industrial arts teacher is to show how the industrial arts formed society, how they contributed to the growth of civilization in the past and how they can contribute still more to the achievement of the goals of the future. (1967, p.32)

Kranzberg believed that industrial arts had a great deal to contribute to the preparation of children for life in the future but was not living up to its potential.

In 1969, DeVore, who credited Kranzberg’s journal Technology and Culture as being a major influence on him, and Will J. Smith together edited the monograph Education in a Technological Society: Proceedings of the Education in a Technological Society Conference. This conference, and its published proceedings, was a very early effort to promote the study of technology as a part of formal education.
Also in 1969, Edward Kabakjian replaced Howard S. Decker to become the third full-time, paid executive secretary of the AIAA. Kabakjian also functioned as the Editorial Director of *The Journal of Industrial Arts Education*. In January 1970, *The Journal of Industrial Arts Education* was renamed again, only six years after its first name-change. This time it was heralded as *Man/Society/Technology*. Kabakjian was very interested in promoting the technology-based approach. He made this extremely clear in the April, 1971 issue of *Man/Society/Technology* when he stated:

> The task to move, in a short period of time, more than 50,000 industrial arts teachers, scattered throughout every city, town and hamlet in the United States, from the traditional program of instruction into a broader and more comprehensive technological base is a near impossibility without some major Federal support. . . . (p. 206)

Alvin Toffler was a noted American futurist and author of the celebrated work *Future Shock*, published in 1970. Toffler, who served briefly as a Visiting Professor at Cornell University, was a Visiting Scholar at the Russell Sage Foundation. While there, he taught courses at the New School for Social Research, and was one of the first to offer courses oriented toward the future. He offered the first such course during the 1966-67 academic year and his experiences as an educator prompted him to serve as editor of the book *Learning for Tomorrow*, which addressed specific educational issues. In *Learning for Tomorrow*, Toffler wrote:

> The ultimate purpose of futurism in education is not to create elegantly complex, well-ordered, accurate images of the future, but to help learners cope with real-life crises, opportunities and perils. It is to strengthen the individual’s practical ability to anticipate and adapt to change, whether through invention, informed acquiescence, or through intelligent resistance. (1974, p. 34)
Futurism in education meant teaching in such a way so as to help students use knowledge to make it relevant for the future. This concept is applicable to any body of knowledge, including history. Those interested in establishing technology as the content for industrial arts immediately saw the relevance of futurism to their objectives. Within the industrial arts profession, a sudden increase in efforts to study the future became especially noticeable during the 1970s.

Planning for the Future within the Profession

The study of the future by a select group of industrial arts educators during the 1970s contributed to the profession immensely. In 1972, the ACIATE sponsored an ad hoc “Committee for the Study of the Future” which was to foster futuristic activities in the industrial arts profession. The role of this committee was primarily to sponsor related presentations at conferences and to develop and disseminate materials that would be beneficial to classroom teachers. The need for the curriculum to change from its traditional structure was stressed through most of their efforts.

One goal of the Committee was to have an ACIATE yearbook dedicated to the topic of futurism and the future of industrial arts. This was achieved in 1976 with the publication of the 25th yearbook titled Future Alternatives for Industrial Arts. A number of articles included in this yearbook were authored by members of the Committee. Chapter five, “Implications for Industrial Arts,” was of direct interest to the profession. The authors, DeVore and Donald P. Lauda, cited eight implications that the study of the future would
have for industrial arts. The first declared that "if industrial arts is to contribute to the study of the future, then the most appropriate discipline base is the study of technology" (1976, p. 142). Other implications involved necessary changes in facilities, instructional strategies, teacher preparation, and a clear definition for the content and structure of "technology education."

Another point made by DeVore and Lauda was the need to change the name of industrial arts. This was certainly not the first time that such a suggestion had been made concerning the title of the profession. In 1966, for example, William E. Warner pointed out that "there is no question about our need for a new professional label because neither 'Industrial Arts' nor 'Industrial Education,' are descriptive or explicit enough to fill our needs in the decades ahead" (p. 8). Regarding the term "technology," Warner stated: "it is very palatable and certainly generic, but because of this, can be claimed by many others, so our use of it must be done with care" (1966, p. 8). Another discussion of this topic took place at the April 18, 1966 AIAA Executive Board Meeting in San Jose, California. From the minutes of that meeting is a written record that Association President Earl M. Weber "... discussed scheduling of time at the summer Board meeting for considering a name change for 'industrial arts'. He ... stated that one hour would be stipulated for discussing a name change at the summer Board meeting" (AIAA, 1966, p. 6). This early consideration of a name change for the AIAA did not culminate in any action since a majority of leaders at that time, including Weber, were opposed to such a change.
Lauda later identified 25 presentations, or publications, generated at AIAA conferences, from 1974-1978, that focused specifically on futuristic endeavors (1979, pp. 217 - 244). One of those publications identified by Lauda was presented at the 1976 AIAA conference in Des Moines, Iowa by Kendall N. Starkweather. In “Industrial Arts in the Industrial and Postindustrial Society,” Starkweather recognized that “the profession of industrial arts has not been known as being futurist oriented. Very little real planning for future events has ever taken place in our field.” He concluded his message by stating: “We, as educators in the field of industrial arts, have had a rich heritage despite the lack of planning. The future of our profession will evolve as we identify strategies and goals which our field should strive to attain” (1976a, pp. 355-358). This reasoning undoubtedly contributed to the trend towards long-range planning that later developed.

In a related article, titled “The Nature of Industrial Arts In a Post-industrial Society,” Starkweather described how industrial arts professionals ought to prepare for the future. He said “future studies rely heavily upon the rational study of anticipated happenings. The anticipated happenings are based on data from which planners and policymakers may pursue the goals of education for the coming years” (Starkweather, 1976c, p. 196). Starkweather pointed out that such studies related to the future of industrial arts were not available for use but, if they were, they would provide “a basis for action appropriate to the field in the years ahead” (1976, p. 196).

As a graduate student at the University of Maryland, Starkweather had established himself as a forward thinker. In 1975, he completed his doctoral dissertation titled A Study of Potential Directions for Industrial Arts Toward the Year
2000 A.D. It was based on the views of 10 experts of futuristic studies within the industrial arts profession and concluded the following:

1. A new name should be created for the discipline appropriate for a profession seeking to interpret technology and industry in a post-industrial society.

2. Programs will move in the direction of applying technology to solve the major problems facing humankind.

3. Technology will begin to be studied from an international base.

4. New areas of content will begin to emerge (e.g., plastics, ceramics).

5. Traditional areas (e.g., wood, metal, drawing) will be grouped into broader areas of study such as materials and processes.

6. Industrial arts will become more interdisciplinary and systems oriented.

7. Course content will have an emphasis on environmental considerations.

8. Post-industrial development will influence content with emphasis on technical knowledge, research, data retrieval, design, and technological change.

9. The affective domain and value systems will receive more attention. (Cited in Lauda, 1979, p. 237)

Although they may seem like predictions, in most instances, it was not the first time that these conclusions were proposed or acted upon. By virtue of employing a Delphi methodology, the conclusions from Starkweather's dissertation were effectively a compilation of the best existing ideas related to the development of a new approach for industrial arts. Yet, each statement was well formed and helped to define the characteristics of the technology-based approach for instruction, serving as a forecast of things to come. Most of
these conclusions have since become realities largely as the result of the strong convictions of Starkweather, who was then hired as an Assistant Professor at the University of Maryland, and the leaders who contributed to his study.

*Equity Issues*

From its inception, industrial arts was considered a program area for males. Much of the literature related to industrial education from the early half of the twentieth century exclusively addresses the activities of boys and rarely is their mention of the involvement of girls. For many years, the counterpart program considered appropriate for females was home economics and, in fact, most people considered it perfectly acceptable to stereotype educational programs by gender.

As mentioned earlier, female involvement in industrial arts classes only began to occur in considerable numbers after World War II, largely as a result of the war effort. However, only since 1972, has federal law prohibited the restriction of females students from any educational program solely based on gender. Title IX of the federal Education Amendments of 1972 specifically addressed this issue of bias and gender-role stereotyping. No longer was industrial arts expected to serve only males.

Although traditionally a male dominated field, industrial arts educators were generally receptive to the inclusion of females in the classrooms and in the profession. It was becoming clear that men and women needed exposure to the same types of educational experiences in order to
function in modern society and that women were, in most cases, equally capable of performing the tasks required of men, and in some situations better. Female interest in industrial arts programs bolstered the enrollment and as the number of females in the workforce grew, women quickly became a valuable resource for business and industry.

Industrial arts programs have also responded to the needs of another human resource not to be overlooked — that is the many disadvantaged individuals who have the potential to contribute quite considerably if certain needs are met. Federal legislation has provided incentive for programs to make their facilities accessible to the physically disadvantaged. Also, learners with special needs have always been readily accommodated through the variety of instructional approaches that industrial arts programs utilize. In many cases, the gifted as well as the educationally disadvantaged students have responded well to industrial arts.

**National and Regional Forums**

Another milestone for the profession that took place during the early 1970s was a series of forums conducted by the AIAA and funded in part by the U.S. Office of Education. These forums were designed to bring industrial arts educators together with leaders of government and industry, as well as representatives of foundations and professional organizations. The Educational Office of the National Aeronautics and Space Administration (NASA) was also instrumental in the presentation of this series of forums.
The first meeting was a National Forum held in Washington DC that lasted for two days in January, 1970. At this forum, the discussion was focused on the perceived need for change within industrial arts. The participants sought ideas that would improve industrial arts education through a cooperative effort, thus establishing valuable relationships between the participating organizations. During the National Forum, a suggestion was made to conduct regional forums throughout the nation in order to extend the benefits of the forum activities to those more intimately involved with instruction in the schools.

Between March, 1970 and November, 1971, eight regional forums were conducted, each lasting two days. In these forums, the procedure involved asking the cooperating agencies what they could do to help industrial arts. The rationale for this aid was that the improvement of industrial arts would provide a more adequately educated youth which in turn would contribute to the interests of such agencies, as well as society in general.

These forums were planned to help programs in public schools and teacher education institutions recognize the role of industrial arts as the interpreter of technology for American schools. In his address to the Southeast Forum, Delmar W. Olson explained:

In any culture, the primary function of the school is to acquaint the young with the nature of that culture. . . . that medium for today's youth is a culture which is characteristically and intensely technological. The American school, then, has as its primary responsibility to acquaint the young with that type of culture. In so doing, it acquaints them with the technology itself. . . . In accepting this commitment, the school calls on industrial arts to assist the individual in the process of self-realization within the context of technology.

(1972, p. 34)
A change was in order and many realized that this change would take time since the field was still quite unsettled. That traditional programs had some shortcomings was apparent to many, and as many different recommendations existed concerning the direction of future change. At another regional forum, from a presentation titled “Industrial Arts - An Educational Responsibility for Interpreting Technology,” Willis E. Ray depicted the situation at that time as follows:

For the last ten years, professionals in our field have been analyzing man’s accumulated knowledge to establish the base discipline which our field represents. Some have said our discipline is technology. Some have said our discipline is based upon a study of industry. Others have defined our base discipline as industrial technology. Another major consideration is that we must not departmentalize our work as a single discipline, but we must look at it in an interdisciplinary context - how our field relates to science, mathematics, and/or the various social studies. Some would urge that we must be interdisciplinary in nature, rather than discipline-centered. (1972, p. 56)

Despite the apparent turmoil, it is clear that the AIAA leaders had an agenda for these forums. From the Minutes of the Executive Board meeting which occurred on April 6, 1970, it was recommended that “the project should emphasize (1) technological literacy, (2) industrial arts as the core of a curriculum, (3) industrial arts as being interdisciplinary, and (4) involvement of education, industry, and government” (AIAA, 1970, p. 27). In his presentation for the Mideast Forum, Donald Maley offered sweeping support of these goals and stated:
It is here that I would make my bid for the emphasis on the study of technology. I would not limit such a study to the technology of industry or production. Nor would I advocate, for general education purposes, the in-depth, taxonomical study of any one or more of the identifiable technologies.

My reasoning in this regard is not geared to the study of technology as a function of one’s employment, but in a much broader sense-I would opt for a study of technology that would be useful to the future citizen of a democratic nation as he tries to solve the pressing problems of his society. (1972, p. 58)

The interest in technology was growing. Franzie Loepp wrote: “Our challenge for the seventies, then is to continue to teach an understanding of technology which will enable our students to apply it to man’s problems” (1972, p. 175). Promotional campaigns such as the regional forums were designed to make industrial arts educators aware that a broad understanding of technology was important to them. Another promotional method employed by the AIAA around the early 1970s was a “Focus” series of monographs that addressed topics of interest to industrial arts educators. One such issue was titled “Focus on Technology in the Classroom.” However, while many individuals began to “focus” on the role of technology in industrial arts during the early 1970s, they were slightly distracted by a different educational issue demanding national attention.

*Career Education*

Due to the concerns of the United States Commissioner of Education, Sidney P. Marland, a great deal of attention was being given to a new controversy during the first term of the Nixon Administration. Marland believed that education, as it evolved in the United States, was not
realistically preparing the majority of American students for the options available to them in adulthood. He felt that the extensive academic preparation, through instruction primarily in the liberal arts, that had become standard in public schools was appropriate for only about 30% of the student population. According to statistics he cited in 1971, only two-thirds of those students would actually complete undergraduate college programs. Thus, he estimated that roughly 80% of the children who started elementary school did not pursue the path for whom the academic curricula was intended. As a result, Dr. Marland was compelled to ask the following question of the National Association of Secondary School Principals:

Shall we preserve the traditional practices that are obviously not properly equipping fully more than half of our young people, or shall we immediately undertake the reformation of our entire secondary education in order to position it properly for maximum contribution to our individual and national life? (cited in McLeod, 1971, p. 214)

The change proposed by Marland became known as career education, which meant preparing the majority of students to become usefully employed following high school. Immediately, many in industrial arts recognized that they could contribute significantly to this national concern — others weren’t so sure it would be for the best. Zeigler wrote:

Career education opened to mixed reviews in industrial arts. To many associated with industrial arts, the stated outcomes looked very similar to those that had been stated for industrial arts. To others, the relation of career education objectives to industrial arts objectives were envisioned as a Pandora's box. (1979, p. 181).
In 1973, a position paper was published by the AIAA on the topic of career education. This essay was broken into three sections. The first section raised the question “What is Industrial Arts?” This description stated that “industrial arts provides experiences and information dealing with the world of work and occupational opportunities in industry. This develops career awareness and provides career exploration experiences.” It was clear that industrial arts was already addressing the concerns of career education. The paper further expressed, “the students also study effects of industrial technology on all elements of society and the environment. This provides for industrial-technological understanding and application” (AIAA, 1973, p. 262). Note that industrial arts was considered the study of industrial technology, indicating that technology was being accepted as essential to industrial arts, yet there was still some reluctance to give up the traditional concentration on industry.

The second portion, “What is Career Education?,” identified this endeavor as an attempt to unify collegiate, college preparatory, general, and vocational education into an articulated and a cooperative effort. In the realm of general education, including industrial arts, career education was to be considered “the responsibility of the total school program and includes all disciplines in the curriculum” (p. 263).

The final portion was given the heading “What is the Role of Industrial Arts in Career Education?” Acting in the interest of its members, the Association wrote:
The teachers of industrial arts have a deep commitment to the purposes of industrial arts and the contribution that it makes to each individual to become a valued and contributing member of society through attainment of industrial-technological literacy, occupational literacy, and providing for individual needs.

Career education has similar and compatible goals of enabling a student to arrive at decisions which would provide for the greatest degree of compatibility between himself as a human being and the career ladder he embarks upon as a productive citizen. (p. 263)

While career education was described as compatible with industrial arts, there was some concern that career education within industrial arts would be construed by the public as being “vocational” in nature. Industrial arts has never intended to provide specific training for particular occupations; however it could provide students a broad exposure to potential careers in industry.

*Debut of Technology Education Programs and Materials*

Kozak and Robb have reported that, “technology education, as a name for a program area of study, evolved from a discussion (circa 1970) between Dr. James Harlow, President of West Virginia University, and Dr. Paul DeVore” (1991, p. 35-36). In a personal conversation DeVore recalled that, at about that time, he and Department Chair Thomas J. Brennan, along with a small group of consultants, had prepared a proposal that they submitted to Harlow. What they petitioned for was the establishment of an institute or center for the study of technology and human resource development at West Virginia University. Harlow alternately suggested that the Department of
Industrial Education be altered considerably and referred to as the Technology Education Program (P. W. DeVore, personal communication, April 20, 1992). It was in this manner that West Virginia University made the first complete curriculum change to technology education at a college or university. This change was affected at the graduate level only and led to master and doctorate degree programs in technology education.

A number of undergraduate courses studying technology had been offered through industrial education programs at institutes such as St. Cloud State College, the University of Wisconsin-Stout, Western Michigan University, and Indiana State University. Most of these courses were developed primarily due to the efforts of a single faculty member and were not indications of departmental interest in converting to a technology-based approach. However, in 1975, Eastern Illinois University did start planning for the initiation of a technology-based teacher education program (AIAA, 1971, pp. 22-32).

The following year, the first undergraduate program leading to a degree in technology education was established under the direction of Donald Lauda. The technological systems of communication, energy/power, and production provided the basis from which content was derived for the classes offered through this new program (Robb & Jones, 1990, p. 44). The School of Technology at Eastern Illinois University also developed two Master’s of Science degree programs based on the study of technology — one was designed with a technology education option for teachers and the industrial technology degree offered an industrial management option (J. R. Wright, 1980b, p. 237).
Davis Publications, of Worcester, Massachusetts also launched the first plan to publish a technology-based textbook series. DeVore, who played a major role in organizing and developing these resources wrote the following:

Creating a society in which technological systems serve human purposes will require a new discipline of technology, a discipline which focuses on a human centered technology which serves social purposes rather than technical purposes. It is for this reason that Davis Publications initiated, with considerable insight and foresight, a series of publications designed to serve a critical educational need of society existing at all learning levels. (1978, p. ix).

