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Integrating the Study of Technology into the Curriculum: A Consulting Teacher Model

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Over the past 40 years there have been several initiatives by leaders in the profession to make revolutionary changes in philosophy, curriculum, methods, and facilities in the transition from industrial arts to technology education. The transition to technology education has been grounded in the dramatic changes that technology and technological innovations have brought to all aspects of society. It has been postulated that to fully participate in a technologically-based society, people must be technologically literate (Pearson & Young, 2002). Thus, the need arose to assure that all students have experience in technology education in order to acquire technological literacy.

The goal of technological literacy has general acceptance in the profession, however no consistent plan has emerged for organizing and teaching technology education across states and school districts. The debate continues concerning which curriculum theory, or organizing pattern, "best" fits technology education (Zuga, 1989; Herschbach, 1992). The result has been a diverse array of plans and models for the delivery of technology education in K-12 education. The result, as indicated by Wright (1995) in a CTTE Yearbook chapter entitled "Technology Education Curriculum Development Efforts," has been a diverse array of plans and models for the delivery of technology education in K-12 education.

While there are many of models for technology education, organizing technology education as separate and distinct courses is the most common approach at the middle and high school levels. The distinct course, or separate subject, approach is grounded in academic rationalism that identifies technology education as an academic discipline (DeVore, 1965; Erekson, 1992; Zuga, 1989). Likewise, a major purpose for the Technology for All Americans Project was to establish technology education as a core subject in the curriculum (Satchwell and Dugger, 1996).

While there are many examples of successful technology education programs that are grounded in the separate subject approach, it may take decades for technology education to gain acceptance as a new academic discipline, if it is

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possible at all (Erekson, 1992). Furthermore, Custer (2000) questions whether the profession should seek disciplinary status:

> At a time when technology educators are working hard to position the field as a new academic discipline, the questions must be asked, "Do schools need yet one more academic discipline?" or "Would students be better served if technology education was to serve as the mechanism and catalyst for blurring the boundaries among the disciplines?" (pp. 127-128)

Must the profession pursue disciplinary status or are there other educational strategies that will achieve the educational goal of technological literacy for students and co-equal status for technology teachers? Should technology education become a "catalyst for blurring the boundaries among the disciplines?" The purpose for this article is to present an alternative approach for the delivery of technological literacy education utilizing an integrative model.

An Integrative Discipline

Technology, by its very nature, touches all facets of society. It can be considered a universal that permeates culture. Gagel (1997) supported this notion, that is "there is a dimension of technology, like literacy, that is culturally universal . . the ubiquitous occurrence of technology (like language) in human cultures." (p. 20). The universal, society-permeating nature of technology makes it very difficult to focus and organize technology education curriculum. Likewise, Wiens (1995) noted that "technology cannot be studied in isolation. Technology is a social process that occurs within a social, environmental, economic, and political milieu" (p. 130).

Technology, being ubiquitous, offers a robust opportunity for connections with all areas of study in the schools. Many have suggested that technology education is, by nature, interdisciplinary (Erekson & Johnson, 1989; Herschbach, 1995; Loepp, 1991; McHaney & Barnhardt, 1989; Welty, 1989). Liao (1998) stated that "[s]ince technology education includes the study of how technology works and is designed and how it interacts with other societal systems, only an interdisciplinary approach to its study is appropriate." (p. 52). He further noted that "one of the unique features of technology studies is that it is an integrative discipline" (p. 53).

Has the time come for technology education to establish its position in the educational community by exploiting its integrative uniqueness? Hershbach (1996) noted that technology education has the potential to "fully integrate interrelated fields of study." This shows promise for our profession and for the overall improvement of education in technologically-based societies. Integrating the subjects in schools to provide a sense of connectedness is grounded in "contemporary research on cognitive theory" and many educators "have come to realize the limitations of teaching in relative isolation" (LaPorte & Sanders, 1995, p. 195). Palmer also supports the contention that curriculum integration can improve the effectiveness of education.

