Technology in Secondary Career and Technical Education: Issues for the New Millennium

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Abstract

Today, school districts continually struggle with the following questions pertaining to career and technical education programs: How does career and technical education fit the secondary curriculum? What is the magic mixture of knowledge, skills, and attitudes needed to ensure that American students have the competitive edge in the workplace? How should school districts train teachers of career and technical education to teach in the information age? How will the efficacy of technology implementation in career and technical education be measured? What trends should drive changes in career and technical education?

As we move deeper into the information age, we must seek to resolve these issues. This article addresses each of these concerns by exploring the use of technology in the secondary career and technical education classroom.

Introduction

Since the early 1990s, school districts across the United States have developed and implemented technology plans to address the educational needs as identified in the report What Work Requires of Schools: A SCANS Report for America 2000 (Secretary's Commission on Achieving Necessary Skills, 1991). This report identified specific foundational skills and competencies deemed essential to the future of the American workforce and society. The underlying impetus for the SCANS report

stemmed from the advent of the global economy; if the United States is to remain at the forefront in this high-tech, global marketplace, the workforce must possess the requisite technological competencies and academic skills. Consequently, career and technical education programs have become a major facet of this technology-based educational philosophy.

O’Neil (1995) has suggested that, with the advent of technology, the curriculum must be rigorous and relevant to our technology-based society. O’Neil (1995) further suggested that unskilled and low-skilled jobs are rapidly disappearing.

With such an emphasis on technology as a prerequisite for success in today’s competitive job market, it is only logical that technology be infused in the secondary curriculum. This requires that the curriculum become more application based. Where does this fit? The applied or practical approach is common in the career and technical education curriculum. Consequently, learning environments will be technology-driven, and technology will eventually be integrated into teaching methodologies (Gaines et al., 1996).

Unfortunately, many career and technical education programs have been perceived as the educational avenue for lower-level students and students with known discipline problems. This may have been true in the distant past; however, today’s career and technical education programs combine the best components of vocational and academic elements. Most career and technical education curricula require the application of higher-order thinking skills, development of interpersonal skills, combination of theory and application, and technology (Gaines et al., 1996).

Typically, states develop their own curricula for career and technical education. The Texas Essential Knowledge and Skills (TEKS) is a broad framework of concepts and skills the students must know and be able to do at the end of each course of study (Texas Education Agency, 1998d). As an example, the state of Texas defines career and technology (career and technical) education as follows:

[It is] a comprehensive experience-based educational program that allows students to investigate and experience the means by which humans meet their needs and wants, solve problems, and extend their capabilities. It is concerned with the knowledge and skills to develop, produce, and use products or services, and how to assess the impacts these activities have on humans and the world. (Texas Education Agency, 1998a)
The Texas curriculum integrates technology into the academic and career and technical education curriculum, thus providing students with learning opportunities that mirror life and the occupational experiences of the real world. This plan was designed to enable students to develop critical thinking and analytical skills. In doing so, students will acquire a strong structure of foundation skills, which will place them well on the path to being technologically literate and prepared for a lifetime of learning (Texas Education Agency, 1998c).

For technology application to be relevant, a commitment must be made to provide state-of-the-art technology in the classroom. This should also include provisions for teacher training and professional development. Because future learning environments will be technology-driven, technology will be integrated into basic teaching methodologies (Texas Education Agency, 1998c).

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**Technology**

Before beginning this discussion of technology in the secondary career and technical education, technology should be defined. “For education or training, technology can be defined as the utilization of theory, processes, information, and materials to improve the knowledge, skills, and attitudes of a society” (Wircenski & Allen, 1998, p. 36). This is a very broad definition of technology that not only describes hardware and software, but the teaching and learning theories necessary to improve learner capabilities. Likewise, “Educational technology can be defined as the use of computing, media, and telecommunications technologies in the process of teaching and learning” (Bizzocchi et al., 1998). Educators and technology planners, on a daily basis, necessarily only take a narrow slice of these technology definitions to fight the fires.
An educational technology plan is a living document containing the results of various technology assessments for a given entity such as a school district. This document is developed over a period of time, usually a year, by community and school district stakeholders. An technology plan contains directions and component elements that have been deemed necessary for technology implementation: vision and mission statements, goals, stakeholders, resources, curriculum, etc. (National Center for Technology Planning, 1996). Technology plans continue to gain popularity in school districts as an effective tool for planning long term technology implementation strategies.

