Technology Education Curriculum Designs in Michigan Secondary Education

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As changes have occurred over the past decade in the field of technology education, the transition from industrial arts to technology education has brought new curriculum designs and approaches for implementing the new concepts and ways of teaching about technology (Herschbach, 1996). Teachers could change to the new design of technology education, remain with the industrial arts design, or adopt a hybrid curriculum design while still calling the new curriculum technology education (Wicklein, 1997b). These curriculum designs were implemented across the United States.

Technology education programs in Michigan secondary schools have increased over the past decade. The increase can be attributed to changes in the Michigan curriculum framework established by the Michigan Department of Education (1998), innovative secondary education teachers, state technology education organizations, the development of the Standards for Technological Literacy (International Technology Education Association [ITEA], 2000), and the development of university technology education programs (Jennings, Napthen, & Sypniewski, 1997). As technology

Table 1. Predominant Technology Education Curriculum Theories and Designs

Theory	Design	Subdesign	Authors and Dates of Recommendations
Social Efficiency	Academic		DeVore, 1964, 1980 McCrory, 1980 Maley, 1982 Yost, 1988 Zuga, 1988
	Technical	Task Analysis	Selvidge, 1923 Bollinger & Weaver, 1955 Fryklund, 1956, 1970
		Systems Analysis	Towers, Lux, & Ray, 1966 Witherspoon, 1976 Ritz, 1980 Schwerkolt & Spontelli, 1987 Wescott, 1988 Jones, 1988 Bjorklund, 1988 Snyder & Hales, 1981 Savage & Sterry, 1990
		Performance Objectives	Wilber, 1948 Almost all authors have focused on objectives
Human Development	Intellectual Processes		Sarapin & Starkweather, 1981 Maley, 1982 Moss, 1987 Hatch, 1988
	Personal		Maley, 1973 Mentioned by: Sarapin & Starkweather, 1981 Maley, 1982 Moss, 1987
Social Meliorism	Social		Pytik, 1981 Wright, 1988

Note: Adapted from Zuga, 1993, p. 15.

education programs developed in Michigan, each program followed a curriculum design influenced by its school district and region needs. The designs they followed are not generally known to researchers because a state database of curriculum designs was not maintained. This article reports and discusses a study that examined the implementation of technology education curriculum models in Michigan secondary schools (Michigan Department of Education, 1996).

Technology Education Curriculum Designs

The five main curriculum designs in technology education are described by Hansen (1995), Wicklein (1997a), and Zuga (1989, 1993) as academic rationalism, technical curriculum, intellectual processes, social adaptation or reconstruction, and personal relevance (see Table 1).

The academic rationalism curriculum design tends to focus on a body of knowledge, which is grouped into disciplines, subject matter, or broad fields of study. This design is reflected in the way in which curriculum focuses on technology as the basis of content and also focuses on taxonomies of technological concepts, as discussed by DeVore (1964).

The technical curriculum design is based on the analysis of process or performance, using a job and task analysis or the identification and sequencing of a highly structured behavioral outcome approach (Zuga, 1989). This design is very popular in vocational education, industrial education (Allen, 1919; Fryklund, 1956, 1970; Lux, 1979; Selvidge, 1923; Selvidge & Fryklund, 1946), and industrial training curricula.

The intellectual processes design makes development of either cognitive processes such as critical thinking and problem solving or human processes and traits such as creativity and self-confidence the focus of the curriculum, rather than a structured discipline or a sequence of tasks. The primary goal of this design is to increase the student's learning ability through the utilization of problem-solving activities in order to transfer problem-solving abilities to all areas of the curriculum and life (Wicklein, 1997a).

The personal relevance curriculum design centers on the student with a focus on the individual's needs and interests. The primary goal of this design is to put the student in control of the curriculum instead of allowing subject matter specialists to dictate the curriculum for the student (Maley, 1972; Zuga, 1989).

The social curriculum design focuses on the application of knowledge in realistic or real world situations. This design includes two distinct and opposing views: the adaptation side to social curriculum and the reconstruction side. The social adaptation side of the design comes from the work of Bobbitt (1918), which focuses on preparing students to fill specific occupational roles in society. The social reconstruction end of the design focuses on the way in which the future of society can be changed as a result of the educational activities of current students (Zuga, 1992). The technology education curriculum tends to follow the social reconstruction design to the extent that it tries to incorporate the works of Dewey (1916) and Counts (1932) as well as the works of Apple (1979, 1990), Anyon (1980), and Pinar (1981).