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> We have long known that making connections between and among the disciplines provides the setting for increased understanding, retention, and application . . (Palmer, 1995, p. 55)

Models for Curriculum Integration

An array of models for curriculum integration have been developed and tried. Loepp (1991), citing Dossey, identified five basic formats for curriculum integration. The five formats include:

1. The simultaneous model – students taking courses in different disciplines with the teachers "deliberately" making "ties between the content of the courses."
2. The braided model – content from various disciplines viewed as strands to be visited on some type of "cyclical pattern to develop a spirally organized curriculum."
3. The topical model – a curriculum that focuses on a topic, or theme, throughout the year, or a major portion thereof, across multiple subjects.
4. The unified model – teachers from two or more disciplines working together to "identify a set of unifying ideas," often implemented with team-teaching techniques.
5. The full interdisciplinary model – the merging of the content from two or more disciplines. (p. 3)

In technology education there are several examples of the above listed formats for curriculum integration. For example, Maley (1989) worked with teams of math, science, and technology teachers in curriculum development that coincides with the simultaneous model. McHaney and Barnhardt (1989) promoted the central project model with a student space station simulation that is an excellent example of the topical or thematic model.

While perspectives of the effectiveness of the five models are somewhat subjective, the authors suggest that the full interdisciplinary model, in which the content from two or more disciplines are merged, has the potential to be very effective in technology education. While this model appears to show promise, it also appears to be the most elusive.

The National Standards and Curriculum Integration

A major purpose for Technology for All Americans project was to establish technology education as a core subject in the curriculum (Satchwell and Dugger, 1996). From within the profession the perspective of establishing standards is one that supports the separate subject, or unique discipline approach. Influence from key constituencies outside of the profession, however, broadened the focus of the national standards. William A. Wulf, president of the National Academy of Engineering (NAE), was an active participant in the development of the standards. He noted the broadening as follows:

> One question that emerged early in the NAE's involvement in the standards project was whether the standards were meant to serve the professional

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> interests of technology educators or the more general goal of technological literacy. That is, were they principally to provide a framework for improving and expanding the reach of formal technology education courses, or were they instead to provide a vision for incorporating the study of technology across the curriculum?
>
> It is my sense that the early drafts were focused on the former objective. In contrast, the views of the NAE committee, and later, of the NRC committee, were that the broader goal should predominate. It is again to the credit of the leadership at ITEA and of staff at TfAAP that the standards evolved to favor the broader goal over the narrower one. (Wulf, 2000, p. 12)

Barriers to Curriculum Integration

If curriculum integration and interdisciplinary efforts have the potential to dramatically improve education, why has implementation lagged? Loepp (1991) identifies several barriers to curriculum integration.

> The barriers to curriculum integration are readily apparent. Turfism runs rampant throughout the educational enterprise. Teachers trained to teach a discipline become threatened when others impinge on their subject area. They also tend to feel inadequate when asked to stray from their traditional subjects. Also, teachers in elementary and secondary schools are loaded with day-to-day responsibilities and have little time to reflect on curriculum – let alone integration. Further, most readily available curriculum materials are discipline-specific and only casually refer to content from other disciplines. For many years, schools have been organized around various disciplines. Additionally, high school graduation requirements and entrance requirements to higher education institutions are discipline-specific. (Loepp, 1991, p. 4).

The barriers to curriculum integration identified by Loepp exacerbate attempts at full integration. Turfism, discipline envy, inadequacy, time constraints, lack of integrated curriculum materials, school structure, and college admission requirements are real barriers to full curriculum integration. In addition, high stakes testing is another very real barrier to curriculum integration as a study of elementary teachers involved in high stakes testing found a narrowing of the curriculum, more time spent on test review, and less time spent on instruction (Hoepfl, 2001). Can a full integration model be developed that addresses and overcomes these barriers? If this is possible, can technology education professionals exploit the integrative nature of technology and provide leadership for such an effort? Are technology teachers (and supervisors and teacher educators) willing to try something different to make full integration happen?