The first book of this series was Technology, Change, and Society, by Pytlik, Lauda, and Johnson, published in 1978. The audience for this book was to be at the college level, particularly those interested in the study of technology. The intention was to provide a resource that would help establish a foundation from which a more focused study of technology might unfold.

The second text in the series, Technology - An Introduction, was authored by DeVore and published two years later, in 1980. DeVore wrote “its purpose [was] to order and structure the discipline of technology by identifying and analyzing the component parts and to examine technical means as critical variables in the affairs of humankind” (1980, p. xi). Technology - An Introduction continued the college level series of five books which also included volumes that dealt with the technological systems of communication, production, and transportation.

Davis Publications was the first to venture into the production of texts and study materials for precollege students from kindergarten through secondary levels. Taking on this new concept of technology-based resources was a calculated risk on their part. Retrospectively, Gerald Stashak of Davis
Publications said: “obviously Davis is committed to the technology-based curriculum. As a matter of fact, we wrote off industrial arts when we decided to enter this field” (1985, p. 95). In 1992, however, Davis dropped their interest in the publication of technology education, releasing their series to another publisher.

Davis also provided a grant that made it possible for *Man/Society/Technology* to feature, in its September/October, 1982 issue, the first “Resources in Technology,” a pull-out section for classroom teachers. This became a popular highlight in subsequent issues of the AIAA journal. The early resource material was created by the Technology Education Program at West Virginia University as part of a project, called the Development of Technological Resources for Industrial Arts Instruction, conducted for the Virginia Department of Education. “The instructional materials called Resources in Technology included specific topics within the technical systems of energy, transportation, production, and communication” (McCorry & Maughan, 1983, p. 13).

In 1984, Davis published a monograph version of *Resources in Technology*, kicking off an annual series that included each of the “Resources in Technology” sections from the journal during the previous year. In 1986, the Association itself took over the responsibility of publishing and later Tidewater Associates became responsible for the material development.

**Standards Project**

In 1976, Kendall Starkweather made a concise, and most incisive, remark in a presentation at the annual AIAA conference. That statement was as follows: “we have no consistent standards for industrial arts” (1976a, p.
In October of 1978, a three-year project, funded by the United States Department of Education, commenced at Virginia Polytechnic Institute and State University. This project not only established standards, it also generated valuable data that would contribute to future planning and policy-making within the profession.

Titled the “Standards for Industrial Arts Programs Project,” this effort was reminiscent of the Standards of Attainment in Industrial Arts Teaching developed in 1934 by Robert Selvidge and the special subcommittee of the Industrial Arts Division of the American Vocational Association. Like the older Standards of Attainment in Industrial Arts Teaching (American Vocational Association, Industrial Arts Section, 1934), the primary goal of the new Standards for Industrial Arts Programs Project was to establish the level of attainment that could be regarded as a measure of adequacy for industrial arts programs nationwide. Project Director William E. Dugger, Jr. said: “the overall purpose of this project was to develop standards and guidelines for the improvement of IA programs that fulfill the objectives of the Vocational Education Act of 1963, as amended by the Educational Amendments of 1976” (1980, p. 3).

Over 400 industrial arts teachers, state and local supervisors, teacher educators and consultants participated in a series of ten regional workshops. Advisory committees were formed to oversee particular aspects of the Project and to ensure that the standards were “systematically developed, thoroughly reviewed, and empirically validated” (Dugger, Bame, & Pinder, 1985, p. 60). All states and territories had the opportunity to be represented in the regional workshops which were organized for the purpose of developing and validating the standards which were categorized under ten headings...
previously established through research conducted by the Project staff. Special
corns concerns such as sex equity, students with special needs, and input from the
American Industrial Arts Student Association were addressed through
another workshop. In addition, special sessions regarding the Standards
Project were held during annual AVA and AIAA Conferences.

Dugger also disclosed: “an important secondary task of the project was
to establish a data base on IA in the United States” (1980, p. 3). Prior to the
Standards for Industrial Arts Programs Project, the 1966 Schmitt-Pelley study
had been the most recent report to provide comprehensive data regarding the
status of industrial arts programs in the United States. Each of these studies
now stand as “quantitative benchmarks” for the profession (Dugger, 1988, p.
91).

The information collected in the Standards for Industrial Arts
Programs Project was categorized under the following headings:
philosophical views, instructional program, students, student organizations,
teachers, facilities, finance, and evaluation in industrial arts education. Based
on the surveys conducted, Dugger (1988) reported that, philosophically, there
had been “little change in the 15 years since the Schmitt and Pelley study” (p.
98). This was determined by answers to survey questions regarding the
perceived purposes of industrial arts from state supervisors, principals
guidance coordinators, and department chairpersons. “With 46 states
reporting data, there were 20,230 public secondary schools, of which 15,315
had industrial arts programs” (Dugger, 1988, p. 101). The majority of
respondents felt that industrial arts programs were indeed associated with a
general, rather than a vocational, education approach. The most common courses offered had changed very little from those considered traditional for several decades including wood, metals, general industrial arts, mechanical drawing, and architectural drafting. The study also revealed that the majority of industrial arts students were male and that a low percentage of handicapped students were enrolled in industrial arts courses. A small percentage of the schools offered student organizations. An increasing shortage of teachers was identified even though supervisors reported plans for construction of over 500 new industrial arts facilities. Funding was generally considered the greatest weakness of existing industrial arts programs. Student evaluation within industrial arts programs was a fairly standard practice, however, state minimum competency tests rarely included items related to industrial arts.

Upon completion of their study in 1981, the staff of the Standards Project made the final product of their efforts, the booklet of *Standards for Industrial Arts Programs*, available to professionals in the field. Originally, 1,000 copies of the *Standards for Industrial Arts Programs* were published, but it was soon apparent that the information resulting from this project warranted a more substantial distribution. With backing from the AIAA, approximately 6,000 more copies were issued for dissemination among teachers, teacher educators, state supervisors, state advisory councils, professional associations, regional accrediting associations, and others (Dugger, Bame, & Pinder, 1985, p. 60). The AIAA endorsement of the Standards Project marked the first time that this organization officially supported a set of standards for the profession.
Jackson's Mill

In 1979 and 1980, three separate meetings referred to as the Jackson's Mill Industrial Arts Curriculum Symposium provided the opportunity for 21 members from the vanguard of the profession to meet and deliberate on the direction of the industrial arts field. This symposium was organized in West Virginia and supported cooperatively by the AIAA, the American Council of Industrial Arts Supervisors, the American Council on Industrial Arts Teacher Education, the American Technical Society, Fairmont State College, and the West Virginia Department of Education.

The leaders that participated offered strong opinions on what the direction of the profession ought to be and they effectively debated the two established schools of thought. Willis Ray stated: "leaders debated the apparent bipolar positions of 'industry' and 'technology' extant to the field. An attempt was made to develop a rationale that would lead to consensus" (1981, p. 7). Lux and Ray, of The Ohio State University, led the majority of industrial arts professionals who followed the more industry-based approach. Paul DeVore spearheaded the technology-based outlook that had been gaining momentum and support from post-secondary educators.

The significance of the Jackson's Mill Industrial Arts Curriculum Theory, the report from this symposium that was published in 1981, was indeed the eventual consensus of these different points of view. Undeniably, the Jackson's Mill Industrial Arts Curriculum Symposium involved some give and take. For those who supported an industry-based view, it was difficult to give up "industry" as the key organizer even though, in the case of the IACE,
they had previously identified technology as a major concern for the study of industry. The fact that those who favored the industry-based approach accepted technology as the motive underlying industrial arts education was significant. It represented a paradigm shift that, for many, required a great leap of faith.

However, the condition of acceptance that the proponents of an industry-based curriculum imposed upon the technology-based theorists was that the broad study of technology be delimited to areas in some way related to industry. The supporters of industry-based curriculum were also concerned that the instruction of technics, that which had always made industrial education unique, would lose its value through the study of technology.

Therefore, the symposium participants concluded that the content of industrial arts should focus on “appropriate technical means” in accord with a posited “universal systems model” of the ideological, sociological, and technological adaptive human systems. The technology-based theorists declared that any subject area considered for inclusion would also have to be considered a “human endeavor.” Therefore the “systems approach” intended to study the productive activities of humans from historical, societal, and environmental perspectives by analyzing inputs, processes, outputs, and feedback.

With that in mind, the content areas of communication, construction, manufacturing, and transportation were recognized as appropriate subject area organizers for industrial arts in the future (Snyder & Hales, 1981). The Jackson’s Mill Industrial Arts Curriculum Theory also offered a plan for implementation that included individual, local, state, national, and
international strategies. The suggested organizers would utilize the following sequence of events in their establishment: rationale, objectives, pre-assessment, instruction, self-evaluation, evaluation, and feedback.

Symposia

In the spring of 1980, another symposium, titled "Symposium '80 - Technology Education" was held at Eastern Illinois University. This was the first national conference organized to address technology education specifically. Symposium '80 provided a venue for concerned professionals to express their opinions and discuss the issues related to the technology education movement. Keynote speakers at this conference were Donald Lauda, Paul DeVore, and M. James Bensen. The Proceedings of Symposium '80 - Technology Education, edited by John R. Wright (1980a), were published, thus providing "a number of substantive papers worthy of serious consideration" (Ray, 1981, p. 7).

The accomplishments of Symposium '80 inspired a second Technology Education Symposium on May 1-2, 1981 that drew over two hundred participants to the University of Wisconsin Stout. The theme of Symposium J was "Technological Literacy." In 1982, the progression of annual Technology Education Symposia continued at Ball State University in Indiana. Subsequent symposia continue to be offered annually at various universities across the country, usually following a theme related to some issue in technology education.

Regarding the success of the symposium series, M. James Bensen has said:
the symposium series has played a major role in sharpening the theory and outlining the practice of education program development in the study of technology. These symposia, which are held annually, have grown in prominence to the point where they attract educators from all levels and from throughout the country. (1991, p. 119)

This symposium series has continued to proceed uninterrupted and each year the proceedings from the annual symposium have continued to supply valuable resources to the research base for technology education.

Pressure for Change in Education

In 1980, Maley wrote:

The Proposition 13 advocates, 'back to basics' promoters, and the numerous challengers to public education have a message that is loud and clear, and should not be misunderstood. All of education is under the microscope of public investigation and examination. (AIAA, 1980, p. 11)

In the early 1980s, a number of commissioned studies of the American educational system issued reports that called attention to the apparently dire state of the nation's schools. One report, Educating Americans for the 21st Century, was endorsed by the National Science Board (NSB) Commission on Precollege Education in Mathematics, Science, and Technology. This report proposed that science and technology education at the precollege level be aimed more toward developing the observation and interpretation skills of students, as well as their proficiency for problem solving and critical thinking. It was also felt that students should acquire the knowledge necessary for exercising democratic participation and coping with life in contemporary society, and, whenever possible, creative thinking should be stimulated. In a summary of the objectives for science and technology education, the committee stated:
Students who have progressed through the Nation’s school systems should be able to use both the knowledge and products of science, mathematics, and technology in their thinking, their lives and their work. They should be able to make informed choices regarding their own health and lifestyles based on evidence and reasonable personal preferences, after taking into consideration short- and long-term risks and benefits of different decisions. (National Science Board Commission on Precollege Education in Mathematics, Science, and Technology, 1983, p.)

The National Science Foundation (NSF) itself is an organization that has done a great deal to encourage the development of technological literacy in educational programs. The NSF was founded on May 10, 1950, as an independent agency of the Executive Branch of the Federal Government. The NSF consists of a National Science Board, which performs policy-making functions, and a Director, who act as administrator of the Foundation.

In the same year, 1983, another federally commissioned report, A Nation at Risk: The Imperative for Educational Reform, was published. This study, by the National Commission on Excellence in Education, pointed out that the educational establishment was seemingly unable to respond effectively to evidence of risk such as statistics on functional illiteracy and declining test scores. Yet another study, titled High School: A Report on Secondary Education in America, by Ernest L. Boyer, was sponsored by the Carnegie Foundation for the Advancement of Teaching, and was issued in 1983. The approach to reform that Boyer adopted was a science, technology, and society (STS) theme. Part of Boyer’s plan was to include the specific study of technology. The report declared: “we recommend that all students study technology: the history of man’s use of tools, how science and technology have been joined, and the
ethical and social issues technology has raised” (Boyer, 1983, p. 110). Boyer continued by emphasizing the relationship between technology and society: “the great urgency is not ‘computer literacy’ but ‘technology literacy.’ The need for students to see how society is being reshaped by our inventions, just as tools of earlier eras changed the course of history” (p. 111).

**Plan for Professional Improvement**

In the Fall of 1981, the National Industrial Arts Advisory Council (NIAAC) of the AIAA was organized for its first meeting. This council, comprised of members from business and industry, reflected the trend of private sector involvement in education influenced by the Reagan administration. The result of this council was a challenge to the AIAA. The NIAAC asked for a response to the number of commissioned reports on education that declared a need for major reform. They suggested that the AIAA should take a leadership role and define the direction of the profession.

On November 20, 1982, the AIAA Board of Directors met in Fort Worth, Texas for a planning session, under the direction of Association President Ronald L. Foy. The primary goal of this session was to form a committee to develop a professional improvement plan. Also during this session, the members discussed the question of taking a more active position as a leadership organization rather than simply a professional organization. The idea generated some interest and soon the original committee was expanded to include a subcommittee formed to pursue such interests.
Thomas Hughes and Kendall Starkweather were the members of this subcommittee on leadership. In 1980, Starkweather himself had been appointed the Executive Director of the AIAA, thus enabling him to provide a great deal of optimistic leadership in guiding the direction of the profession.

This series of developments resulted in a sudden, dramatic step for the profession. On March 2, 1983, the members of the Board of Directors received a completed manuscript for the Professional Improvement Plan. It was approved under the theme “AIAA Pioneering Leadership in Industrial Arts/Technology Education.” The first plan was organized for the three-year period from 1983-1986, and proved to be a very worthwhile undertaking. A four-year plan was intended for the subsequent period, from 1986-1990.

In the Plan, the transition from industrial arts to technology education was described as “a national concern,” “a mission for education,” and “a stimulus for a new curriculum with new goals directed toward technological literacy” (Starkweather, 1983, p. 8). The Plan itself identified three major goals:

I. Pursue the ideal form of industrial arts/technology education to ensure technological literacy of all people.

II. Profit from personnel development exercises developing and nurturing programs that apply technology to societal problems.

III. Exchange ideas and practices within and outside the profession to foster a positive, consistent view of industrial arts/technology education. (AIAA, 1983, p. 4)
According to the goals listed, the leaders of industrial arts planned to improve the technological literacy of all people through innovative new programs that would study technology and apply it to solve problems. Also, it became clear that the AIAA desired to become a leadership organization that would promote the profession and suggest standards for programs. The mission statement from the *Professional Improvement Plan* declared that:

The mission of the American Industrial Arts Association is to provide industrial arts teachers, supervisors, teacher educators, and other educators a means (1) to define, stimulate, coordinate the ideal form of industrial arts education as a vital aspect of education for all students on all levels; and (2) to promote the improvement of the quality of instruction in industrial arts education by assisting educators, students and all others concerned to keep instructional content, methods, and facilities current with the rapid changes in industry and technology. (AIAA, 1983, p. 4)

To achieve this optimistic aspiration, the Association was relying on the strengths of those within the profession. It also expected to make use of the qualities unique to industrial arts, such as particularly successful instructional approaches and the knowledge gained from the many curriculum programs of the 1960s and 1970s. In announcing the new plan to the profession, Kendall Starkweather stated: “we shall produce ‘technology teachers’ who can direct educational situations in providing an industry and technology education for the learner.” Starkweather firmly added:
This program will not be executed for the profession. It will be developed and executed by the profession. This new thrust will not be narrowed in scope by content and methodologies, but will have guidelines involving various teaching styles and philosophies. This effort will not be by just one school system, university, or state, but will be for the entire United States. This will not be a program for a selected few in the profession. It will be a program for everyone who wants to accept the challenge to improve their conceptual and professional thoughts, become a better teacher, and provide dialogue for colleagues who will be involved with similar activities. This will be the industrial arts campaign for excellence in the next few years. (1983, p. 8)

This statement reflected the determination of the leaders in the AIAA to make a significant change in the profession, one which had been alluded to for years but never acted upon on such a scale as was about to take place.

Summary

A number of early leaders in the profession speculated on the implications of technology as it related to the study of industry. Especially during the economic growth that followed World War II, many leaders considered the study of technology a vital concern in the curriculum of industrial arts. "The New Industrial Arts Curriculum," which became known as A Curriculum to Reflect Technology, was the first curriculum for industrial arts that employed an analysis of technology.

By the 1960s, programs identified by organizers describing specific materials or processes (e.g., woodwork, metalwork, or plastics) were being considered by curriculum developers as outdated and insufficient for the modern general education curricula. Although modified, many new
programs still held firmly to industry as the basis for organizing content. The difference was that newer curricula were organized around much more exhaustive analyses of industry and/or industrial processes than had been common in the past. Along with the emphasis on industrial processes, prevocational aims and project-oriented methods often abided.

A different approach, a technology-based curriculum, was much more controversial because it was a somewhat radical departure from traditional industrial arts. A very small group of industrial arts professionals started to explore the possibilities of basing the industrial arts curriculum on an analysis of technology, as opposed to an analysis of industry. Gradually, more professionals came to accept technology as the motive of the profession. While the study of technology was identified as a viable discipline, it had not been tested extensively. Supporters of this effort were primarily concerned with the place of students in the contemporary technological society.

Literature focusing on technology and the future became widespread by the 1970's. Although the concept of an educational program based on technology emerged well before the 1970s, the interest in technology became especially noticeable through the sudden increase in efforts, by industrial arts professionals, to study the future. Technology had become a theme worthy of contemplation by many disciplines, including industrial arts. Societal pressure began to build and provided an impetus for rapid change in educational programs. As a result, leaders within industrial arts considered a major paradigm shift for the profession. This proposed transition towards a program focused on technology met with mixed reactions and ultimately resulted in a compromise within the profession.
CHAPTER 5

The Process of Change and the Establishment of Technology Education
Critical to the understanding of the establishment of technology education in the United States is the realization that it was the result of an incremental conversion from industrial arts. The change to technology education did not come easily since the growing acceptance of technology as the profession's *raison d'être* represented a fairly extreme theoretical departure from the industrial-based paradigm typified in industrial arts. For this reason, confusion and disagreement continued over the extent to which technology was to play a role in the "new curriculum."