Primary Curriculum Theories

Although the previous five designs are considered to be the primary curriculum designs in the technology education field, these curriculum designs can be simplified into three curriculum theories offered by Kliebard (1985), which are relevant to this discussion (Zuga, 1993). These are the social efficiency theory, the human development theory, and the social meliorism theory (see Table 1).

The social efficiency theory consists of two primary thrusts, namely, the academic thrust and the vocational thrust. Although the academic rationalism and vocationalism thrusts tend to be split as a result of the ongoing influence of Greek philosophy, they can be united through the concept that "the goal of education and curriculum is to reproduce, efficiently, the existing culture" (Zuga, 1993, p. 10). As Zuga (1993) stated, much of the technology education curriculum theory and design discussions are in this area.

As for the human development theory, it has been a part of curriculum circles since the late 18th century. Some major works in this movement include Dewey's (1916) *Democracy and Education,* Rousseau's (1979) *Emile,* and Herbart's (1914) *Herbart's ABC of Sense Perception and Minor Pedagogical Works.* The human development theory is based on the creation of a curriculum from the ways in which children normally develop (Kliebard, 1985). The focus of this curriculum paradigm is on higher-order thinking skills and problem solving. It is believed that "learning to solve problems and investigating topics and problems of personal interest are the keys to a successful education" (Zuga, 1993, p. 12). This paradigm rejects the social efficiency theory of filling empty heads and molding raw material. The technology education intellectual processes and personal relevance curriculum designs are included in this theory (Zuga, 1993).

The social meliorism curriculum theory focuses on the changing of the existing society (Kliebard, 1985). The social meliorism theory implies that "society needs to be changed and students should plan and implement ways in which to change it" (Zuga, 1993, p. 13). The concept of social meliorism began almost 70 years ago with the social reconstruction philosophies of John Dewey (Bode, 1933; Counts, 1932; Dewey & Childs, 1933) and is active today with the work of curriculum theorists such as Apple (1979, 1993, 1995) and Pinar (1981). The technology education social adaptation and reconstruction curriculum designs fit into this theory (Zuga, 1993).

Lack of Consensus in Technology Education

Over the past 40 years, the technology education field has been evolving out of an industrial arts background (Lux, 1981). During this evolution, the implementation of a technology education curriculum in technology education programs has varied greatly. At one end of the spectrum, programs have completely thrown out the old industrial arts influences of the past and adapted state-of-the-art laboratories and technologies (Neden, 1990). At the other end of the spectrum, programs have merely changed their name without changing any of the curriculum or facilities, focusing on a hybrid of industrial arts curriculum laced with technology education ideas (Oaks, 1989).

Because of the wide variety of programs that existed in the United States, the call for national standards in technology education increased, resulting in the Standards for Technological Literacy (ITEA, 2000). Although national standards in technology education have been established, technology education programs in Michigan remain diverse in relationship to one another with respect to their curriculum designs. Because of the continued inconsistency among technology education programs, there was a need to understand the diversity of technology education programs in Michigan secondary schools and the curriculum design that each school embraced.

Purpose

The school districts in Michigan enjoy relative curriculum autonomy granted to them by the state constitution. Although the districts are encouraged to follow state benchmarks and goals, each district can decide the curriculum designs it wishes to follow. The purpose of this study was to learn the types of technology education curriculum designs that exist in the public secondary schools within Michigan and to what extent the designs varied among programs. Knowledge of the types of technology education curriculum designs implemented in schools throughout the state of Michigan would help to show a need for an increase in federal and state funding to all Michigan technology education programs.

What We Did and How We Did It

To obtain information regarding the technology education programs in Michigan secondary schools, the best design was determined to be a survey research design.

All certified secondary technology education teachers in the state of Michigan were targeted. They were certified to teach technology education or industrial education in Grades 7 to 12 during the 1999–2000 school year. At the time of the study, 865 certified teachers in Michigan were teaching in a program related to their certification. We were careful to prevent teachers from duplicating the survey.

All 865 certified technology education or industrial education teachers in the state of Michigan were eligible to take part in the study. Since the demographics in Michigan were quite varied, a stratified random sample technique was used to select the sample, based primarily on population density. Since the population of eligible persons was less than 1,000, 33.3% of each demographic population of certified individuals was selected to participate in the survey, resulting in 260 randomly selected people.