Custer (2000) noted that, while showing great promise, curriculum integration has not materialized to any great extent:

> Educational delivery systems tend to artificially carve schooling up into academic disciplines, separated from authentic contexts. While integration, authentic learning, and contextualized education have become popular in recent years, the reality is that little progress has been made in integrating the curriculum. (p. 127)

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People view new stimuli (things) through the lens of their past experiences. The authors, with backgrounds in both technology education and in special education, have a perspective of curriculum integration that is influenced by models designed to educate exceptional children. It is the authors' belief that full curriculum integration can be achieved, exploiting the ubiquitous nature of technology, through a model that is similar to the special education model of the consulting teacher/resource room approach. The following sections provide a brief description of the special education consulting teacher/resource room approach followed by a discussion of how this model could work to fully integrate technology into the curriculum.

A Consulting Teacher Approach

The area of special education has gained standing in the schools without trying to become an academic discipline. Furthermore, special educators have used an array of service alternatives to teach exceptional students and to integrate them into the regular classroom to the extent possible. Hallahan and Kauffman (1997, p. 16) describe the special education service alternatives in which the exceptional student is most physically integrated into the regular classroom as:

Regular class only
Regular teacher meets all the needs of student; student may or may not be officially identified or labeled; student totally integrated

Special Educator Consultation
Regular teacher meets all needs of student with only occasional help from special education consultant(s); student may not be officially identified or labeled; student totally integrated

Itinerant Teacher
Regular teacher provides most or all instruction; special teacher provides intermittent instruction of student and/or consultation with regular teacher; student integrated except for brief instructional sessions

Resource Teacher
Regular teacher provides most instruction; special teacher provides instruction part of school day and advises regular teacher; student integrated most of school day

The models above present strategies for integrating the exceptional student into the regular classroom. One of the goals of these strategies is to have the regular classroom teacher assume the responsibility for teaching the exceptional student. The undergirding belief is that education of exceptional students in the regular classroom is more enriching than education in a segregated classroom.

The notion that special education teachers should provide consultation to regular teachers became popularized in the 1970's and 1980's. Recently, however, the approach of collaborative consultation has been advocated in

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special education. According to Hallahan and Kauffman (1997) the special education teacher and the general education teacher "assume equal responsibility for the student with disabilities" (p. 67). They further note that "[r]esearch suggests that collaborative consultation is a promising approach to meeting the needs of many students with disabilities in general education settings" (p. 67).

Consultation in Technology Education

Can, or should, technology education implement a special education-like model of integration that utilizes the concept of collaborative consultation and resource rooms? Does such a model show promise for increasing technological literacy? It is the thesis of the authors that not only will collaborative consultation work in delivering technology education, but it will enhance the students' understanding of technology by grounding it in the context of the various school subjects. At the same time, using this model will enhance the various subjects by providing an authentic context for learning.

How might the collaborative consulting model work in delivering technology education? In a technology education collaborative consultation model the goal would be to integrate technology into the general curriculum such that it permeates *every* school subject at all levels K-12. Palmer (1995) noted that "to be effective, integration must be both vertical and horizontal – that is, across content areas and between grade levels" (p. 58). In this model, the technology teacher will fulfill the role of a consultant who helps teachers integrate technology education content and activities into the regular curriculum, in effect, facilitating such instruction in the context of traditional subjects. Welty (1989) noted how this might work:

> . . . since technology touches almost every aspect of life, it can be used to bridge the gap between abstract concepts and concrete life-experiences. When the study of technology is integrated into the curriculum, numbers in mathematics have identities, messages composed in English class are transmitted beyond the classroom, and the laws of nature discovered in science are applied to problems in the real world. When the skills and concepts introduced in academic subjects are applied to problems in everyday life and the world of work, the curriculum intrinsically enters the realm of technology.(p.21)

Wulf (2000) supported this notion and provides a perspective in which the implementation of the new Standards for Technological Literacy is accomplished through an array of teachers. He noted:

> As the standards make clear, the goal of technological literacy requires that the content for the study of technology be delivered by a wide array of teachers – in math, science, language arts, social studies, art, history, to name some of the most obvious subject areas. Mostly, and especially in the elementary grades, this content will not be presented in stand-alone courses. Rather it will need to be infused in the lessons, lectures, and instructional materials already in place. (p. 12)

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Collaborative consulting technology teachers can make a major impact by helping regular teachers integrate technology into the context of the disciplines. In such situations the technology teacher can help the regular teacher change the esoteric nature of education in the various subjects, rendering it more exciting and meaningful to students.