Until the Jackson's Mill Industrial Arts Curriculum Theory, few of the many curriculum projects that existed had a considerable impact on the profession. The content derived for technology education was the culmination of many analyses of industry and technology, and the structure of the curriculum has been based around a variety of content models. Furthermore, although the concept for technology education came primarily from teacher educators in the colleges and universities, the most consequential curriculum efforts came from state departments of education and through state legislation.

The name change of the American Industrial Arts Association marked an important turning point in the transition of the profession to technology education. Executed in a "top-down" fashion, this campaign for changing the title to "Technology Education" did not come primarily from the teachers in the field. However, the opportunity to vote either for or against the name change was made available to every member through *The Technology Teacher*.
magazine resulting in a required two-thirds majority of the voting membership in favor of the change. As significant as the name change of the Association was in the transition from industrial arts, it was just one step toward instituting technology education in schools throughout America.

The process of implementing technology education was a major task in itself and the way that it has been achieved is further evidence that the transition from industrial arts was a gradual process. Since most of the technology teachers in the field were former industrial arts teachers, it has taken a good deal of time and effort on their part to get technology education programs up and running. The ITEA developed a number of resources to promote technology education and to help teachers get started with new programs. Also, professional literature, as well as products and services, began to emerge specifically for technology education.

In order to properly evaluate technology education programs, the existing Standards for Industrial Arts Programs had to be revised to apply to technology education. The standards for technology teacher education were also changed for accreditation purposes during the mid 1980s. Startlingly, however, a majority of established programs which submitted portfolios in 1988 failed to meet the new standards for accreditation. Several explanations have been offered for this shortcoming, and measures were taken to correct it and bring teacher education programs in accordance with the standards that have been set for them.

Also, in 1985, federal legislation was proposed that identified technology education as a separate area of content in general education. In
1990, the Omnibus Trade and Competitiveness Act appropriated $988,000 for technology education demonstration projects. These projects got underway in 1991, and stressed an interdisciplinary approach to teaching technology education.

Efforts have been made in the past to invoke a truly international outlook on industrial arts. Now, technology education is occurring worldwide. Although in different stages of development internationally, the different approaches that have been recognized throughout the world each contribute to the improvement of technology education. Research has also shown that there are differences in the perceptions of technology among nations. In fact, it has been suggested that the United States is not the most advanced nation in respect to technology education. Technology educators in the United States have shown interest in exchanging ideas with other nations and have taken steps to encourage such actions.

Some Thoughts about Change

Previous shifts in tendencies or trends of the profession have repeatedly been described as “movements.” The transition to technology education has been considered in the same way. In 1967, Barlow ventured to make a projection about the future of industrial arts:

> It is to be expected that industrial arts will continue to move more prominently into the technological era – history shows that manual training, manual arts, and industrial arts programs have always been associated with contemporary issues. In fact, this is one of the strengths of the movement.

(p. 502)
Barlow also predicted that "... industrial arts will sharpen its identity and responsibility in the area of occupational training," and "an emphasis will be placed on vocational guidance ..." (p. 502). To a certain extent, these predictions were realized during the career education trend promoted by Sidney Marland in the early 1970s. Thereafter, however, technology education has minimized such emphases and it is unlikely that Barlow anticipated the extent of the changes that took place in the 1980s.

The aggressive leadership that emerged from within the AIAA during the early 1980s precipitated change and created a bold new outlook for the profession. In 1983, AIAA President Vaughn E. Croft also referred to the actions of the Association as a "movement" when he stated:

We at AIAA are beginning a new movement we believe will bring industrial arts to the forefront and meet needs in education as reflected from an industrial and technological perspective. We must do this to prepare all students for the technological world of today and tomorrow. (1983, p. 6)

This statement also identified the careful compromise which existed between the industry-based and technology-based perspectives. The spirit of this compromise had been exemplified by the *Jackson's Mill Industrial Arts Curriculum Theory* which has been identified by many as instrumental in the change to technology education in the United States.

Todd offered an explanation for why the *Jackson's Mill Industrial Arts Curriculum Theory* was not a complete departure from the traditional industrial arts model when he criticized it as being "simultaneously one of the major strengths and weaknesses of the conception of technology and technological literacy in the United States." He felt that the *Jackson's Mill
Symposium participants focused primarily on what would become of industrial arts when influenced by technology rather than how technology itself might become a new curriculum. He said: “Consequently there was little success in breaking out of the historical mold or conceptual paradigm that dominated the thinking of the profession” (1991, p. 21). Still, a substantial change in the philosophy of the entire profession could hardly be expected to occur overnight.

In 1982, LaPorte offered some “Thoughts on Why We Haven’t Changed” (pp. 75-79). He recognized that dissatisfaction with things as they were indicated a condition that required change. However, since there was still a need for a program that offered some of the unique features of industrial arts, there was still hope -- another condition for change. The final condition described by LaPorte was the power to enable change. Bjorkquist believed that each of these conditions involved attitudinal elements which first required the willingness to change (1986, p. 42).

The issue of the direction of change was heavily debated during the early 1980s. In 1982, R. T. Wright responded to a “Perspective” article promoting technology as a content base for the profession, by John Ritz in the September/October issue of Man/Society/Technology, by defending “Industry as the Content Base for Industrial Arts,” stating:

Good industry-based industrial arts is a broad study of all human productive activity, all activities involving transforming: the transforming of materials into manufactured products through the act of manufacturing; the transforming of materials and manufacture goods into constructed projects and structures through construction activities, the transformation of information into media messages using communications techniques; and the transforming of energy into power to provide means for relocating goods and people using transportation systems. (p. 2)
Since Wright participated in the Jackson’s Mill Symposium, he was obviously familiar with the outcomes of the *Jackson’s Mill Industrial Arts Curriculum Theory* and the argument for technology education. He also must have been aware of the technological systems approach when he essentially equated industry with the processes portion of that approach stating: “Industry is the predominant way humans transform primary resources (inputs) into more usable forms (outputs)” (p. 2). Thus, industry could have been considered one element of the broader study of technology.

In 1985, McCrory authored a “Perspective” article titled “Technology or Industry: Which Shall It Be?” In it, he identified the two distinct “camps” that had formed in the profession. He wrote: “The technology education camp proceeds from a macro view of technical systems and their impacts on individual and society. This perspective was described in the *Jackson’s Mill Industrial Arts Curriculum Theory* as the study of human adaptive systems.” (p. 2). By comparison, the other camp, the industrial technology camp, adopted a more micro view of the technologies used by industry which in turn would limit the audience. According to McCrory, “it makes a great deal of difference if a program’s perspective includes the broader aspects of technology and society, as does technology education, or if it focuses on specific technologies applied in industrial settings, as does industrial technology” (p. 2).

This article was answered in turn by Sinn, who identified a “major flaw” in McCrory’s reasoning. “The flaw,” he wrote, “is simply that we must be realistic, to some extent, about our mission as educators about technology.” He further explained that “the reality is that we live in a culture and world which is currently confronted with numerous issues either directly or indirectly related to technology – particularly industrial forms of technology.”
In response to McCrory's statement regarding the difference in perspectives, Sinn replied: "Again, perhaps a blend of broadly conceived specializations for general applications to industry and technology is the key" (p. 30). Oddly, this sounded like a description of the traditional industrial arts.

The arguments in this issue did not create extreme animosity within the profession, but there were strong feelings among those defending each position. For the most part, the debate served to strengthen the profession and its position. Beyond the dialogue, the industrial-based approach represented the views of the majority of professionals. Perhaps it was the familiarity that made it popular, or the resistance to change which caused people to eschew technology education. Martin said it well: "Change, you see, is difficult to accept unless there is overwhelming evidence that change is necessary . . . . the strong supporters of the need for technology education as a major part of industrial arts have an uphill battle" (1983, p. 4). He backed this comment with several good reasons, including the fact that supporters of technology education were a minority made up primarily of teacher educators who were lecturing to themselves. Still, the lobby for technology education was powerful and growing.

Derivation of the Content for Technology Education

Like the profession itself, the organization of information considered essential to technology education has been the result of an unfolding process. During the first half of this century, programs were often planned with course content based solely upon knowledge and techniques utilized in regional industries. Because of this practice, the content of industrial arts varied
according to locality. A *Curriculum to Reflect Technology* had sought to reunite the profession by establishing technology as the common element among industrial arts programs. Based on this view, all existing content could then be reorganized within the framework of the broad technological domains of construction, communication, management, manufacturing, power, and transportation. While this early taxonomy remained relatively dormant for some time, new “arts of industry” rapidly emerged and older sources of content became either extremely specialized or obsolete.

Technology-based approaches were explored as industrial arts content became more and more diverse. In *Industrial Arts and Technology*, Olson devised his own analysis of technology. He then applied it, in conjunction with an analysis of industry and a list of common elements within industry, to a plan with virtually unlimited content. In comparison, DeVore’s revolutionary consideration of technology as a discipline included a taxonomy based on two broad elements, the technical and cultural-social, which each led into further hierarchical structures. According to him, technical content would be based on the technological areas of production, communication, and transportation. (DeVore, 1964, p. 15).

Among the many curriculum projects of the 1960s, the *Industrial Arts Curriculum Project* (IACP) received perhaps the broadest audience among the industry-oriented approaches. Delimiting its realm of content to “industrial technologies,” the IACP saw a need for only two broad instructional areas: construction and manufacturing. When asked what direction curriculum innovation should take during the 1980s, a co-author of the *Industrial Arts Curriculum Project*, Willis Ray, said: “One alternative would be for industrial
arts to concentrate on the technology of industry, i.e. construction and manufacturing” (AIAA, 1980, p. 10). The fact that these two content areas were later included in the Jackson’s Mill Industrial Arts Curriculum Theory should not be overlooked.

Donald Maley’s Maryland Plan, although primarily concerned with instructional methods that maximize student development, incorporated content such as communication, construction, power and energy, production, tools and machines, and transportation. Maley’s was a wide-ranging curriculum that allowed learners to explore their own interests through research and experimentation, group projects, and other action-based learning activities. He often blended positive aspects of both industry-based and technology-based approaches.

Despite the otherwise growing gap between proponents of industrial-based and technology-based approaches to industrial arts, the vast number of curriculum projects during the 1960s served as evidence that change was necessary and some difficult decisions were in order. The Jackson’s Mill Industrial Arts Curriculum Symposium bridged the gap regarding content for industrial arts through a debate that ended in a compromise. The content organizers (communication, construction, manufacturing, and transportation) agreed upon at this symposium were integral to the transition to technology education.

In 1985, AIAA President William E. Dugger, Jr. directed a writing team from Virginia Polytechnic Institute and State University to rewrite the existing standards for industrial arts programs so they would reflect the direction of technology education. The new Standards for Technology Education
Programs, funded through grants by the Technical Foundation of America and the International Technology Education Association, provided a systematic arrangement of criteria to simplify the assessment of comprehensive technology education programs.

The portion of the Standards dedicated to content was intended to assess whether programs offered the broad areas of communication, construction, manufacturing, and transportation systems. It also attempted to ascertain whether content was selected to provide for all students, if courses were well-articulated, and if accurate descriptions for each course were available to students prior to enrollment. Teachers were expected to have organized course outlines, as well as unit and lesson plans that were up-to-date and identified state-of-the-art technologies. The course content was to be developed utilizing approved curriculum guides, courses of study, and other professional resources. Appropriate revisions were to be made following an annual review of content (Dugger, Bame & Pinder, 1985, p. 17).

Leaders in the profession are beginning to shape technology education into an educational experience that will blend any or all academic disciplines in a pragmatic and realistic fashion. The Advisory Council of the International Technology Education Association has stated: “The interdisciplinary nature of Technology Education is inherent in its content and strategies for instruction” (1988, p. 3). The primary goal of technology education, preparing students to be technologically literate, involves more than the mere understanding of what technology is and/or the acceptance of it. It involves many questions on the relevancy of the technology and its applications. Beyond the content, the learning process is also critical to the development of the student. “Thus the curricular role of technology
education can and must be one that provides for an integrated, holistic approach to education in the 21st century" (Technology Education Advisory Council, 1988, p. 3).

**Curriculum Models**

In March, 1980, at the AIAA conference held in St. Louis, David L. McCrory presented “A Guide for Curriculum Development in Industrial Arts/Technology Education.” His opinion was that a guide for curriculum development in this field should identify the frame of reference for the curriculum, whether it be technology or industry. He stated:

> For example, if the resulting curriculum is intended to broadly encompass a wide range of learnings about technological phenomena, the guide will discuss how those learnings should be selected. If, on the other hand, the new program is to focus on the fundamentals of industry, then a procedure will be described whereby those fundamentals may be identified. (p. 26)

He added that a curriculum guide “... should provide a single, comprehensive conceptual model for curriculum design, development, implementation, evaluation, and revision” (p. 25). McCrory also expressed that a good curriculum guide would clarify terminology; identify decisions to be made and suggest procedures for doing so; and provide a system for organizing the work of developing a curriculum.

One of the keynote speakers for Symposium ‘80 - Technology Education was M. James Bensen, the Dean of the School of Industry and Technology at the University of Wisconsin-Stout. Bensen’s address discussed the complex process of selecting content and also drew attention to the need for those positing technology education to arrive at an appropriate frame of reference if progress were to be made towards curriculum design in this field.
To accomplish this, Bensen readdressed the need for an established rationale for technology education, including a clear statement of purpose. The need for a rationale was discussed by Stanley Kasprzyk, of the State University of New York College at Buffalo, in 1971. He stated in his article "Toward a Rationale for the Study of Technology:"

... there appears to be little if any evidence to indicate that 'we are all agreed' on whatever it is that industrial arts ought to 'reflect' when we say the industrial arts ought 'to reflect the technology.' In view of the seeming paradox, perhaps there is a critical need for the profession to reflect upon (i.e., give serious consideration to) and make explicit the rationale (the underlying principles) for its technology-centered conceptions of industrial arts education, and thereby justify the basic assumption that industrial arts ought to center on the study of technology. (1971, p. 2)

Using the Tyler model as an example of how to build a rationale, Bensen identified three sources around which content should be based: the needs of students, the needs of society, and the subject matter itself. These sources could then be tested from the perspectives of educational philosophy and educational psychology.

Next, Bensen described five different models, or approaches, he believed could be used legitimately as frames of reference for technological content. He also provided diagrams of each model to illustrate each approach as it might appear if adopted by technology education. The models listed included the behavioral approach, the conceptual approach, the societal problem approach, the systems approach, and finally the transactional analysis approach. Curriculum designers use many different terms for curriculum models, but most classification schemes accept five similar approaches despite their various identities.
The conceptual approach described by Bensen was the technique that DeVore used to describe his discipline of the study of technology in *Structure and Content: Foundations for Curriculum Development*. This approach emphasizes subject matter and typically identifies major concepts. It then arranges subconcepts in a hierarchical taxonomy. The behavioral approach was frequently used by competency-based programs that wanted to measure acquisition of specific skills. The societal problem model was identified as an extremely motivational approach using research and development as an instructional approach and was exemplified through the Maryland Plan. The transactional analysis plan was also appealing as a process for curriculum derivation due to its concern for individual, needs, interests, and activities.

The systems approach was a convenient method that included inputs, processes, outputs, and feedback as components of a holistic study of technology. Although no evidence of prior application in the field was given for the systems approach, it was favored by Bensen. He said: “The systems approach, however, appears to insure the greatest degree of completeness, dynamics, and balance in its output.” He also said: “... throughout much of the literature, the areas of content that seem to appear logically for inclusion are communications, construction, manufacturing and transportation” (1980, p. 14). It was no coincidence that these were the same organizers accepted in the *Jackson's Mill Industrial Arts Curriculum Theory* or that it, in turn, utilized primarily the systems approach.

Prior to the *Jackson's Mill Industrial Arts Curriculum Theory*, the numerous curriculum projects that were developed utilized a wide assortment and/or combination of approaches like those described by Bensen. These efforts
reflected the lack of consensus that existed regarding content and its structure, yet the problem went beyond that. An overabundance of cursory curriculum models was a hindrance in and of itself. Few of the curriculum projects that had been developed in the 1960s were compelling enough to gain much support. This is not to say that there were no good models created, but rather that none were espoused by a majority of the profession. In most cases, this was due to the fact that the curriculum projects were developed by small groups with limited resources for promoting their ideas.

State Plans for Technology Education

In comparison to smaller curriculum efforts, when a State Department of Education develops a curriculum plan it tends to have greater influence because the population it will serve has already been targeted and the public expects progress. Many states have accepted technology education and/or identified technological literacy as critical to the function of their educational system.

As early as in 1964, the Department of Public Instruction for the Commonwealth of Pennsylvania wrote: “Industrial arts education is designed specifically to help prepare individuals for meeting the requirements of a technological culture” (p. 7). Also, the first of five objectives published in Pennsylvania’s Industrial Arts - Philosophy and Objectives was “to develop literacy in a technological civilization” (p. 7). This statement was an example of state concern over technological literacy and was identified relatively early due in part to the influence of the Industrial Arts Association of Pennsylvania and the strength of numerous school and collegiate industrial arts programs. But
technology education was far from being realized at that time, and the curriculum was still broadly industry-based.

In 1981, Lux wrote: “One now can find recommended curriculum schemes in such states as Iowa, Kansas, Ohio, Tennessee, and Virginia that are far closer to what leaders long have advocated than they are to Woodward’s trade-oriented schemes” (p. 223-224). Illinois was also among the earliest states to organize curriculum efforts around the theme of technology, particularly as it related to industry. The project began in 1981 under the direction of Frarzie Loepp from Illinois State University and produced The Illinois Plan for Industrial Education, published in 1983. It developed an entire schema to study technology for students at four different levels: K-5th grade, grades 6-8, grades 9-10, and 11th grade through graduate education.

The elementary level was designed to offer Technological Studies Units in which students became aware of technology. The next level, the junior high or middle school level, focused on providing students with opportunities to explore industry and its technologies. In the first two grades of high school, four one-semester courses guided students through an orientation to the four bodies of content representing the industrial technologies and including communication, production, transportation, and energy. Beyond the tenth grade, students could pursue advanced elective technical studies or opt for vocational education.