We adapted an instrument from a study performed by Engstrom (2000). The major emphasis of the instrument was to obtain information from the participants regarding their current curriculum. Some of the demographic questions related to gender and age were removed, leaving the majority of the instrument untouched. The coefficient alpha internal reliability coefficient for this instrument was .83, similar to the reliability coefficient reported by Engstrom.The Technology Education Component Rating Matrix (TECRM) survey instrument developed by Engstrom focused on determining the components necessary in a technology education program versus an industrial arts program. This survey asked people to respond to activities categorized as industrial arts or technology education in nature. Engstrom determined the categories through research and a review of available literature. Engstrom's survey questions, or components, relating to each category were determined by a review of literature and by panel review.

This study did not cover detailed information within each program. Only people certified in technology education or industrial arts in the state of Michigan were selected to participate in the study. Also, the study was not meant to influence teachers to change their technology education program curricula to follow a specific curriculum. Confidentiality was ensured through a coding system.

The survey instrument, along with instructions for completing and returning it, was mailed to 260 participants during the second week in May 2000, with a second mailing distributed the first week of June 2000. Ten blank surveys were returned due to address changes, resulting in a modified sample size of 250. One hundred and fourteen surveys, or 45.6%, were completed and returned. Of the surveys returned, 5 were unusable due to respondents not completing large portions of the survey. This resulted in 109 usable surveys. Nonresponse correction was performed on 22, or 15%, of the nonrespondents.

What We Learned

The data obtained through the instrument were analyzed using SPSS version 9.0 computer software. To summarize the findings of the study, it appears there was an elevated emphasis on technology education and problem solving and the integration of mathematics, science, and technology education, with 71.0% of the respondents indicating they offered a technology education program. One aspect of the data that was somewhat enlightening was the fact that woodworking laboratories were indicated as the most prevalent laboratories used in the field, at 67.9%. This may indicate that industrial arts and industrial technology curriculum designs remain popular in Michigan schools.

The nondemographic information gathered from the survey was converted into numerical data via an interval scale. Therefore, a multidimensional chi-square was performed using SPSS version 9.0 to compare teacher responses to the questions on the questionnaire to test our hypotheses. The software was also used to correlate question responses to curriculum theories and designs and to crosswalk responses back to industrial arts and technology education activity categories. The alpha levels were set at .05 and .01 for this study.

Data Related to Curriculum Design

The research questions were revisited to help in the direction of the analysis. Question 2: Are technology education curriculum designs implemented differently at the secondary school level in the state of Michigan? In order to answer the question, the survey questions needed to be related to the various curriculum designs indicated by Zuga (1993). This was completed with the assistance of professionals in the field of technology education, who reviewed the questions and helped to relate them to the five general curriculum designs.

Question 1: What different curriculum designs for secondary technology education exist within Michigan schools? The data indicated that all five technology education curriculum designs existed in Michigan secondary education schools.

When the responses to the questions were reviewed, the academic, technical, personal, and social curriculum designs had a higher rating for technology education related questions than for industrial arts related questions. The intellectual processes curriculum design was rated slightly higher for industrial arts related components. A possible explanation for industrial arts related components being rated higher than technology education components could be that technology education teachers may have confused industrial arts intellectual components as being related to technology education.

Component Ratings

As determined by Engstrom (2000) through a review of literature, there are four levels for rating a component: (a) *irrelevant* component rated less than 2.5 on a scale of 1 to 4, (b) *desirable* component rated from 2.5 to 3.25, (c) *more* desirable component rated from 3.25 to 3.49, and (d) *essential* component rated from 3.5 to 4.0.

Of the four items rated as *essential* (3.5 or higher), three were from the technology education category (safely use tools and machines, select proper tools and materials appropriately, and receive formative and summative feedback from teacher) and one was from the industrial arts category (use drawings for illustration and construction purposes). Eleven components were identified as *more desirable*. Eight components were related to technology education (e.g., design a solution to the problem, build a solution to the problem, and test and evaluate the solution) and three were related to industrial arts (acquire some degree of dexterity when working with tools, appreciate good design, and develop hand-eye coordination).

Thirty-five components were identified as *desirable* by the respondents. Twenty-one were related to technology education (e.g., use the same principles as a technologist to solve problem, solve a problem that has a practical solution, and integrate information from other academic studies), and 14 were related to industrial arts (e.g., develop an appreciation for good craftsmanship, build a project that is based on student interest, and identify common hand tools). Two of the components were rated as *irrelevant* by the respondents, both of which were related to industrial arts (make something that is useful around the home and make plans for a home workshop).