This approach would be similar to the way specialist teachers are used in elementary schools. Sanders (1996) noted that "[t]echnology teachers might be employed in the elementary schools the same way that art, music, and physical education teachers are currently utilized." (p. 4). This approach provides regular classroom teachers in elementary schools who are supplemented with specialist teachers who provide instruction in specialized areas like music and art. Of course, the authors propose that this model not be limited to elementary schools. Rather, it should be implemented K-12.

The collaborative consulting technology teacher model could address several of the barriers, real or perceived, to curriculum integration. For example, time constraints could be reduced or eliminated since the "time" for the technology teacher would be totally dedicated to curriculum integration (the technology teacher would not be responsible for teaching separate technology education classes). However, time could be a factor if the consulting/collaboration load is too heavy. By eliminating separate technology courses, discipline envy and "turfism" could be eliminated, or at least minimized. With supportive consulting by the technology teacher, feelings of inadequacy that regular teachers may have when asked to enhance the curriculum with technology education can be negated.

Technology Education Examples

The closest example of the collaborative consulting technology teacher model was found in a rural Wyoming school district (Wright and Miller, 1997). In this situation, technology education was integrated at each grade level K-12. The technology lab was, in many respects, used as a resource room in which classes could come for hands-on activities in support of the concepts being taught in the regular classes. Often the elementary students were in the technology lab at the same time as high school students, further evidence of its use as a technology resource room for all students. The technology teacher provided support and consultation to the regular teachers. Additional technology curriculum and activities were developed by the technology teacher for use in regular classrooms. Thus, technology education was not limited to the technology lab. Rather, technology permeated the K-12 curriculum. It should be noted that in this school separate technology education courses were offered at the middle and high school levels. Continuing to offer a few separate courses may be needed in the transition to the resource lab/consulting teacher technology education model. However, the authors suggest that there is no need for separate technology courses at the middle and high school levels.

Another example of the resource room model was found at Spanish Fork Junior High School (personal communication, November 12, 2002). The school

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included grade levels 7, 8, and 9. In this situation the technology teacher made the communication technology lab available to the math and English teachers in the school. These teachers would bring classes of 7th or 8th graders to the communications technology lab for instruction in English or math with learning activities that made use of the technological devices in the lab. The technology teacher used his 9th grade communication technology students as peer teachers and teacher's aides in supporting the math and English instructional hands on activities.

A third example of the resource room model was found at Hemmingway Elementary School in Ketchum, Idaho (Thode and Thode, 1997). In this setting there is a technology education teacher, Terry Thode, who operated a technology resource room available to all classes in the school. The technology teacher operates like other specialist teachers at the elementary level (e.g., art, music) in providing a specialized lab and hands-on instruction for elementary students. Terry Thode gained national recognition as an innovative technology teacher who delivers technology education to elementary students using a technology education resource room approach.

Collaborative Consulting Technology Teachers

Glen (1994) noted that collaborative consulting special education teachers have more responsibility than regular teachers and that effective consulting teachers have developed specific skills in consultation. Likewise, collaborative consulting technology teachers will be educational leaders who will have more responsibility than regular teachers. In effect they will become classroom/laboratory supervisors who work with teams of specialists. The competencies and roles of the technology teacher will be similar to those described by Stadt and Kenneke (1970) in their monograph, *Teacher Competencies for the Cybernated Age*. This approach will "require a more mature teacher than has heretofore been graduated" (Stadt and Kenneke, 1970, p. 26). Leadership, the ability to arrange and balance activities of an educational team, the fundamentals of human relations, the ability to delegate, knowledge of instructional software and hardware, superb communication skills, and the ability to work in teams are attributes that Stadt and Kenneke (1970) identified as critical to the success of future technology teachers. Collaborative consulting technology teachers will also need these attributes. Inservice technology teachers will likely need targeted professional development in collaboration, and technology teacher educators should consider including these attributes in preservice teacher education programs.