Specific steps for implementing The Illinois Plan were also provided with the overall goal being “to help students become technologically literate and equipped with the necessary skills to cope with, live in, and work in a
highly industrial/technological society" (1983, p. 9). Although it limited the study of technology to that within industry, this state plan was very progressive and influenced the direction of many subsequent efforts in other states.

At about the same time, the New York State Education Department undertook a major restructuring of its curriculum for “Occupational and Practical Arts Education” by establishing “futuring” committees that represented seven different areas of content including industrial arts. In May, 1981, “more than 200 participants, including teachers, administrators, business and industry personnel, students, union representatives, and other concerned individuals, convened at an initial meeting in Albany, New York” (Barden & Hacker, 1983, p. 13). This effort, which became known as the “New York Futuring Project,” challenged each program area to redefine its mission and clarify its goals.

In the first year-and-a-half, the Industrial Arts Futuring Committee identified the mission for industrial arts, its roles and purposes, student competencies, and categories of program content. Barden and Hacker wrote:

> The mission statement adopted by the Futuring Committee accepts as industrial arts’ major role the interpretation of technology and also proposes that all persons should be provided with technological literacy as part of their fundamental education. It further states that industrial arts, through its traditional activity-centered learning techniques, is ideally suited to the study and understanding of technical adaptive systems. (1983, p. 13)

As the Futuring Committee determined “the scope and sequence of a K-12 technology education program,” the New York State Board of Regents became active in affecting policy change that would benefit technology.
education. "As a result of these parallel state supported efforts, and the
timeliness of the national reports . . . which proposed technological literacy,
the Regents saw fit to include a one-unit Technology Education mandate as
one of the middle school requirements" (Hacker & Listar, 1985, p. 76).

The development of curricula began in the summer of 1983 and
continued through 1985. The seventh grade program commenced in 1986,
and the eighth grade program was implemented the following year. An
extensive in-service training program had been directed by Ronald Todd, a
professor at New York University. It was initiated during the summer of 1984
and continued in the summer of 1985 to prepare teachers for the new
approach. Another noteworthy outcome of the New York Futuring Project
occurred in January, 1983. The Industrial Arts Futuring Committee, by virtue
of a majority vote, renamed Industrial Arts to Technology Education in the

Another curriculum project emerged during the early 1980s -- not the
result of a government effort but, instead, sponsored privately by the
Technical Foundation of America. Titled Industry and Technology Education, this
curriculum guide outlined schedules for three different situations in general
education: small programs, medium-sized programs, and large programs.
Each plan was developed to include eighteen-week courses for each of the
four content areas of communication, construction, manufacturing, and
transportation. Modeled around the content established in the Jackson's Mill
Industrial Arts Curriculum Theory, this venture proceeded by developing
activities and plans in order to aid the transition from theory to reality.
However, rather than referring to the subject area as "technology education,"
the guide used the phrase “industrial technology.”

A New Name

Despite the discussions that occurred in 1966 regarding the possibility of a name change for the profession, no attempt was made toward that end until 1973. During the international conference of the AIAA held in Atlantic City, New Jersey that year, DeVore submitted a resolution to the House of Delegates to replace the term “industrial arts” with “technology education” in the name of the Association. While nothing came of this bid at that time, the public introduction of the phrase “technology education” had been made.

Lauda has stated his belief that the phrase actually originated in 1970 during a meeting of the ten participants of the Industrial Arts Teacher Education Fellowship Program in the Technologies, held at West Virginia University. (D. P. Lauda, personal communication, April 27, 1991). This has also been documented in the 35th Yearbook of the American Council on Industrial Arts Teacher Education (ACIATE) which read:

In the spring of 1970 a group of graduate and postgraduate students at West Virginia University were presented with the question of What title should be given to a program designed to help students comprehend their technological inheritance and technological future? After careful deliberation, it was decided that such a program should be called Technology Education. Thus the first program in the history of the industrial arts profession changed its name to reflect contemporary technology. (Lauda & McCrory, 1986, p. 15)

In 1976, Starkweather suggested, in Future Alternatives for Industrial Arts, that by the year 2000 the name of the profession may be something different than industrial arts (1976b, p. 2). This idea was reinforced with a rationale for
change provided by DeVore and Lauda, who wrote in the same publication: “the term industrial with arts implies the study of the arts and crafts of industry. The continued use of the term industrial arts disregards the fact that our society is now moving into the post-industrial era” (1976, p. 145). Soon, the topic became a controversy. However, in the May/June, 1981 issue of *Man/Society/Technology*, Starkweather presented M. James Bensen, Daniel Householder, and Kenneth Phillips, each prominent leaders in the profession, with five questions regarding the possibility of a name change for industrial arts. Each of the three men responded favorably to the possibility of a name change, and each identified “technology” or “technology education” as acceptable for the title of the profession.

Around this time, however, the phrase “technology education” was used only occasionally in the professional literature, and usually by purists of the technology-based approach. Then, around mid-1983, it became common for the two phrases “industrial arts” and “technology education” to be separated by a virgule (e.g. industrial arts/technology education), meaning that either phrase was an acceptable means for identifying the profession. This usage can be found in an article by Starkweather for the final issue of the AIAA journal printed under the title *Man/Society/Technology* (1983, pp. 10-13). As of September, 1983 this same journal would henceforth be known as *The Technology Teacher*, hearkening back to the era from 1942-1963 when it was founded as *The Industrial Arts Teacher*. From its inception as *The Technology Teacher*, the journal routinely referred to the profession as “industrial arts/technology education.”
Also in 1983, a renewed effort was made toward changing the name of the AIAA. It was introduced as a proposal to study the feasibility of such an effort and occurred during the House of Delegates assembly at the annual AIAA conference held in Milwaukee, Wisconsin. The motion passed despite known opposition.

Many were resistant to a name change simply because they felt it would do little good. Donald G. Lux, of The Ohio State University had warned: “changing names while leaving the referent unchanged causes nothing but confusion and loss of face validity” (1983, p. 2). Lux reasoned that the name for the profession had been changed twice previously, resulting in little significant alteration of the program itself. With good reason, Lux felt that attention needed to be given to eliminating the differences between theory and practice within the profession, and that a name change attempt was insignificant until that took place.

Nevertheless, in 1984, the AIAA Administrative Committee, consisting of President Vaughn Croft, President-Elect William E. Dugger, Jr., Immediate Past-President Ronald L. Foy, and Executive Director, Kendall N. Starkweather, received a report by the Committee on the Study of an Association Name Change. Chaired by M. James Bensen, this Committee had conducted a study that included a questionnaire mailed to 400 Association members selected randomly. From this sample, 72 teacher educators, 94 classroom teachers, and 66 supervisors responded with their opinions on the matter. The instrument used required respondents to rate different elements of a name. These elements included the sphere of influence (i.e., American,
national, international, world), the content (i.e., industrial arts, technology education, industrial technology, etcetera), and organizational format (i.e., association, league, society, fellowship, etcetera). The opportunity to write in their own options, or to leave the existing names "as is," was provided to respondents. From the results, the Committee concluded there was a "general openness" to the possibility of a name change and that the term "technology" received strong support for inclusion.

Based on the study, in November, 1984, the AIAA Board of Directors decided to change the name of the Association if the membership voted in favor of it. In February, 1985 a vote by the Association membership was solicited through a mail-in ballot in *The Technology Teacher* and resulted in a constitutionally required two-thirds majority of the voting membership favoring a change of the name. In April, 1985, at the San Diego conference, AIAA President William E. Dugger announced that the American Industrial Arts Association would henceforth be known as the International Technology Education Association (ITEA).

There were those who remained in opposition to the name change even after the fact. N. Edmunds asked: "Why should I change? Industrial Arts has been good to me" (1985, p. 47). John Feirer, of Western Michigan University, stated at Technology Education Symposium VII: "I am here to defend the proposition that we continue to call our program *industrial arts*. The AMERICAN INDUSTRIAL ARTS ASSOCIATION has bowed to certain pressures by changing its name to the INTERNATIONAL TECHNOLOGY EDUCATION ASSOCIATION" (1985, p. 16).
Dugger later conceded that there had been some concern among the leaders regarding a splitting of the membership at the time of the name change (W. E. Dugger, Jr., personal communication, November, 1990). Since the idea of changing the name of the Association was promoted primarily by teacher educators and officers of the Association, most of those at the "grass-roots" level had minimal involvement in the procedure, except of course in gaining the vote of a majority of the respondents. While the name change was gradually accepted throughout the profession, many initially regarded it as superficial.

Following the name change, many questions arose from within the profession. To address concerns regarding the abandonment of traditional industrial arts programs, ITEA president Thomas Hughes, Jr. spoke out about the meaning behind the new name. Reassuringly, Hughes announced:

"This is not an issue of one ideal opposed to another. It is the natural follow-through of what we have purported to do for many years. The real issue is to help the profession effectively serve students with a dynamic program and that is how we intend to expend all of our energies." (1985, p. 3)

Indeed, it was not the first time in what has been considered the evolution of the profession that the name had been changed to represent a more updated image. Each time this occurred in the past, the best ideas from the previous system had been retained. This was also true for technology education. Hughes added, "our need and desire is to help the industrial arts profession evolve into a renewed solid position in the schools" (1985, p. 3).

Shortly after the name change, other organizations, especially those affiliated with the ITEA, followed the example of the Association with similar alterations in their titles. The American Council of Industrial Arts
Supervisors became the International Technology Education Association - Council for Supervisors (ITEA-CS). The American Council of Industrial Arts State Association Officers was renamed the Council of Technology Education Associations (CTEA). The American Council on Industrial Arts Teacher Education changed to the Council on Technology Teacher Education (CTTE). The American Council on Elementary School Industrial Arts altered its name to the Technology Education Council for Children (TECC). The American Industrial Arts College Student's Association switched to the Technology Education Collegiate Association (TECA) and the American Industrial Arts Student Association became the Technology Student Association (TSA). The Industrial Arts Division of the American Vocational Association also changed its name to the Technology Education Division. (Oaks, 1989, pp. 63-66).

The Role of Technology Education in America's Schools

Declaring a need for an educational program and establishing guidelines was a prerequisite to actually developing it. The question of how to get programs going was the real challenge. In 1988, the Technology Education Advisory Council developed a booklet titled, Technology: A National Imperative. This booklet undertook to justify the study of technology in our schools by carefully describing what technology is and why technology education is important for our youth. The following passage addressed the need for technology education:
Because the American culture is distinctly characterized as technological, it becomes the function of our educational system to provide every student an insight and understanding of the technological nature of the culture. All persons must be knowledgeable of their technological environment so they can make rational decisions about their own lives or a day-to-day basis and participate in controlling their own destiny. (p. 2)

According to the same source, "Technology Education programs are organized around a set of concepts, processes, and systems that are uniquely technological" (p. 16). This criterion for a technology education program seems rather broad, and indeed it is. Within any of the content areas, the range of topics that could be studied was extensive. Yet, the unique feature that set technology education apart from other educational programs was that much of the learning was activity-based. The application of the concepts, processes, and systems referred to above has been considered an essential element of any technology education program and the booklet outlined the role of technology education at the elementary, middle, and high school levels.

"However, a more vital and valuable role is one of integration within the middle, junior, and senior high school" (Technology Education Advisory Council, 1988, p. 11). This integration, or merging of other topics and/or activities, has also been attempted in the elementary school. In fact, there has been a long tradition of teaching industrial arts to elementary level students that can be traced back to individuals such as Froebel, Herbart, Pestalozzi, and Rousseau. Miller wrote:
Even though American education began to develop some uniqueness during the 19th century, it wasn't until the 20th century that an American philosophy of education emerged to shape the educational system of the United States; therefore, to trace the evolution of the American elementary school movement, it is first necessary to analyze the forces that shaped European educational philosophy during the 18th and 19th centuries. (1979, p. 45)

Industrial arts from its inception was developed by specialists in elementary education such as Bonser, Russell and Mossman who had been influenced by Dewey to a great extent. However, for many years there was little change in the status of elementary industrial arts education. Not until after 1950 was there a revival of interest in this area. In 1962, ACESIA, now the TECC, was formed to provide leadership in elementary school industrial arts. While there has been some growth in this area since the 1960's there is still a great deal of opportunity for technology education to improve its position in elementary education (Miller, 1979, pp. 43-58).

Since the change to technology education, many curriculum efforts have addressed the needs of elementary level programs. Technology education is expected to reinforce the educational goals of the overall elementary school program. Activities should help elementary students develop psychomotor skills as well as introduce them to technology, and its most basic tools, materials, and processes. Students should learn to identify the products of technology and be introduced to the possibilities of careers in technical fields.

At the middle school level, considered grades 6-8, it is expected that an exploratory approach would be cultivated. Activities based within the areas of organized content can refine skills and problem-solving techniques, expand
students' career orientation, and introduce social issues related to technology. At this level: “Students learn about construction/fabrication of materials and processes, research practices; the practical use of mathematics, scientific principles and practices; and the interrelationship of society, technology and economics. More important, they learn about themselves by discovering capabilities and aptitudes” (Technology Education Advisory Council, 1988, p. 18).

At the high school level, students would begin to pursue technological content that would be more specific to their interests through electives. Initial courses would provide students with a general understanding of technology and a firm basis for career preparation. Elective courses would be beneficial to students who are planning for careers in technical or scientific fields because such courses would allow students to do more in-depth research and experimentation in a specific area of interest to them. From *Technology: A National Imperative* comes the statement: “The teaching of technology at the high school level has been organized in numerous ways to address the many aspects of technology.” Yet, “whatever the approach, the current trend in Technology Education is to use a systematic study developing broad and useful understandings for a more technologically literate citizenry and productive society” (Technology Education Advisory Council, 1988, p. 19).

The development of problem-solving abilities has repeatedly been emphasized as integral to technology education. However, not everyone in the profession has perceived problem-solving the same way. Waetjen has stated: “technology, by its very nature, is the process of solving problems . . . . problem solving, then, is not just another trick in the technology teacher’s
bag, problem solving is the *essence* of technology*"* (1989, p. 10). Waetjen’s

*Technological Problem Solving: A Proposal* addressed the misunderstanding of
problem solving by proposing a framework for problem-solving activities in

*Guiding the Implementation of Technology Education*

The implementation of technology education programs was the next
issue addressed by the profession. Just as there were differences between the
content of traditional industrial arts and technology education, so too were
there certain instructional strategies that were best suited for technology

education.

In 1985, the AIAA had made available to its members a publication
titled *Technology Education: A Perspective on Implementation*. The intention of this
publication was to offer the views and practices of several contributing
members of the profession in order to motivate teachers to pursue
technology education actively. It was not designed to explain how to teach
technology education as much as to provide an overview of technology
education and the inspiration to pursue it further through in-service and/or
careful use of professional resources such as the *Standards for Technology
Education Programs* (AIAA, 1985b, p. 2).

The *Standards* served the valuable purpose of assessing the
implementation of technology education courses. A variety of teaching
methods were identified in the *Standards* as appropriate for technology

education. Instructional methods were expected to meet individual student
needs, including special needs students. Both group and individual learning was to be offered and interdisciplinary learning was encouraged. Both teacher-centered and student-centered instructional methods were to be combined in teaching concepts and operating characteristics of technological systems. Instructional methods were also expected to promote the development of process skills such as creative and critical thinking, decision-making and problem-solving” (Dugger, Bame & Pinder, 1985, p. 40).

In 1986, the ACIATE published a yearbook titled Implementing Technology Education in order to provide readers with information on how to design and build programs for technology education. Jones & Wright said: “Implementing Technology Education provides clear concise instructions, suggestions, hints, activities, and methodology for change” (1986, Preface). Individual chapters of this volume addressed ways to implement technology education for elementary, middle school, high school, undergraduate, and graduate level programs.

Literature, Products, and Services for Technology Education

A quick review of the history of the professional journal of the AIAA/ITEA shows that it began publication of The Industrial Arts Teacher in April, 1942. The Industrial Arts Teacher was the first journal published exclusively for the profession. It continued under that title until 1964 when it became The Journal of Industrial Arts Education. Six years later, the emphasis on technology in the profession became evident when the journal was given the title Man/Society/Technology. In September, 1983, it was renamed yet again as The Technology Teacher.
While this publication served the general membership of the Association, there had never been a research journal published by the Association primarily for technology teacher educators. In 1985, the Executive Boards of the ITEA and CTTE set out to change this shortcoming by authorizing the publication of what was to be known as the *Journal of Technology and Society (JTS)*. The first copy of the *(JTS)* was issued from The Ohio State University in the Winter of 1987; however, subsequent volumes were delayed. In 1989, the Boards of the ITEA and CTTE, accepted a proposal from the Technology Education Program at the Virginia Polytechnic Institute and State University to assume the responsibilities of publishing the journal. This proposal included the stipulation that the journal title be changed to the *Journal of Technology Education (JTE)*.

The first issue of the *(JTE)* was published in the Fall of 1989, and subsequent issues were produced on a biannual basis. Co-sponsored by the ITEA and the CTTE, the *(JTE)* "provides a forum for scholarly discussion on topics relating to technology education" (Sanders, 1989, p. 73). A unique feature of the *(JTE)* was that, since 1992, it is one of less than 10 refereed journals published electronically. Within one month after offering the *(JTE)* electronically, there were more than 800 electronic subscribers, complementing the approximately 500 previous hard copy subscribers to the journal.

The *Journal of Industrial Teacher Education (JITE)* was first published by the National Association of Industrial and Technical Teacher Educators (NAITTE) in 1963. NAITTE has served a wide range of client groups, including technology education, and one of its goals has been to help foster cooperation
among contingents. Ralph C. Bohn, its first editor, stated one of the Journal's objectives as being to "establish harmony within the profession by promoting the unification of all phases of industrial teacher education into a common objective of providing an ever improving program of industrial education for all of the youth of America" (Bohn, 1963, p. 1).

Until the publication of the JTE, the JITE was the only scholarly periodical for teacher educators in the field. While it often includes information regarding technology education, the JITE has had a much broader scope than the JTE which has been more specifically oriented towards technology education. The JITE has been published four times a year and mailed to members as a service paid for through association membership dues.