When looking at the ratings of the components, 32 (61.5%) were rated as *essential, most desirable,* or *desirable* related to technology education, whereas 18 (34.6%) were rated as *essential, most desirable,* or *desirable* for industrial arts. The two components rated *irrelevant* were related to industrial arts. These ratings indicate a significant difference between the number of components related to technology education compared to industrial arts. This shows a definite difference in the curriculum designs being used in secondary technology education programs. More information was obtained related to this difference in the analysis of the hypotheses.

Revisiting Our Hypotheses

The null hypothesis indicated that there was no significant difference in the implementation of technology education curriculum designs among secondary schools within the state of Michigan. The alternative hypothesis indicated that there was a significant difference in the implementation of technology education curriculum designs among secondary schools within the state of Michigan. When performing a chi-squared analysis of the data as related to the five designs referenced above using ∂^2 = .01, there appeared to be a significant difference between the designs according to the data, with ∂^2 = 6.635 and 1 degree of freedom. Therefore, the null hypothesis was rejected. A significant difference existed between curriculum designs among secondary schools in Michigan. The *essential* ratings of the data supported the alternative hypothesis for the academic (∂^2 = 12.41), intellectual processes (∂^2 = 24.23), and social (∂^2 = 19.75) curriculum designs. The *more desirable* ratings supported the alternative hypothesis for the technical (∂^2 = 14.31) curriculum design. The *desirable* ratings of the data supported the intellectual processes (∂^2 = 26.56) and social (∂^2 = 13.75) curriculum designs. The *irrelevant* ratings supported the technical (∂^2 = 32.22) and intellectual processes (∂^2 = 21.79) curriculum designs.

According to the data, there appears to be a significant difference regarding the curriculum designs being used among technology education programs in Michigan. Some programs follow the newer technology education design while others continue to follow the industrial arts mode. There is a significant difference in the types of curriculum designs being used among secondary schools in Michigan, supporting the alternative hypothesis.

What It Means

The initial review of literature suggests that technology education curriculum designs are being implemented in technology education programs across the United States and in Michigan. However, the types of curriculum designs being followed in Michigan secondary schools were not known.

With the completion of the national standards for technology education (ITEA, 2000) and the need of state funding for technology education programs, information was needed regarding the curriculum design that each technology education program endorsed. The certified technology education teacher respondents in Michigan told us that there was a significant difference in the types of curriculum designs being used among secondary schools in Michigan, supporting our alternative hypothesis, that there was a significant difference in the implementation of technology education curriculum designs among secondary schools within the state of Michigan.

The most common curriculum designs being used in secondary technology education programs in Michigan were the intellectual processes and personal designs. The intellectual processes curriculum design supports the use of problem solving in the curriculum and focuses on traits such as creativity and self-confidence. The personal curriculum design focuses on the student's individual needs and interests. Both of these designs are used extensively in current technology education curricula.

The technical and academic curriculum designs were less prominent, indicating less emphasis on technical knowledge and taxonomies of technological content within secondary technology education programs in Michigan. The social curriculum design was rated the lowest, showing a lack of interest in social adaptation and education reform.

Another issue that became apparent from the data is the fact that most of the teachers in the field are nearing retirement. Over half of all the teachers in the field have more than 20 years of service in Michigan. This hints toward an increase in the demand for technology education teachers in the near future.

It was hoped that this study would help to show if there is a shift occurring in technology education secondary programs within Michigan. From the observed data, this shift has been a migration from the industrial arts curriculum design to the contemporary technology education curriculum design.

Although it was not the initial focus of this study, the issue regarding reasons for variability among technology education programs has become evident. Some of the demographics data related to responses to the ratings data indicate a possible link to regional vocational or economic needs. For example, 29% of respondents said their program had a career emphasis, followed closely by 27% who said they focused on design and problem-solving skills.

The variability among programs can also be attributed to the fact that Michigan certifies teachers for technology education and industrial arts or industrial technology programs. In the more rural and agricultural areas of Michigan, school districts tend to promote industrial arts or industrial technology programs, as indicated by the data. Technology education programs were more prominent in urban and suburban areas of Michigan. This indicates a desire for both industrial arts or industrial technology programs and technology education programs in Michigan. In order to discuss this phenomenon in further detail, a more in-depth study would need to be performed.

As technology education professionals in other parts of the United States, may we ask that you consider replicating a study similar to this one in your state or region. Although this study cannot be generalized beyond the target population within Michigan, the significance of the study indicates the possibility that other states and regions may have similar characteristics to Michigan technology education secondary curriculum designs. The time is ripe to learn more about the development of technology education throughout the country as we move forward with the incorporation of the national technology education standards into the K–12 and postsecondary education curricula.

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