Wulf (2000) supported the notion of the technology teacher filling a different role in implementing the National Standards for Technological Literacy. He believes that the new standards will expand the influence of the technology teacher. He sees technology teachers as "resident experts" who will be "called on to advise schools and school districts" that are trying to meet the goals of technological literacy (p. 12). He further delineated the future roles for technology teachers as:

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> They [technology teachers] will be expected not only to be teachers of students, but also teachers of other teachers – of their colleagues who must deliver technology content but who have little or no technical background. They will undoubtedly play other important roles. (p. 12)

Wilber (1990) reported that special education resource room teachers indicated a need for teacher trainers to provide direct instruction of specific consultation skills to better prepare them for the consulting roles. Likewise, technology teacher educators would need to design and deliver programs that develop specific skills in collaborative consulting. This will require new approaches to technology teacher education, including direct, purposeful experiences in collaboration and consultation.

Comparative Analysis

If the consulting collaborative model works in special education, will it work in technology education? Will the collaborative consulting technology teacher model as presented herein actually be implemented in the public schools? What types of educational policies, and funds, will be required to implement this model?

It must be noted that special education is implemented in public schools because of state and federal laws, and court decisions, which mandate a free, appropriate education for all individuals with disabilities in the least restrictive environment, the regular classroom where practicable (Hallahan & Kaufman, 1997). Having law and court rulings that support a collaborative consulting model has the effect of forcing it to happen in special education. In addition, special education receives significant federal and state funding, providing resources to cover the costs for the range of educational services to special students, including consulting special education teachers.

It should be noted, however, that prior to the enactment of special education laws, some school districts saw the need for special education programs and these districts funded such programs from local revenues (Hallahan & Kaufman, 1997). These early efforts were often at the request of parents of disabled students. Parents of the disabled historically have been activists in seeking specialized education legislation and funding for their children.

Unlike special education, technology education currently does not have the power of federal and state laws, and court decisions, which mandate that all students must be educated to become technologically literate. In addition, technology education is not included as part of state and national testing programs like reading, mathematics, and science, nor is technology education considered a part of college preparatory education (Erekson & Shumway, 2002). As such, technology education does *not* carry with it the mandates, or the resources to cover the costs, for collaborative consulting technology teachers.

Furthermore, the collaborative consulting technology teacher model will likely be viewed as duplication of effort by school administrators as has been the case with specialist teachers at the elementary level (e.g., art, music) when budget challenges arise. Elementary specialist teachers are often viewed as

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something nice to do when you have the resources, but in times of funding shortages they are generally the first to be cut with their responsibilities given to the regular elementary teachers.

It appears that the collaborative consulting model is teacher specific. That is, its success depends heavily on the capabilities and dynamics of the teacher. For example, in two of the technology education collaborative efforts cited above (e.g., Ten Sleep, Wyoming and Spanish Fork, Utah), when the teacher left the school and administrators changed, the collaborative technology education classes were discontinued.

In some states federal Perkins funds for career and technical education are used to improve (fund) technology education programs, and most of the technology education state supervisors are housed in the career and technical education units. Traditional career and technical education administrators may perceive the collaborative consulting technology teacher model as a program improvement, however this is unlikely as it will be difficult to assess the impact of the model.

Faced with no legislative mandates or targeted funding, it is unlikely that the collaborative consulting technology teacher approach will have any wide spread acceptance. However, there may be some instances where school districts, based on their commitment to teaching technological literacy, will use local revenues to fund the collaborative consulting technology teacher model.

End Note

Proposing a model to deliver technology education that eliminates specific courses and has the effect of making the role of the technology teacher transparent will not be popular in the profession. The profession has gone to great efforts to establish technology as a discipline with its unique content and methods. These efforts have brought some change, but the goal of universal technological literacy continues to evade us. Can this goal be achieved with the current direction? Maybe, given time and effort. With a new paradigm of curriculum integration in which the technology teacher becomes a collaborative consultant or "resident expert" who manages a technology resource room (lab), can the goal of technological literacy be achieved sooner? Maybe. At this point the profession needs innovators who are willing to further develop and test the collaborative consulting model in technology education.

Custer (2000) noted a unique opportunity for the profession with curriculum integration:

> If the technology education profession is successful with an integration agenda, we could well find ourselves at the core of education in the 21st century. But integrated learning environments will be very different. The risks and demands will be considerable. (p. 130)

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