The Journal of Epsilon Pi Tau, published primarily for the members of the honorary fraternity Epsilon Pi Tau, began publication in 1974 under the editorship of Delmar Olson. White wrote: "The central mission of the Journal of Epsilon Pi Tau has been to serve as a medium of communication between Epsilon Pi Tau chapters and to stimulate chapter activity that warrants international publicity" (1979, p. 445). For years it has promoted dialogue concerning the profession and continues to offer feature articles, chapter news, research, and other information related to technology education.

Other publications in the form of textbooks for technology education have also become commonplace. Following the lead of Davis Publications, Inc., such publishers as Bennett & McKnight, Delmar, Glencoe/McGraw-Hill, and Goodheart-Willcox, have all since produced textbooks specifically
addressing technology, or based on information relevant to one or more of the content area organizers for technology education. These publishers routinely display their products at conferences for technology education.

Another group that has played an important role in the profession for many years has been the Educational Exhibitors Association (EEA), also referred to as “the ship.” Established in 1923, the EEA-SHIP participated in its first conference in 1924 at the meeting of the Western Arts Association in Dayton, Ohio. This organization has since worked diligently to represent a large group of quality exhibitors who participate regularly in national and state conventions.

Exhibitors among the EEA-SHIP have responded enthusiastically to the opportunities provided by the transition to technology education and quickly developed products that were appropriate for the problem-solving approach of technology education. Many new products, such as computer hardware and software and kits for problem-solving activities, have become useful to technology educators in recent years due to technological advancements. Entrepreneurs within the profession have also developed entire systems for managing instruction of technology education.

*Revised Accreditation Standards for Technology Teacher Education*

Another phase crucial to the implementation of technology education was the preparation of new teachers. Obviously, it would be necessary for teacher education programs to undergo some critical changes in curriculum and instructional methods in order to properly prepare future technology teachers. The standards used by the National Council for the Accreditation of
Teacher Education (NCATE) to measure industrial arts teacher education programs were outmoded so it became essential for new criteria to be established.

John R. Karsnitz, chair of the CTTE accreditation committee from 1981-85, was selected to chair an ad hoc ITEA task force for accreditation beginning in the 1984-85 academic year. Following a survey submitted to teacher educators to determine appropriateness, the ITEA Executive Committee reviewed the guidelines and then presented them to NCATE through Donald Lauda.

In April, 1987, the NCATE sanctioned the CTTE guidelines developed in cooperation with the ITEA. To accomplish the task, an Accreditation Committee was formed within the CTTE. When the revised guidelines were finally published in the NCATE Approved Curriculum Guidelines, they became the national standard for technology teacher preparation programs. The involvement of CTTE and the ITEA in this policy-making effort was notable since, as Wiens put it, “for many years, leaders in technology teacher education have desired to set the standards for the profession” (1990b, p. 25).

Universities that desired accreditation for professional education units (e.g. colleges of education) were required to notify each specialty area (e.g. technology education) of the timeline for recertification designated by the NCATE. Specialty programs then had to prove compliance with the latest guidelines through the clear and accurate completion of a folio, or report, documenting the sequence of courses and experiences required for the preparation of teachers in that area. This curriculum folio was designed to
gather information that would provide evidence of the universities’ ability to deliver a quality technology education teacher education program. Each folio would then be reviewed by three evaluators from the ITEA/CTTE. The specialty area review hinged entirely upon the folio evaluation and was not subject to the site visit that was part of the overall NCATE assessment of the educational unit. In the final review, the entire professional education unit, not specific programs, was to be evaluated for NCATE accreditation.

In 1990, a “progress report” was issued by Wiens regarding the technology teacher education programs that had submitted folios, in the fall of 1988, for NCATE accreditation. This report took many members of the profession by surprise when it reported that 65% of the 38 programs under review did not comply with the ITEA/CTTE guidelines (1990b, p. 25). Some criticized the guidelines as being unclear and the Accreditation Committee responded by confirming that refinement was to be expected. Although NCATE reassuringly explained that low compliance rates were common when specialty organizations (e.g. the CTTE/ITEA) first initiated their own standards, there were some definite concerns within the profession. Perhaps the most significant was the lack of a technology-based curriculum structure among the programs, suggesting a slow transition to technology education from industrial arts at the teacher education level.

Wiens may have offered another explanation for this initial lack of success when he summarized another study dealing with the degree to which state plans and certification requirements complement the NCATE guidelines:
States have been slower to recognize the need for course work in the international/global dimensions and impacts of technology. Considering the relative status of state plans and the necessity for teacher education programs to comply with state requirements, the rigid application of CTTE/ITEA Guidelines by the folio reader/evaluators may be three to five years premature. (1990a, p. 64)

Lack of documentation was yet another major shortcoming. Wiens recommended that “a handbook for preparing the folio should be in the hands of every program chair or coordinator prior to the folio preparation” (1990b, p. 28). Even though an ITEA/CTTE/NCATE Curriculum Folio Preparation Handbook for Basic (Undergraduate) Programs in Technology Education existed, and workshops on preparing folios had been offered since 1988, these were either confusing, inadequate, or restricted by dates and/or prohibitive by cost. In February, 1992, an improved version of the Folio Preparation Handbook was produced by the CTTE Accreditation Committee. Edited by Ritz and Loepp, and revised by Householder, it was titled The Preparation of Curriculum Folios in Technology Education. This publication served the purpose of guiding teacher education programs through the completion of the curriculum folios in a logical manner, consistent with the desires of the accrediting agencies.

Technology Education Legislation

Strategic to the transition process was the aim to gain recognition through Federal legislation supporting technology education. Prior to the name change, the legislative committee of the AIAA began serious action towards this goal shortly after the publication of the numerous reports calling for national reform in education, many of which were commissioned by the
Reagan Administration. Most of these reports proclaimed that American schools needed to revitalize mathematics and sciences, and some expressed concerns that youth were becoming "technologically illiterate."

On February 6, 1985, Dugger, Hughes, Maley, and Starkweather met with Congressman Frederick C. Boucher to present him with a proposal for a technology literacy act. This proposal pointed out the findings of several commissioned reports, the historical impact of technology, and implications for the future. The proposal also defined technology education and explained how technological literacy could be addressed through such a program. In expressing the need for a technology literacy act, the authors listed five necessary funding elements that included curriculum development, research, establishment, supervision of model programs for technology education, as well as pre-service and in-service programs for teacher training. In conclusion, the authors expressed the opinion that "improving education through increased emphasis on science and mathematics will not solve the problem of technological literacy" (AIAA, 1985a).

On July 30, 1985, Congressman Boucher submitted the Technology Education Act of 1986 to the House of Representatives. The proposed bill requested authorization of $3,000,000 for the fiscal year of 1986 and stipulated three major aspirations. First, model programs would be developed in secondary schools throughout the country for demonstration purposes. These programs would examine the history of technology and its relation to societies throughout the world. Students would be provided practical, exploratory experiences and consider problems and benefits of technology. Second, support would be provided through grants for research and
development of curriculum materials for model programs and statewide distribution. Finally, each demonstration program would be required to share all information related to its experience to encourage modeling in other programs.

In November, 1985, John D. Rockefeller, IV, of West Virginia presented the Technology Literacy Act of 1985 to the United States Senate. This bill promoted technology education as a part of the secondary curriculum within general education that would provide practical experiences with technological principles. It also recommended support for the development of model programs throughout the country and for research, curriculum development, training, and materials for dissemination. This bill also called for $3,000,000 to establish matching-grant programs to achieve its goals.

On February 19, 1986, ITEA President Thomas Hughes, Paul DeVore, and ITEA Advisory Council member Forrest D. Brumnett, of General Motors, were presenters at a hearing that resulted in the passing of both bills. Unfortunately, the bills did not immediately receive the requested funding. To have the bill become appropriated, an unsuccessful attempt was made to include the bill as a rider on an omnibus bill, the Education Consolidation and Improvement Act, also known as H.R. 5. Another effort was the inclusion of "Chapter 2 - Instructional Programs in Technology Education" in H.R. 3, the Omnibus Trade and Competitiveness Act of 1988. Regarding education, this bill suggested reauthorization of over $150,000,000 funding for maths and sciences, a $50,000,000 dropout prevention program, a $20,000,000 program supporting model foreign language programs, and $2,000,000 for model technology education programs.
On August 23, 1988, the 100th Congress of the United States of America approved the Omnibus Trade and Competitiveness Act of 1988, declaring it as Public Law 100-418. According to section 6111 of this Act, the purpose was "to assist the development of a technologically literate population through instructional programs in technology education" (p. 1505). The primary focus of this law was to develop demonstration programs for technology education according to the provisions, outlined in section 6112, which consider course content, safety, objectives for student learning, development of teacher capabilities, as well as research and development of curriculum. Section 6115 of the Act authorized $2,000,000 in appropriations "for fiscal year 1988 and such sums as may be necessary for each of fiscal years 1989 through 1993 to carry out the provisions of this chapter" (p. 1507). These funds were to be made available through grants administered through the Department of Education. Applications submitted by local, state, public or private educational agencies, or organizations, and institutions of higher learning would be considered and distributed according to equitable geographic guidelines. The Omnibus Trade and Competitiveness Act of 1988 also included this definition of technology education:

Technology education means a comprehensive educational process designed to develop a population that is knowledgeable about technology, its evolution, systems, techniques, utilization in industry and other fields, and social and cultural significance. (§ 6116)

As is often true in bureaucracies, there was some delay and the monies were not appropriated until March, 1990. According to a notice printed in the March 14, 1990 issue of the Federal Register, it was estimated that four technology education demonstration programs were to be authorized to
receive approximately $247,000 each, totaling $988,000, which was less than hoped for. Only 65% of the total cost of a funded project was to be supplied by the Department of Education and no less than 10% had to be provided by private sector contributions. The project period for funding was two years, and application information was made available through the office of Vocational and Adult Education (Brand, 1990, pp. 9630-9632).

Technology Education Demonstration Projects

In 1991, five applicants were offered funding through the Technology Education Demonstration Program of Public Law 100-418. An article from The Technology Teacher titled “Technology Education Demonstration Projects” described four of the individual projects, identified by regions: the Appalachian Region; the Mid-America Region; The Northeast Region; and the Far Northwest Region. Each region independently took a different approach toward creating a system to explore “… ways in which the math, science, and technology education departments within public schools can work together in establishing innovative opportunities for students to connect the concepts and activities within each of these disciplines” (Wicklein et al, 1991, p. 3).

The Appalachian Technology Education Consortium (ATEC) existed as a collaboration between four colleges and universities in the region and twenty-seven secondary schools. Directed by Paul DeVore, the Consortium established Professional Development Research Centers at California University of Pennsylvania, Fairmont State College, Salem-Teikyo University, and West Virginia University. These centers included resources
such as computer equipment, peripherals, softwares, technology-based
textbooks, videos, relevant periodicals, and guides to other resources useful
for the development of a technology education program. The resource centers
were available for use by teachers educators, as well as the teachers in the
region. Seven of the participating middle schools and high schools served the
Project as demonstration schools, while the rest of the schools participated by
observing with the goal of emulating the exemplary instructional practices.

The unique aspect of the teaching method promoted by the ATEC was
its use of instructional modules designed and developed by consortium
members. The modules were tested in classrooms and evaluated by specialists
from each discipline and industry prior to being used in the demonstration
schools. Each module would typically last one week. The modular approach
allowed students to encounter action-based learning in a technology
education facility, and each module was designed to focus on technological
concepts from one of three primary systems: Communication and
Information; Production and Transportation. Individuals interested in
teaching the modules were prepared through one-day seminars referred to as
"Teacher Capability Institutes" offered by the consortium. The modules were
also made available to others in the profession located outside the
Appalachian Region (Wicklein et al, 1991, p. 7-8).

The Mid-America Region established its demonstration programs in
four small or rural schools. The approach used in these schools was a team-
teaching effort combining the capabilities of a mathematics teacher, a science
teacher, and a technology teacher. Through a coordinated approach, the
teachers of each discipline were able to integrate the three areas through
related activities, or studies, in each class.
Through the demonstration programs in the Mid-America Region, a number of multidisciplinary curriculum approaches were developed. Also, teacher workshops were provided in conjunction with a teleconference in order to promote participation from other schools. In September, 1992, a final teleconference was planned for the dissemination of information regarding the Mid-America Project and its outcomes. The Director of Mid-America Project, Robert Wicklein said of these efforts:

Much of the content for the multidisciplinary workshops will be drawn from the experiences of the demonstration site students and personnel who have been associated with these demonstration programs. (Wicklein et al, 1991, p. 4)

The North-east Technology Education Consortium (NETEC) consisted of a group of teachers, state supervisors, teacher educators, project staff, and representatives from industry. Co-directed by William Boudreau and John Wright, this Project sought to situate the demonstration sites in dissimilar school settings. Five schools in New York and the New England States were selected for this reason as well as for their accessibility for teachers throughout the region who might be interested in visiting.

The NETEC adopted an approach that was centered around individual technology teachers incorporating the concepts of several disciplines into activities in the technology education classroom. Using the appropriate curriculum for technology education in the respective state of each demonstration site, these teachers participated in the development of several teaching/learning activities demonstrating the interface of mathematics, science, and technology. The primary method of dissemination was to have other teachers actually visit the sites.
The Far Northwest Region Project found its base in Alaska. The approach for program development that co-directors Douglas Hammer and Jerry Balistreri considered most appropriate in this setting was to establish a single exemplary demonstration site. An attempt could then be made to replicate this model program throughout the region.

A "Blueprint for Literacy in Technology" was developed to guide the Project and proposed a curriculum "that provides student experiences to gain technological literacy" (Wicklein et al, 1991, pp. 5-6). The introduction to technological literacy began at one junior high school and one high school in Anchorage in the spring of 1991. Teachers at expected replication sites received in-service training and in turn exposed their students to activities designed to promote technological literacy. The final event of this project, an International Technological Literacy Symposium, occurred on June 25-26, 1992. It served to share the experiences of those involved in the Far Northwest Region Project with technology educators from around the world.

The fifth project that was funded through the Technology Education Demonstration Project was the Milwaukee Area Technical College (MATC) in Milwaukee, Wisconsin. Project Director Joseph Pellegrin organized an effort that coordinated basic skills and technical education offerings between MATC, community based organizations and the metropolitan Milwaukee business and industrial complexes. The program was intended to focus on improving teacher capability and curriculum, and interfacing technical education with science, mathematics, and communication skills. Although this project received a disproportionately large award, its aims were significantly different than those of the four previously mentioned projects.
International Perspective

The desire among American professionals to form an international network for industrial arts dates back to the mid 1960s. From the Minutes of the Executive Board Meeting of the AIAA held in Minneapolis, Minnesota from August 11-13, 1967 comes the following passage:

Dr. Robert Woodward recommended the establishment of an international organization of industrial arts and technology, with the AIAA as 'administrator', or 'executor', or 'parent organization.' Our Association with WCOTP and all of our international members would be serviced through this organization. (p. 16)

WCOTP stood for the World Confederation of Organizations of the Teaching Professions, to which a small number of AIAA constituents were also members. Recognizing the global influence of technology, the Association realized it was necessary to gain other perspectives and share its perceptions of industrial arts with other countries.

The following year, Woodward reported to the Executive Board for the Special Ad Hoc Committee on Industrial Arts and Technology International Education. He presented several difficult questions regarding the establishment of a special international education affiliate and was entrusted by the Board with making the proposal to the International Relations Committee of the AIAA. Although no affiliated organization for international education ever really got off the ground, in 1971, the AIAA opened its national conference to the world, and ever since the Association has considered its annual conference an international event.
When the AIAA changed its name in 1985, it included the decision to expand its official “sphere of influence” to the international level. Perhaps the impact of the term “technology education,” used to describe the body of content, diminished the recognition of this fact — but certainly not its significance. At about the time of the name change, Todd authored an article titled “Technological Education: An International Perspective,” in which he identified the need for technology education worldwide, and established a framework to determine the status of technology education in differing countries. This framework supported two basic premises: first, that “all countries go through an evolution of technological growth and development”; and second, “the technology education of a country closely reflects its technology’ (1985, p. 19). The framework proposed that five stages of technological development existed in the world: indigenous, emerging, developing, industrialized, and cybernetic. Todd stated: “As a country’s view of technology moves toward a global concern, more educational attention is given to the potential consequences and impacts of technology.” He also added: “The interest in consequences seems to increase as a nation becomes more advanced, and hopefully more mature, in its use of technology” (1985, p. 23).

Todd also identified numerous countries that had developed some form of technology education or had expressed interest in making a transition from industrial arts. In 1986, another article by Todd, “Technological Literacy: An International Perspective,” recognized an increased number of nations with educational programs pursuing the study of technology in some form. He also posited that “the process through which
the goal of technological literacy is achieved must be technology education. But this is not necessarily technology education as perceived by professionals in the United States” (1986, p. 63). In fact, according to Todd’s findings, the United States was not the leader in the development of technology education internationally. He has expressed the opinion that programs in England had exceeded our progress in technology education. However, the approach in England has been almost exclusively limited to the design aspects of technology. Todd, along with many others, have supported cooperation among nations and suggested that technology educators worldwide should avoid isolationism and willingly exchange information in regard to their theories and practices.

In 1984, an effort that eventually developed into a significant international research project was first conceptualized at Eindhoven University of Technology in the Netherlands. Through a project to develop and evaluate technology courses, titled “Physics and Technology,” a study was conducted of the attitudes of students, usually about 13 years of age, towards technology. Jan Raat and Marc de Vries concluded from their work that, in general, these children had a very limited knowledge of technology, and that there were distinctive differences between boys and girls regarding their attitudes towards technology. Following further investigation, they discovered that very little research had been done in this area. So, at a conference in London, they proposed an international study that they referred to as Pupils’ Attitudes Towards Technology (PATT). “It was from these proposals that the PATT research originated” (Raat, Wolters, & deVries, 1987, pp. 15).
The PATT research initially set out, through the use of pilot studies, to ascertain whether the development of one international instrument was feasible. A single questionnaire to measure the attitudes of students, based on the Likert-scale model, was developed in English. There are four variables that have been of particular concern in this study which included interest in technology, consequences of technology, sex differences, and the difficulty of technology. In addition to the attitude questionnaire, a concept questionnaire was developed and an essay was required for additional feedback. Although the results are rather generalized, these studies have shown that, worldwide, pupils tend to have a fairly positive attitude towards technology. However, they do have some difficulty defining technology. Gender differences were found to be significant. Apparently females are disadvantaged in their conceptualization of technology and conceptualizing therefore also have a less positive attitude towards technology. It has also become apparent that pupils from different cultures have developed different perceptions of technology.

In March, 1988, at the ITEA International Conference held in Norfolk, VA, the first World Assembly on Technology Education was organized. This special effort invited papers and presentations from technology educators throughout the world. Participants came from such nations as Australia, Canada, England, Finland, Germany, Italy, the Netherlands, and Zimbabwe. This venue for international participation in technology education has proven to be very successful and has encouraged worldwide cooperation in establishing technology education as a meaningful educational institution.
Summary

Proponents of technology education believe they can contribute to society by preparing its members to make informed decisions that will ultimately shape their future. By guiding students' understanding of technology and their perception of how systems work, the ultimate goal has been to see learners realize the fullest possible potential of technology in society. Of course, this can become very complex and requires a comprehension of the history of the use of tools and techniques, an appreciation of modern technology, an awareness of ethical and social issues that relate to technology, and an understanding of how to deal with forces that influence the future.

Technology education, above all other instructional strategies, has emphasized a hands-on approach to learning, as did the related programs that preceded it. The difference has been that the technical skills students are introduced to are incidental to learning about the broader concepts surrounding technology education. When involved in appropriate activities, students learn to apply tools, materials, processes, and technical concepts safely and efficiently. While the application of technical skills is an essential element in technology education, technics are not the primary focus for instruction. Instead, students are encouraged to explore and learn through action-based activities that involve experimenting, solving, planning, inventing, creating, and producing. Learners investigate ideas by applying problem-solving techniques and knowledge of other disciplines.
Several new initiatives have been developed to promote the integration of mathematics, science, and technology as the focus of technology education. Already, technology education often combines the application of principles not only from these bodies of knowledge, but also from history, writing, and the fine arts. The International Technology Education Association stated in a promotional brochure:

The so-called basic skills have limited impact on their own. It is through their application in our lives that they gain relevance. The action-based programs in Technology Education call on students to use their basic knowledge. This reinforces their learning of basic skills. (1991)

Technology education has emerged for all students and it exists at all levels of education throughout the world. Still, technology education should not be confused with vocational education. Its aim has not been to prepare students with the specific skills required for decided occupations. While it can provide an introduction to, and foundation for, many possible technical careers, the primary purpose of technology education has been to help learners become technologically literate so they may function efficiently in this technological world.
CHAPTER 6

Concerns and Projections for the Future of Technology Education
The transition to technology education helped to circumvent the identity crisis into which industrial arts had tumbled, particularly in regard to its relationship with vocational education. Many in the profession have stressed the need to guard against a recurrence of this problem. However, a similar dilemma emerged in the federal funding of the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 which created an initiative for a new educational approach referred to as “tech prep.”

The desire of many other areas of instruction to incorporate the study of technology into their programs has also presented a challenge to technology education. Despite the call for the liberal arts to accept the study of technology decades ago, only recently has this begun to take place. Also, a number of projects have been organized, mostly through funding from science interests, to develop interdisciplinary educational approaches that include technology. The Science, Technology, and Society (STS) movement, which first came about during the 1960s, has since developed a considerable following.

For years, industrial arts professionals suggested alternate curriculum design models to typify the discipline. In 1980 the Jackson's Mill Industrial Arts Curriculum Symposium established a reasonable model that the profession could follow. In 1990, the “Jackson's Mill II” conferences, which produced A Conceptual Framework for Technology Education aimed to improve upon the landmark Jackson's Mill Industrial Arts Curriculum Theory. The
Framework focused primarily on how to achieve the aims of the earlier effort. While there has been some thoughtful criticism of the Conceptual Framework, many leaders in the profession regard it very highly and expect it to have a significant impact on the direction of the profession.

Questions concerning content are also a constant challenge to the profession. Due to the ever-changing nature of technology, it has been suggested that technology education must continually update the content within the field. The appropriateness of the present content organizers has been disputed, and arguments for the inclusion of biotechnology, or biotics, emerged. Another issue has concerned the value of studying the history of technology.

Also, some apprehension has arisen regarding technology teacher education programs which, at present, seem to be the weakest link in the scheme of technology education. Perhaps one cause for this has been the shift of a majority of traditional teacher education programs towards Industrial Technology. Despite this and other problems, the outlook for technology education among professionals in the field has remained positive.

Technology Education in Relation to Vocational Education

It has been no secret that a philosophical split emerged between vocational education and industrial arts in the early twentieth century. The needs of industrial arts teachers prompted the establishment of an Industrial Arts Division within the American Vocational Association. With the establishment of the American Industrial Arts Association (AIAA) in 1939,
the split became a chasm. More problems arose as vocational education received more and more federal funding, with little or no support allocated for industrial arts. When finally included in vocational funding, a debate ensued within industrial arts regarding the appropriateness of a general education program accepting funding under the auspices of vocational education. Although the money may have been helpful, it was almost as if industrial arts had to sell a characteristic piece of its identity for the funding.

One purpose for the AIAA’s desire to change its name to the International Technology Education Association (ITEA) was to reestablish its identity which was successful during the last half of the 1980s. Recognition of this new identity was evident in specific funding for technology education through the Omnibus Trade and Competitiveness Act of 1988, as well as specific references to technology education in educational literature. However, in 1990, the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 introduced the term “applied technology education,” leaving some technology education professionals with a distinct feeling that they had been infringed upon.

Yet, despite the differences between vocational education and technology education, there may still be enough similarities so that cooperation would improve the entire educational system. In 1950, Bawden wrote:

It is a significant fact that many of the leaders in industrial education made notable contributions both to vocational-industrial or trade training and to general-education industrial arts. In most instances these leaders came to appreciate the place and importance of industrial arts as a basic preliminary to vocational-industrial or trade training. (p. 6)
Since industrial arts courses were originally intended to provide a general orientation to industry and helped students develop reasonable competence with tools, materials, and processes of industry, historically, it often served as pre-vocational education. Technology education has also continued to provide a link to vocational preparation at least through its partial involvement in career orientation.

In levels up to and including high school technology education courses, the influence of career education has helped expose students to the variety of technical career choices possible for their future. For students interested in more advanced technical careers, such as engineering, further study in technology education has also offered a useful and practical alternative. Still, due to any number of circumstances, vocational education has often been the best opportunity for some students, and proper guidance has helped them grasp this opportunity.

Vocational education has traditionally provided an individual with more immediate access to employment, which may be imperative in many cases. Vocational education has been primarily concerned with preparing individuals with the technical skills and knowledge needed for employment in specific trades. Due to the rapid changes in modern society, most individuals can hardly be expected to maintain the same job skills throughout their lives. Thus, vocational training may become necessary at various stages of one's life.

Technology educators have recognized that rapid societal change makes it necessary for students to prepare for life-long learning at an early age. Since the primary emphasis of technology education has been to help students
prepare for life in a technological society, that means they must learn to adapt to change. For this reason, it has been viewed as essential for the study of technology to begin at the elementary level and continue through high school.

Tech Prep

Tech prep has been another option that has emerged for students. It was conceived as an approach that would be tantamount to college prep tracking in the schools. Kazis and Roche have written: “Tech prep has evolved from the efforts in the 1960s and 1970s to improve ‘articulation’ between secondary schools and community colleges” (1991, p. 6). Tech prep was first promoted as a concept by Dale Parnell, President of the American Association of Community and Junior Colleges. In 1984, Parnell authored the book The Neglected Majority which maintained, along similar lines as Marland in the 1970s, that the educational system in America does not address the needs of the majority of the nation’s students. In 1988, research by the William T. Grant Foundation Commission on Work, Family, and Citizenship, culminated in the book The Forgotten Half: Non-College Youth in America: An Interim Report on the School to Work Transition which continued to promote the concept of tech prep.

Parnell’s idea consisted of abandoning the ambiguous general education curriculum for a more focused alternative aimed at the roughly 40% of students who were in that track. Tech prep curriculum, like college prep curriculum, has been goal-oriented for the student and, as it was written,
"provides technical preparation in at least 1 field of engineering technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health, or business" (Congress of the United States, 91, p. 54). Most tech prep programs already have operated on a "2 + 2" basis, which means that after two years in the secondary program the student would be prepared to follow through for two years in a community college. Tech prep has gained particular attention since the reauthorization of the Carl D. Perkins Act.

The Carl D. Perkins Vocational and Applied Technology Education Act of 1990 authorized federal spending of up to $1.6 billion per year for programs that would teach "skill competencies necessary to work in a technologically advanced society" (Wilcox, 1991, p. 16). This was the greatest amount of federal funding ever approved for vocational education, although the amount actually appropriated for fiscal year 1991 was $125 million.

This new legislation differed considerably from previous vocational statutes, including the Carl D. Perkins Act of 1984. The new law emphasized the integration of academic and vocational education as well as clarifying the distinction between secondary and postsecondary levels of vocational education. These two characteristics of the legislation were fundamental to the concept of tech prep. Vocational education had traditionally involved training learners for jobs by developing a very specific set of skills necessary to carry out that role. The aims of the Perkins Act of 1990 were much broader, emphasizing the application of academic knowledge by connecting thoughts with actions. Articulation of vocational education with postsecondary programs has also been a problem in the past. The new law hoped to address
this situation by identifying what was appropriate learning in the schools and by acknowledging a need for national policy in the nation's system of postsecondary occupational preparation. A third factor emphasized in this law was cooperation from business and industry. Federal incentive was provided by giving special consideration to programs applying for funding that had been planned in cooperation with such enterprises. Since the overall aim of tech prep was to better educate Americans for technical careers, it seemed to be in the interest of business and industry to support such an effort.

Tech prep has a number of implications for technology education. Encouraged by funding from the Perkins Act, states and localities began implementing tech prep in their educational systems. There have been few federal restrictions on what constitutes tech prep, and the crux of the problem has often related to how the state educational systems traditionally offered technical programs. In areas where vocational education has been offered through regional centers, a transition to a tech prep approach may accept technology education in the schools and utilize the vocational centers as postsecondary institutes. However, in many states vocational education has remained an integral part of the comprehensive high school and, hence, vocational education programs would take on responsibilities very similar to those of technology education. It would seem, then, that one of the two programs in a comprehensive school could be rendered virtually useless.

Technology education has already established a curriculum that fits the description of what the promoters of tech prep hope to achieve. Grubb, in his article "Tech-Prep Programs: Issues in Implementing the Carl Perkins
Amendments of 1990, studied the question: “Which fields of study should qualify for tech-prep programs?” (1990, p. 2). He suggested that:

... certain fields of study linked to math science, and emerging technologies -- including such fields as electronics, laser optics, robotics, computer-related programs, energy-related programs, medical technologies, CAD/CAM, computer-integrated manufacturing, and bio-technologies -- be eligible for federal funding, but that others without important technical components ... be ineligible for funding under the tech-prep provisions. (1990, pp. 2-3)

Not only has technology education already become involved with such “fields,” it has identified them as essential to the new paradigm.

Also, since technology education has always been a part of general education, it would be natural for it to play a role in the tech prep movement. If this situation were to occur, rather than having college, general, and vocational “tracks” in schools, all students could benefit equally from a technology education program. All students would then be prepared in a similar fashion to work with others in a technological society regardless of their ambitions following high school and the careers they may choose.

The “neglected majority” of students in America’s schools might then be better prepared to pursue technical careers or education in community colleges or vocational centers for positions in business and industry. Yet, students who pursue careers requiring more advanced academic preparation will have started with the same fundamental knowledge of technology upon which to build. Many college level programs have been broadly oriented towards occupational preparation. However, liberal arts colleges, generally, have not favored such aims and have had limited interest in technical knowledge and/or the study of technology.
Technology and the Liberal Arts

In recent years, a growing number of educators have argued that the study of technology can, and should, be part of a good liberal arts education. Traditionally, the liberal arts have provided a broad-based curriculum that has cultivated classical knowledge and avoided technical intervention.

This idea is not new to the profession and has been considered in the past. Meyer wrote in 1959:

The liberal arts approach to industrial arts needs to be examined. There are those traditionalists who would deny that industrial arts could ever be a liberal art, and yet as has been considered here before, the great movements of our age seem to demand a new interpretation of the meaning of liberal arts. Perhaps this may be done in basic science or possibly it cannot be done at all for many years; still it seems that some effort should be made to realize this larger linkage. (p.18)

Meyer, who was an early advocate of the study of technology in industrial arts, believed that the traditional liberal arts curriculum would benefit from a revision to include the industrial arts. In 1963, A. G. Breidenstine, the Dean of Academic Affairs at Millersville State College in Pennsylvania, spoke at the Annual Convention of the ACIATE in Indianapolis, Indiana regarding "Industrial Arts as General Liberal Education." He declared:

Two specifics about general-liberal education have been recorded through the ages, namely - Education about the subject, man himself, and secondly, about the material universe in which he dwells. It is my contention that the industrial arts relate precisely to these aspects of a complete education. (p. 11)
Nearly thirty years later, these same sentiments were being repeated by individuals outside of technology education. In 1984, Kranzberg declared, "we need a 'new liberal arts,' one which takes cognizance of the new world brought into being by the growth of science and technology and their interactions with society" (p. 35). The dominant force of technology in society had become so far-reaching that to overlook its significance would be a disservice to students.

Technology has also been recognized as an effective way to make liberal education more meaningful. Lisensky, who explored technology as subject matter, was of the opinion that technology can actually provide a link between the study of sciences and humanities. To him, the lack of the study of technology seems to be the very weakness of liberal arts education. Lisensky made his point as follows:

"The introduction of the study of technology also may bring a new sense of dignity to dealing with the 'how-to' approach in education. Liberal education has focused on the 'why,' dealing with the discovery and understanding of knowledge, but not its application. Technology springs from the arts and crafts, yet uses its understandings of science to serve human needs. It uses the technologists' 'how-to' as a bridge between the scientists' questions of 'what is' and the humanists' 'what ought to be.'" (Lisensky, Pfnister, & Sweet, 1985, p. 27).

In 1985, Wiens, a Professor of Industrial Arts, identified a growing trend among liberal arts colleges to expand their programs by offering content that studied technology in some way. In his article "Technology and the Liberal Arts," Wiens wrote: "The impetus for a new look at the liberal arts
comes in part from within, but it is also being promoted by business-backed foundations who recognize the need for more informed decision makers" (p. 13). In addition, he offered examples that illustrated how the study of technology was approached at three different liberal arts colleges in the Eastern United States. Wiens also presented a number of questions regarding the profession of technology education and what should be considered appropriate when teaching about technology.

Two years later, in 1987, Wiens authored a guest article in the *Journal of Industrial Teacher Education* titled "Teaching Technology as a Liberal Art." In it, Wiens provided a brief chronological history of what he referred to as the "development of the technological literacy movement." This history began with the development of a course called "The Man Made World" by the Engineering Concepts Curriculum Project established at the State University of New York at Stony Brook. This curriculum approach began to grow among secondary science teachers in the United States during the 1960s and was considered by Wiens as "one of the forerunners of technological literacy programs . . ." (1987, p. 8).

The next step in the progression of technological studies among liberal arts programs was the result of a private interest in education. In 1980, the Alfred P. Sloan Foundation created a contingent that they called the New Liberal Arts (NLA). The Sloan Foundation chose to provide funding to undergraduate, liberal arts programs that were committed to improving the technological literacy of their students. The NLA contended that there was a distinct division between science and technology, and viewed technology as a broad-based technical system actively involved in solving problems, much
like engineering. The NLA also continued to consider the influence of technology on social and environmental issues and questions regarding ethics and values (Wiens, 1987, pp. 9-11).

In 1984, another effort was made to improve technological literacy in liberal arts colleges. The Council of Independent Colleges (CIC), with funding from the Pew Memorial Trust, set out to encourage education for technological literacy by backing ten pilot programs. In 1985, the CIC also conducted a survey and assessment of the response of liberal arts colleges to technology, a project funded through grants from the Ford Foundation and the Consortium for the Advancement of Private Higher Education. A result of this project was a monograph titled The New Liberal Learning: Technology and the Liberal Arts. In this publication, Lisensky wrote:

As educators grope for academic change responsive to a technological society, we can expect many educational experiments in the years ahead. The ‘new liberal learning’ will come about when education in technology, with its distinct body of knowledge and method of inquiry, is fully incorporated into the liberal arts curriculum. Without this new dimension students will be ill-equipped to deal responsibly with the world in which they live and with the major issues of the day. (Lisensky, Pinster, & Sweet, 1985, p. 27)

Another outcome of the CIC project was the realization that a majority of the liberal arts programs that attempted to improve technological literacy were typically one-dimensional. In most cases, they either emphasized the scientific or the social implications of technology. Still, the participants of this project felt that liberal arts programs in technology could be taught effectively through a variety of disciplines. They referred to this as the “multidisciplinary dimension” of liberal arts programs about technology.
Initiatives for Interdisciplinary Studies Including Technology

Although technology educators have viewed technology as an unique discipline, that is interdisciplinary in nature, many other fields have in one way or another become involved with instruction about technology. Mathematics, the sciences, the social sciences, history and other areas have all begun to focus on the topic of technology. Naturally, this has been a cause for concern among technology educators, since technology education, by and large, has not been required within the schools. Efforts to promote technological literacy through means other than technology education have the potential to diminish the stature that the profession has achieved.

In 1985, the American Association for the Advancement of Science (AAAS) initiated a major project known as Project 2061. Project 2061 has been planned as a long-term, three-phase effort. It began on the assumption that it would be futile to attempt a reform of the current program of science education by implementing a quick-fix scheme. It is expected to be goal-oriented rather than process-oriented, and comprehensive in nature. Its aim has been to develop an educational system that would provide the same core of knowledge to all learners, through a non-tracked instructional program. It is expected that the model developed may provide as much as 85% of the entire curriculum for a given school, with the other 15% molded to fit the particular community. The Project has involved several components including teacher education, changes in school organization, new instructional materials, assessment, community participation, research in education, and other elements.
The book Science For All Americans was the overview report of the first phase of Project 2061. Published by the AAAS in 1989, it identified the failures of the present educational system and helped to disseminate the philosophy and approach of Project 2061. As an approach to reform in science education, Project 2061 has defined "science literacy" in such a manner as to include the natural, physical, social, and behavioral sciences, mathematics, technology, and engineering, as well as the interrelationship of these areas. The Director of the Project, F. James Rutherford, said of Science For All Americans: "Its recommendations on what all students should know and be able to do in science, mathematics, and technology by the time they have finished school essentially define science literacy" (AAAS, 1992, p. 1).

Since technology was considered a subcomponent of the core of essential scientific knowledge, a special panel report on technology was developed as part of the first phase of the Project. Four other panel reports were developed for the topics of biological and health sciences, mathematics, physical and information sciences and engineering, and social and behavioral sciences. The panel on technology identified several current technologies and appropriate concepts for technology education which included the following: agriculture and food, biotechnology and medical technology, communications, computer technology, electronics, environment, energy, manufacturing, materials technology, space, and transportation.

The panel recognized that technology has traditionally been taught in the present educational system through the curricula of industrial arts, vocational education, and some science courses. They also suggested that technology education proceed from kindergarten through the twelfth grade.
and should begin with explanations and illustrations of technological concepts followed by research and investigation of progressively increasing scope and complexity. And, as students progress, they should learn to use the tools of technology, which not only include mechanical equipment, but also computer hardware and software, facilities, human resources, libraries and other sources of stored information, and, of course, the knowledge of mathematics and sciences. The report of this panel declared that scientific "principles govern the processes of technology." It additionally stated that "technology education should emphasize problem solving." The panel on technology also recognized that "expanded technology education can be integrated with history, social science, and many other subjects" (Johnson, 1989, p. 4-8). The view was expressed that these other areas of knowledge should be integrated into technology education, and therefore bring additional meaning to the curricula of the sciences.

In 1988 the National Science Teacher Association (NSTA) conceived of an initiative for educational reform known as the Scope, Sequence, and Coordination of Secondary School Science. In 1992, a guide for curriculum designers titled The Content Core was produced through this project. Although The Content Core makes little mention of technology per se, it does mention that it "is particularly compatible with the direction, tenets, and themes of the American Association for the Advancement of Science's Project 2061" (NSTA, 1992a, p. 9). The work of this project was supported by a grant from the National Science Foundation (NSF) and advocates a constructivist approach to learning science.
Hands-on activities in science are integral to the scope of this project, however, it is important to note that hands-on science does not necessarily imply technology. There are numerous pilot programs throughout the United States, but only a few have incorporated technology into their curricula. At least one pilot school in Iowa has been reported to have adopted an approach that studies technology (NSTA, 1992b, p. 7).

The Technology/Science/Math (T/S/M) Integration Project was another smaller project funded by the NSF that was truly interdisciplinary in design. This project, established in the Technology Education Program Area at Virginia Polytechnic Institute and State University, has as its purpose to develop technology-based problem solving activities that will assist with the integration of technology, science, and math curricula at the middle school level. It is expected to result in a set of middle school technology/science/math education curriculum materials.

Science, Technology, and Society

Although Wiens claimed that STS programs were “spawned at the college level,” Waks and Barchi, in their article “The Progress of STS in School Science: Reflections of National Leaders,” credit the development of STS, as a curriculum theme, to the efforts of “many secondary science teachers in the United States, often working alone at the grass roots level . . . .” (1991, p. 6). This approach introduced the concern for an understanding of social issues related to science and technology. Waks and Barchi wrote: “. . . science, technology, and society is a curriculum emphasis which concerns itself with technology-related topics: artificial intelligence, workplace automation, acid rain, the ozone layer, recombinant DNA, star wars” (1991, p. 6).
Regardless of the origination of STS programs, they quickly emerged at the college level during the 1970s. Among the first to direct such a program, Pennsylvania State University's Rustum Roy has written the following regarding such instruction:

For the *median* learner, we believe that the STS route — entering via the interest in the societal problem — is best. For a 10 percent minority of the population, entering via science (the present tradition in the U.S.) may be the most effective. But for a larger minority, the entry through hands-on technology may be the best. (1990, p. 13)

In recent years, the STS movement has redoubled its efforts in the pre-college education sphere of influence. According to Roy, then, in educating junior high and high school students for technological literacy, STS programs, and technology education would meet the needs of the majority of learners. Generally, STS programs have focused primarily on the impacts of technology and often consider technology as “applied science.” However, they do not have a background of “practicing” technology through a hands-on approach. Indeed, they typically lack the facilities to do so which has been one major advantage of technology education.

While STS programs have tended to focus on societal issues, it has been primarily the discipline of science that has delivered STS in the schools. Yet, the science community has experienced some difficulty establishing STS programs in schools. One downfall has been the lack of a uniform definition of STS education. To address this problem, in 1984, the Science Through Science, Technology, and Society Project was founded at Pennsylvania State University to develop a definitive statement describing STS.
Another outcome of that Project was the establishment of a National Association for Science, Technology, and Society (NASTS). This organization has helped to propel the STS movement, although one leader, Carolyn Graham, commented “STS has still not infiltrated science education; it’s still an add-on. We still have not determined the appropriate place of STS in science education” (cited in Waks and Barchi, 1991, p. 7). Indeed, it has been a small minority of science teachers that have actively adopted an STS approach.

In the future, proponents of STS at the college and university level hope to improve their communications networking, implementation efforts, and their fund-raising capabilities. An annual National Technological Literacy Conference has been held, a STS Newsletter has been developed and articles about STS have been published in the journal Science Education. Also, in 1987, the National Science Foundation supported the implementation of STS programs through funding a national STS network.

Technology has also been studied from the perspective of the social sciences. Historical, sociological, and political viewpoints can broaden one’s awareness of technology, and professionals in these areas of education have, on occasion, used this as topics for instruction. An educational organization dedicated to the advancement of technological literacy known as the Council for the Understanding of Technology in Human Affairs issues a semi-annual journal titled The Weaver of Information and Perspectives on Technological Literacy. The Spring 1990 issue of “The Weaver” was dedicated entirely to the topic of “Technology and The Social Sciences.” In it, such socio-technological issues as genetic engineering, social control through engineering, and the effects of narrowing technological expertise on decision-making in government. While

265
the general tendency in this area, at least initially, has been to study the
negative effects of technology, more progressive social scientists seem to
approach the society-technology discussion with an open mind.

Volti, a sociologist and educator in California, identified a lack of social
research concerning technology and how very few efforts have been made to
link technology to concerns such as the structure of society, how social change
occurs, and how inequality is developed. Volti believed that such a unique
approach might create a whole new realm of sociological studies. While some
sociologists have followed this course, academic departmentalism has proven
an obstacle to this pursuit. According to Volti:

One response has been to fight fire with fire through the
creation of new departments devoted to the study of the social,
political, and historic dimensions of technology, usually
coupled with parallel studies of science under the 51'5 rubric . . .
. The creation of these programs at least has provided an
intellectual home for people sharing similar interests, but it
does pose the threat of ghettoization. Sociologists situated in
this setting may find a congenial intellectual environment, but
at the risk of being drawn from a distinctly sociological milieu.
(1990, p. 3)

Although the social sciences have participated in the discussion of
 technological literacy, this discipline, as has been true with other disciplines,
has experienced difficulty finding a niche for such studies.

Jackson's Mill II

In 1990, an effort was made by twenty-five leaders in the field to
continue to define the model for technology education. This group,
sometimes referred to as "Jackson's Mill II," was afforded the opportunity to
confer several times thanks to the provision of a grant from the Technical
Foundation of America. The goal of this effort was to move beyond the base for curriculum derivation established through the Jackson’s Mill Industrial Arts Curriculum Symposium by providing “an overview of technology and the process that is used to ‘do’ technology” (Savage & Sterry, 1990, p. 7).

R. T. Wright identified some weaknesses of The Jackson's Mill Industrial Arts Curriculum Theory stating: “Included in these are concerns that Jackson’s Mill is industrial, does not address all the technology, or fails to focus on the procedures for developing technology and solving technological problems” (1991, p. 53). Although technology has been generally accepted as the motive for the profession, it has been apparent that many still believe the content should remain focused on technologies related to industry. Wright felt that this was something that should have been addressed in the Jackson’s Mill II conferences, yet this assembly of leaders in the profession was not to be swayed from the focus on technology education.

The Jackson’s Mill II group hoped to build upon the legacy of the earlier effort and, like the Jackson’s Mill Curriculum Symposium, the intent was to reach a consensus within the participating group on related issues. The resulting work of the Jackson’s Mill II group was a document published in 1990 by the ITEA titled A Conceptual Framework for Technology Education. Although The Jackson's Mill Industrial Arts Curriculum Theory had established communication, construction, manufacturing and transportation as the four organizers for the content of technology education, A Conceptual Framework for Technology Education, retained the organizers for communication and transportation, added bio-related technologies, and combined construction and manufacturing to form production.
The significance of *A Conceptual Framework for Technology Education* goes well beyond this simple distinction, however. The dominant element of this document was its "technological method model," a construct that represents the steps and actions necessary to "do" technology. The central and dominating theme of this model was based on the ability of humans to solve problems. This *Framework* would also incorporate an unbiased approach in addressing issues related to the many influences of technology. This was a concern mentioned in *The Jackson's Mill Industrial Arts Curriculum Theory*, but not pursued until Jackson's Mill II.

R. T. Wright, who was a member of the group, faulted *A Conceptual Framework for Technology Education* for causing confusion in the transition from industrial arts to technology education. He felt the publication failed to convince readers that technology education was worthwhile or that the profession really knows where it is headed (1991, pp. 56-57). Indeed, the document hardly establishes a need for technology education and does come across as an inexplicit theoretical discussion seemingly prepared by teacher educators for other teacher educators to read. Perhaps a more straightforward, promotional approach directed toward those who teacher educators are expected to serve would have brought the qualities of this publication more to the forefront.

Another concern expressed by Wright was that many programs have been in the process of transition and yet, as they change, the model they emulate changes. Teacher education programs had already experienced difficulty meeting the NCATE guidelines prior to *A Conceptual Framework for Technology Education*.
Technology Education, which then proposed that the standards by which they are measured be altered yet again (1991, pp. 57-58). Many others concur that, “if it is agreed that change is basic to technology, then it should also be accepted that technology education is a constantly changing curriculum with certain elements periodically being eliminated and others being added” (Pullias, 1987, p. 57).

Technology education programs throughout the nation need to reflect common goals, philosophies, and content. While some differences may be good in any discipline, they should be minimal regarding the curriculum itself. The question of a national curriculum has been raised in the past, and while one advantage might be unity, arriving at that goal through such means would seem almost dictatorial. Standards were established to guide programs so that the programs could be similarly articulated. Still, most technology education programs differ significantly.

history of technology and other content

Another issue has been the role of the history of technology in technology education courses. It should be apparent that one must be aware of history to appreciate technology. Technology can easily be taken for granted and has often been thought of in terms of only the most recent advancements in our material culture. To understand the concept of technology fully, it is necessary to realize that technology is an ongoing process. Not only has technology had a past of its own, but it has influenced all of history. In regard to teaching the history of technology, Maley said:
Thus, teaching of the heritage of technology - past, present, and future - is imperative if we are to understand how we got here, the nature of the impact of present-day technological decisions on tomorrow, and the relevance of tomorrow's technological decisions on the future of the human race.

(1983, p. 3)

Studying and teaching the history of technology can also guide students toward a positive outlook on themselves and their future. Promoters of technology education have commonly said that such a program should focus on the "impacts" of technology. In most cases, people understand this as studying the problems that are created by technology. However, a balanced discussion ought to identify the opportunities that technology provides. There is a great deal of hope for progress, thanks to technology. The essence of technology has been the capability of humans to transform the environment to meet their needs. Undeniably, technology has sometimes caused problems or has been used inappropriately. However, humans do have the ability to develop technologies to solve the problems, and the capacity to make informed decisions about the proper use of technology. Leslie C. Miller, of the University of Iowa, wrote of how this could be meaningful for students:

The history of technology suggests that humankind's relationships with things technical were, from the earliest periods of the human drama, not only essential for one's well-being, but also key to the further development of the species. Industrial teacher educators who are aware of the extensive and symbiotic relationships between early people and their technology, should be able to transmit to their students a new and increased sense of their social worth.

(1984, pp. 53-54)
Some curriculum plans have incorporated the history of technology as a prerequisite course or preliminary level necessary for further study of technology. Others have categorized content into sensible, substantive groups of knowledge that are mutually exclusive and that, when combined, are all inclusive of knowledge in the realm of a given discipline. According to this rule, the history of technology would not seem to be appropriate as a content organizer but would be studied within any of the structured headings.

From this perspective, it seems possible that an area such as biotechnology could be considered an organizer for technology education. Other topics have, in the past, been held up for review under the previous criteria and have posed some dilemmas. For example, electricity and electronics have been relevant content for technology education, yet opinions have varied on whether they are applicable within only one of the existing organizers, whether they are essential to all areas, or whether a new content organizer may be necessary.

The variety of industrial arts/technology education content in schools throughout the nation has been a mixed blessing and continues to be a challenge to the profession. At the 1961 AIAA convention, in a presentation titled "Technology: Implications for Education," R. Lee Hornbake, of the University of Maryland, stated: "Unfortunately for the profession it has been the school programs which have controlled the preparation of teachers. Diversity and confusion in our secondary school programs has made for patchwork and triviality in teacher education" (1962, pp. 19-20). Although the
technology education movement has attempted to establish a distinct curriculum structure, many programs that have accepted the title "Technology Education" have not always conceded to the new content organizers. It has become a considerable challenge to gain the universal acceptance of these organizers in schools.

Promotion of Biotechnology

Content has remained the main subject of discussion in many undergraduate and graduate level technology education programs. One content area that has drawn a lot of attention recently has been "biotechnology." As early as 1979, DeVore had presented the concept of biotechnology as a possible focus of industrial arts. He later speculated that biotechnology will be included as a study of technical means in the future. He projected that the biotechnologies will focus on "... the design of technical systems utilizing knowledge of the natural order and living organisms of their components in the creation, processing, or recycling of resources..." (1991, p. 278). Frequently, those who feel that technology education should not limit itself to studying the technology of industry but should embrace the entire domain of technology also espouse biotechnology as a content area.

In the Summer/Fall 1991 issue of The Journal of Epsilon Pi Tau, R. T. Wright criticized the Conceptual Framework for Technology Education for its inclusion of bio-related technology and stated: "The position reached on content organizers which include bio-related, communication, production, and transportation was not reached through a careful study or a sound
rationale" (p. 56). Wright also wrote: "Many of the bio-related terms are production terms. They belong to the family of production technologies that locate, secure, and transform materials into products and structures" (p. 57).

The next article in that same issue was written by one of the co-authors of A Conceptual Framework for Technology Education, Ernest N. Savage, and was titled "A Rationale for Bio-Related Technology in Technology Education." In it, Savage conceded that "... biotechnology can be seen as a production technology because production technology can use biotechnology to make or modify products and to develop micro-organisms" (1991, p. 59). Savage suggested that biotechnology must be considered on a much broader scale, hence the use of the phrase "bio-related technology." He offered this definition: "Bio-related technology is the practical application of mechanical devices, products, substances, or organisms to improve health or contribute to the harmony between humans and their environment" (1991, p. 29). Examples of such knowledge would include ergonomics; fuel, chemical, and material production; or waste management.

In 1991, Wells introduced the term "biotics" as a more appropriate organizer explaining that the term "biotechnology" describes that which is done within the sciences, and that "bio-related technology" has been too vague to accurately define exactly what it is that technology education would teach. He recognized that the objective of a biotics teacher would be primarily to help students apply the knowledge of biotechnology to solve problems within the scope of their resources. Wells described biotics in the following manner:
Bioteconomics is an interdisciplinary program aimed at meeting human needs. As such, it can support both the Science and Technology Education curriculums. It is in the Science area that most developmental work has taken place, but it is now necessary to shift this development to Technology Education. (1991, p. 14)

Biotechnology, or bioteconomics, has been taught successfully in technology education classrooms, yet it still faces resistance within the profession due to its lack of identification with industry and the way that industry has stereotypically been considered. Expertise in this area has also been limited among technology educators, so cooperation with science instructors has been essential for the development of such programs.

*Impact of Industrial Technology*

The phrase “industrial technology” was initially arrived at through the development of the *Industrial Arts Curriculum Project*, published in 1966. This industry-oriented curriculum and instructional approach was devised with the intention of updating industrial arts education. While there are a number of programs that exist within the public schools of the United States as *Industrial Technology Education*, the term “industrial technology” has also come to represent a different form of industrial education with a history of its own. More recently, industrial technology has been offered primarily in four-year college programs that want to serve the needs of students who desire preparation for a career in production management.

Industrial technology is an educational approach that has helped people gain knowledge of technical processes involved in industry, as well as become capable of handling supervisory responsibilities. Business and
industry have readily accepted graduates of such programs since there has been a great demand for individuals with this type of training. Lewis and Robinson stated: “the gaps in knowledge left by changes in engineering education promoted industrial technology programs” (1969, p. 71). More recently, engineers have been involved with aspects of the industrial process that are more removed from responsibilities such as production management, facilities management, estimating, and the cost analyses involved with industrial enterprises. As in engineering, specialization has been required. A practical knowledge of mathematics and physical sciences has also been very useful. Curricula in industrial technology often include exposure to business administration, social sciences and the humanities.

Industrial technology should be further distinguished from two-year programs, commonly found in “schools of technology” and “community colleges,” that offer related programs leading to associates degrees. Graduates of these programs may pursue employment as technicands in industry or may continue their education in a four-year program. The intent of the industrial technology program has been to nurture skills in synthesis and the evaluation of problems that have been common to supervisory positions in industry. Lauda (1988) stated: “from its earliest conception, industrial technology was designed to be broadly based and heavily involved with a problem-solving approach. In some cases, these emphases were so pronounced that students were unable to acquire adequate technical knowledge in their programs” (p. 264).

Lewis & Robinson credited Pratt Institute, in New York City, and Bradley University, in Peoria, Illinois with creating the earliest industrial
technology programs just prior to the turn of the twentieth century. The curriculum of these early programs entailed mathematics, science, theory in technological areas, plus laboratory experiments and shopwork. They were two-year college programs that were neither specific vocational training nor considered advanced enough for engineering. By 1950, only six four-year colleges across the United States offered similar technical training (1969, p. 78).

Since then, four-year industrial technology programs have found a place in many colleges and universities, particularly in institutions that previously supported industrial arts teacher education departments. At the college undergraduate level, fueled by the availability of funds from federal, state, and private sources, student enrollment for industrial arts programs continued to increase through the 1960s, and into the early 1970s. However, as federal and state budgets were depleted by the military engagement in Vietnam and the apparent shortage of oil during the early 1970s, many industrial arts research and curriculum projects began to dwindle. Rokusek and Israel wrote:

At about the same time that industrial teacher education programs experienced difficulty, industrial technology programs began to flourish and several industrial teacher educators, particularly those who taught laboratory courses, became primarily responsible for teaching and advising industrial technology students. (1988, p. 227).

A large portion of the four-year teacher education programs began to adopt industrial technology as an alternative or, in many cases, the primary course of study within their departments. Donald Lux, co-director of the Industrial Arts Curriculum Project, recognized that traditional industrial arts
teacher education programs would not find expansion to include industrial technology an easy process. He wrote:

Industrial technology, according to any adequate definition, requires expertise far beyond the traditional kinds found in custom-handicrafted production. At the least, it includes all types of engineering, product and architectural design and industrial management. In addition, it suggests the need for unusual strengths in related disciplines such as industrial sociology, industrial psychology, labor and economics. Few of our present teacher education institutions now have available these resources within their total campuses, let alone in their departments. (1976, p. 110)

Still, it should not be surprising that traditional teacher education programs opted to pursue the industrial technology curriculum. Lemons stated: the “strong technical emphasis with management support became popular among teacher education programs” (1988, p. 51). Students were also attracted to industrial technology programs “which moved from teacher education and industrial arts toward the riches and enchantment of industrial employment” (Lemons, 1988, p. 61). The highly technical and advanced nature of this program lent itself well to the preparation of college students for careers other than teaching industrial arts. The result was a substantial decrease in the number of undergraduates majoring in industrial arts education, and an increase in industrial technology.

Concerns for Technology Teacher Education

As the number of Industrial Arts/Technology Education degrees that have been issued annually become fewer in number, the degree in “Industrial Technology” has become more common. This has become evident from a
A close review of the *Industrial Teacher Education Directory* which has been co-sponsored by the National Association of Industrial and Technical Teacher Educators (NAITTE) and the Council on Technology Teacher Education (CTTE) (formerly ACIATE). The *Directory* reveals a consequential shift in the profession within the past fifteen years based on the department headings of related programs at various colleges and universities, and the degrees that they grant.

Keeping in mind that many departments offer multiple degrees, the figures from the 1978-79 issue of the *Industrial Teacher Education Directory* showed that, of the 244 programs listed in the directory, approximately 14% of the listed institutions offered a bachelor's degree in Industrial Education; 33% in Vocational Education and/or Trade and Industry; and 54% in Industrial Arts. Only Eastern Illinois University referred to industrial arts as "Technology Education" at that time. The twenty institutions that had granted the most degrees in industrial arts during the prior year, as a whole averaged about 94 graduates per program. And, only about 6% of all the institutions offered a bachelor's degree including the descriptors "Industrial Technical" or "Industrial Technology" (Dennis, 1978, pp. i-104).

In the 1992 issue of the *Directory*, there was virtually an equal amount of programs granting degrees in Industrial Technology as there were in Industrial Arts/Technology Education, and the number of degrees granted in Industrial Technology was significantly larger. The 1991-92 edition of the *Industrial Teacher Education Directory*, revealed that the twenty institutions that had produced roughly 1,870 graduates of Industrial Arts in 1978, presented merely 325 of the same degrees in 1991. It is therefore not surprising that a
number of these degree programs were either discontinued, or threatened with being eliminated. Also, sixteen of the same twenty institutions offered degrees in Industrial Technology, or some similar title, in 1992 that they hadn’t offered in 1978. The approximate number of degrees granted in these programs was 1,260, approaching the rate of success among undergraduates of industrial arts in the 1970s (Dennis, 1991, pp. 1-108).

Another fact worth noting was that, despite the fact that all of the associations in the field had replaced the phrase “industrial arts” with “technology education,” a majority of the programs still referred to themselves as industrial arts in 1992! Of the roughly 110 departments that issued bachelors degrees in either industrial arts or technology education during the fiscal year July, 1990 - June, 1991, a majority, roughly 55%, still referred to it as industrial arts.

Many technology teacher education programs have failed to offer prospective technology education teachers courses specifically within the framework of the selected content organizers. In part due to the coalescence with industrial technology programs, the course of study pursued by technology education undergraduates has not often been structured to their advantage.

To improve upon this situation, Wilson and Moore (1989-1990) devised a plan recommended for use by technology teacher education programs to prepare teacher candidates appropriately. This plan described four knowledge domains necessary in technology teacher education: general studies, technical base, knowledge of teaching, and pedagogical/clinical knowledge and skills.
For the third domain, the technical base, Hatch and Jones also suggested a possible sequence of courses for technology teacher education programs. First, a “Technological Systems” course could establish the foundation from which the other courses would proceed. Second, a course with a title such as “Tools for Tomorrow” might familiarize the teacher candidates with tools that will be essential to their career as a technical educator. Third, advanced technical courses from all content areas, which included biotechnology, were suggested along with one final “capstone experience” that would integrate their skills and knowledge to solve a significant problem. The final phase of the technical base would include a course to examine “technology in society.” (1991, pp. 243-248).

Student-teaching assignments for undergraduate technology education majors have also been a problem. As early as 1980, DeVore recommended the elimination of student teaching assignments because very few student teachers were offered opportunities to teach new content or use new instructional strategies in industrial arts. Instead, he suggested the establishment of regional training centers for the preparation of teachers and teacher educators (AIAA, 1980, p. 11).

Since the relatively sudden change to technology education, DeVore’s words have become even more meaningful. Regarding technology education, McCrory has stated: “Perhaps the weakest link in the teacher preparation system is the student-teaching phase” (1985b, p. 30). The goal of student-teaching advisement needs to be placement of teacher candidates in an exemplary environment where technology education is taught, yet there
have been limited numbers of technology education programs, let alone outstanding examples.

Hatch and Jones have said: “Technology teacher education programs are faced with the dilemma of preparing a new type of teacher with few, if any, role models” (1991, p. 249). They suggested the use of telecommunication devices to provide live or recorded examples of good teaching. The technology education demonstration projects funded by the Department of Education have provided excellent models but they, too, have been limited in number. Hatch and Jones, similar to DeVore’s earlier suggestion, proposed the establishment of a national (or perhaps international) teaching center for technology education. Such a center could serve to consolidate the profession, networking technology educators worldwide.

In 1985, Dugger identified economics as having a negative impact on the profession in his article “Technology Teacher Education: A Rich History, A Perplexed Present, and An Uncertain Future.” He stated:

Inflation also had a great effect on the amount of funding that teacher education programs could demand for equipment and salaries. This resulted in a drastic reduction in the number of faculty in technology education (industrial arts) teacher education programs. (1985, p. 3)

Dugger based this statement on the total number of faculty listed in the annual Industrial Teacher Education Directory. According to this source, the figure decreased from 3,332 in 1975-76 to 2,665 in 1984-85. In the 1990-91 edition, it reported a total of 2,501 departmental personnel. Around 1991, the national economic situation worsened as the United States fell continued to struggle through a recession. Further cuts in funding, faculty positions, and entire
programs ensued.

In addition to losing a large number of personnel to industrial technology programs, another concern for technology education has been the inevitable decrease of experienced teacher educators. Increasingly, the number of instructors for college level technology education programs will necessarily come from industry with little or no background in pedagogical practices.

The role of the technology teacher educator has also become counterproductive to the advancement of technology education. In most cases, teacher educators have been employed by a system with priorities that seem to typify the law of diminishing returns. Most universities provide incentive for faculty to conduct scholarly research (especially that which brings recognition and/or funding to the university), maintain high standards in teaching, and also provide service to the institute and the community. While these are admirable goals, this combination very often causes mediocrity in at least one of those areas.

This is not to say that either research or teaching may be more valuable than the other, but that they have been at odds with each other. In an article from *The Chronicle of Higher Education* titled “Teaching and Research Are Inescapably Incompatible” Barnett stated:

> Further, research-based reputations most often are built by intensive work in a very narrow specialty. However, the needs of undergraduates are for introductory-level work, broad exposure to several disciplines, and integrated knowledge .... This is not the kind of knowledge contained in the average journal article, which is why a life spent writing such articles is not a particularly good foundation for excellent teaching. (1992, p. A40)

282
Perhaps those who are excellent teachers might be employed to teach, and those who are outstanding researchers ought to be hired primarily for those skills. Especially in colleges of education, prospective teachers should be motivated by the most exemplary teachers rather than good educators who have spread themselves thin trying to meet the expectations of the administration. Teacher educators also have a responsibility to serve teachers already in the field. Evans described the situation:

We spend less and less time in the field, and more and more time on campus. We attend committee meetings and wait for students who come only when they are bribed by salary schedules or coerced by certification requirements. Because of university reward systems, we spend less and less time with undergraduates and more and more time with graduate students and with research and writing. (1992, p. 10)

Another serious misgiving about the profession became readily apparent when technology teacher education programs underwent initial assessment by the National Council for the Accreditation of Teacher Education (NCATE) with little success. Hatch and Jones reported: “As of this writing, almost all of the first twenty-six programs that were reviewed failed to meet one or more portions of the standards” (1991, p. 250). Around the time of the report by Hatch and Jones, a number of technology teacher education programs were closed across the nation. Due mainly to financial constraints brought on by a national recession, many universities have discontinued programs with declining enrollments, such as technology teacher education. In some cases, the initial lack of success in the NCATE assessments may have provided an additional explanation to justify the termination of technology education programs.
Outlook for the Future

In the past decade, there have been many concerns identified for the future of the profession, particularly the teacher education programs. Outside of uncontrollable factors such as national economics, there have been many areas that have been targeted for improvement. Dugger suggested several strategies for improving technology teacher education programs. His list included upgrading programs to reflect technology; providing in-service programs to update teachers of existing programs; actively recruiting students for technology teacher education programs; forming and using an advisory committee; establishing standards for the teacher education programs; promoting and supporting student organizations; and, finally, having faculty become active members in professional organizations (1985, p. 4).

Of course, the Professional Improvement Plan has helped to guide the profession since 1984. In 1988, Lauda said of the Plan:

One of the most successful undertakings in industrial education has been the Professional Improvement Plan of the International Technology Education Association. This long-range plan has provided tremendous help to the leadership in assisting in the direction of the association since 1983. (pp. 257-258)

The most recent Professional Improvement Plan: Advancing Technological Literacy - 1990-95, published by the ITEA, has outlined an index of objectives and strategies based upon six goals. With the mission of the ITEA being the advancement of technological literacy, the following six goals concern that end specifically.
By March 31, 1995 the ITEA proposes to:

1. Provide a philosophical foundation for the study of technology that emphasizes technology literacy.
2. Provide teaching and learning systems for developing technological literacy.
3. Foster research to advance technological literacy.
4. Serve as the catalyst in establishing technology education as the primary discipline for the advancement of technological literacy.
5. Increase the number and quality of people teaching technology.
6. Create a consortium to advance technological literacy.

Although the Standards for Industrial Arts Programs, published in 1982, has since been revised to the Standards for Technology Education Programs (1985), the project from which it came has not been replicated. The Standards for Industrial Arts Programs Project, completed 15 years after the 1966 publication of the Schmitt-Pelley study, remains the most recent comprehensive quantitative study of the profession. Such a study would be of great value to the profession, since the change to technology education, as an indicator of the impact of the transition to technology education.

While some view the problems confronting technology teacher education programs as leading to the eventual demise of the profession, technology education seems to be regaining an audience in the secondary schools. This may be the result of constant efforts contributing to improvement, but this growth must be documented and publicized so as to promote the opportunity that exists in technology education and the need for future technology teachers.
The leadership within the profession has achieved a remarkable accomplishment in bringing about the transition from industrial arts to technology education. However, this same group must recognize the need to perpetuate the improvement and growth of the profession by continuing to recruit and guide promising young individuals into the network of leaders. While there have been steps taken to recognize outstanding young technology educators within the field, perhaps a more personal approach needs to be developed. The highly respected senior members in this field might step back from their busy schedules occasionally to recognize and take on a protegé. Such mentorship should not only occur within the halls of higher education, but also in the community. Leaders in higher education need to remain in close contact with the teachers and students in the public schools in order to foster quality programs. From top to bottom, technology education should be oriented toward people, especially children. Technology educators must be wary of isolating themselves from those who can help them, and especially, those who need them.

Conclusion

It may not be easy for new members of the profession to appreciate the rich tradition of the field or the meaning of the relatively recent transition to technology education. They must first learn of the intricate history of the profession, and they must proceed with caution. There is a lot to learn about technology education and its background.
In 1985, Lauda said it well when he stated: “It has always been my impression that only through the study of history can we understand the true meaning of our discipline” (p. 3). Taken in context, Lauda’s words were in reference to the study of technology. Similarly, though, only through the study of history is it possible to understand the true meaning of the profession technology education.

This study has intended to serve the purpose of synthesizing and organizing a portion of the information available from vast resources that exist on the subject, including a wealth of human resources. Current members of the profession should all consider themselves resources with a wide variety of experiences and opinions. Unless, through studying and teaching the history of the profession, educators impart a thorough understanding of the transition to technology education to those who are newly entering the profession, the education of future technology teachers will be merely a process of indoctrination.

The transition from industrial arts to technology education is still incomplete and there remains to be a significant change in general education as has been called for in recent decades. All students in the United States need to be provided with opportunities that enable them to become technologically literate. Presently, there have been many approaches proposed to meet this end and technology educators must be aware of them, how technology education fits into these schemes, and how technology education has evolved. Only through such awareness and a willingness to adapt to changes will the history of technology education continue to be chronicled.
REFERENCES


American Industrial Arts Association (1966). Minutes of the Executive Board Meeting of April 18, 1966 in San Jose, CA. (From the Association Archives at Millersville University of Pennsylvania).

American Industrial Arts Association (1967). Minutes of the Executive Board Meeting of August 11-13, 1966 in Minneapolis, MN. (From the Association Archives at Millersville University of Pennsylvania).

American Industrial Arts Association (1970). Minutes of the Executive Board Meeting of April 6, 1970. (From the Association Archives at Millersville University of Pennsylvania).


Bacon, F. (1911). The physical and metaphysical works of Lord Bacon, including the Advancement of learning, and Novum Organum. J. Devey (Ed.). London: G. Bell & Sons. (Original work published 1620)


Dennis, E. A. (Ed.) (1978-79). *Industrial Teacher Education Directory*. ACIATE and NAITTE, Department of Industrial Technology, University of Northern Iowa, Cedar Falls, IA.


Dennis, E. A. (Ed.) (1990-91). *Industrial Teacher Education Directory*. CTTE and NAITTE, Department of Industrial Technology, University of Northern Iowa, Cedar Falls, IA.


296


State Committee on Coordination and Development (1934). A Prospectus for Industrial Arts in Ohio. State Committee on Coordination and Development of Industrial Arts Professional Interests in Ohio.


305


VITA

Mark Robert Snyder
513 Wittenberg Court
Normal, IL  61761

Education

Virginia Polytechnic Inst. & State Uni.
Blacksburg, Virginia 24061
Doctor of Education, Voc. & Tech. Education
Degree Completed - July, 1992

Eastern Michigan University
Ypsilanti, Michigan 48197
Master of Arts, Industrial Education
Degree Completed - August, 1985

Millersville University of Pennsylvania
Millersville, Pennsylvania 17551
Bachelor of Science in Education, Industrial Arts
Degree Completed - May, 1984

Distinctions

Participant in National Leadership Institute for
Member - International Technology Ed. Assoc.
History & Archive Committee
Member - Council of Technology Teacher Educators
Member - National Association of Industrial &
Technical Teacher Educators
Member - Epsilon Pi Tau Fraternity
Recipient of Glencoe I.T.E.A. Professional
Development Scholarship (1991)

Publications

Finalist in Photo Contest, Best of College

Teaching Experience

Technology Teacher at the Church Farm School, Paoli, Pennsylvania. Teaching general technology education classes in a private, college preparatory school for boys in grades 7-12. Learning involved a variety of problem-solving activities derived from technology education content organizers. Instrumental in executing the transition of a traditional industrial arts program to technology education.

Graduate Teaching Assistant at Virginia Polytechnic Institute and State University: Two years of experience teaching undergraduate courses in graphic communications. Duties included instruction in offset printing, screen printing, photography, computer-aided publishing and also facility maintenance.

Technology Teacher at Rumson-Fair Haven Regional High School, Rumson, New Jersey. Received tenure during four year experience teaching grades 9-12. Schedule consisted primarily of five sections of drafting and design courses at three levels. Redeveloped curriculum for drafting and design course. Successfully wrote a grant proposal to receive state funding towards a computer-aided drafting/design system. Also coached varsity boys and girls soccer teams.

Graduate Assistant at Eastern Michigan University. Aided instructors and advised students in varied laboratory experiences in industrial education. Duties also included supervising open lab time, machine maintenance and repair, lab maintenance, and assisting E.M.U. staff as requested.

Student Teaching at Holland Park State High School, Queensland, Australia. Eight weeks of lesson planning and presentation to students grades 8-12 in manual art areas of woodworking, metal, and mechanical drawing. Also served at Mount Gravatt State Special School, Queensland, Australia. Six weeks in a school entirely for educable mentally impaired students from primary through secondary levels. Development of psychomotor skills was emphasized in the manual arts lab.

Mark Robert Snyder  7/1/92