**Technology and Students**

The use of technology to meet human needs and extend human capabilities defines the parameters for student interaction. Technology may be used to obtain knowledge. Technology may be used to provide application of the knowledge and skills required in professional fields. Technology may also be used to help students analyze and synthesize information, communicate, interact with others, and produce goods, services, or ideas; however, technology can not be used to replace the content required by the career discipline.

An appropriate balance between technology, basic skills and technical skills needed for a particular career must be maintained. The workplace that students will enter (as a continuing student, an employee, or lifelong learner) will be extremely challenging. The climate will be one of change and uncertainty; the workforce will be more heterogeneous; and employees will assume more responsibility for decisions regarding their performance. Self-management, decision making, and critical thinking skills are and continue to be essential competencies for gainful employment.

The SCANS report identified two essential areas to accommodate these challenges: foundation skills and competencies (Secretary’s Commission, 1991). The foundation skills include basic academic skills, thinking skills, and personal qualities. The competencies include resources, interpersonal skills, information, systems, and technology. The goal is to prepare students so that they enter the workplace with each of these skills and competencies already mastered. Students must be equipped with foundation skills and competencies to ensure success in a technology-based society (Stewart, 1996).

According to Tom Lopp (1996), former AVA president, technology can be the great equalizer among students. The benefits of technology to
students include the assessment of educational resources produced and distributed worldwide, national competition (Snider, 1996), proficiency in basic technological skills, encouragement of lifelong learning, enabling of students to learn by doing, and encouragement of limited English-speaking students and parents to learn English (Lopp, 1996). Technology will change how we view current competency standards; new learning standards will be based on projected outcomes and will therefore be realistic and relevant to today's and the future's needs (Gaines et al., 1996).

The International Society for Technology in Education (ISTE) organization founded the National Educational Technology Standards (NETS), a project designed to provide a venue for the development of national standards for technology applications in educational environments. "Technology foundation standards for students are divided into six broad categories [that] provide the framework for linking performance indicators to standards" (International Society for Technology in Education, 1998, p. 5). According to ISTE, students participating in a technology-enriched environment should have the potential to effectively use technology to perform the following tasks:

- locate, analyze, and evaluate information;
- solve problems and make decisions;
- participate in all realms of communication; and
- learn and apply new technological tools for improving processes.

Ultimately, technology will enable students to become productive and informed adults.

**Technology and Teachers**

Technology will change the way teachers teach and how students learn (Gaines et al., 1996). With rapidly changing technology, teachers must continually upgrade skills in fields relative to the content taught. Many educators are limited in the technological skills needed for successful technology integration in the career and technical education curriculum due to the lack of recent training in the professional field. As a result, professional development must occur to keep teachers current with technology.

Technology, per se, does not happen all at once; it evolves (Barrett as cited in Noori, 1990). Naisbitt (1983) stated that technology passes through three stages: First, technology moves into a ready market. Second, users improve or replace the previous technology. In the third
stage, users discover new functions of the technology. Based on these stages, professional development focusing on technology training for teachers should include:

- technology awareness and skills training;
- peer teaching approach (teachers-teaching-teachers); and
- technology infused instruction.

As teachers attempt to incorporate the use of technology, obstacles often occur preventing stages two and three. Frequently the technology and the software application selected by the school district are not the same as those used in a targeted occupational area. Specifically, technology applications used in various occupational fields are not available to educators. Software application packages for instruction in word processing, data base, and spreadsheets are readily available to most schools. However, the classroom version may not be the most current. Even when teachers attempt to purchase technology applications for use in the curriculum, the secondary curriculum suppliers have not developed such applications. Ideally, educators should obtain the technology-based applications from business and industry or develop the needed application themselves. Often because of hardware incompatibility, this is not feasible. McKenzie (1993) noted that Mandinach and Cline (1992) and Sandholtz, Ringstaff, and Dwyer (1990) identified and refined four similar transitional stages: survival, mastery, impact, and innovation. In the survival stage, educators are inundated with new technology tools and initiatives, often without the benefit of training and formal implementation guidelines. In the mastery stage, educators begin to acquire the knowledge and skills needed to use the technology. The impact stage seems to be the point at which educators transition to facilitators, thus shifting the focus to student-centered learning. In the final innovation stage, educators begin to integrate technology into the curriculum as well as the learning environment.

Although professional development is provided by school districts, time and financial resources restrict technology training. Business and industry must also become accountable by working closely with education in order to prepare students with requisite foundation skills and competencies in order to become highly skilled workers. Due to the constant change in technology, secondary education cannot fully meet the needs of business and industry alone.

Successful technology training of career and technical education teachers is at the very least challenging. Teacher training involves teacher educator institutions, school districts, as well as business and industry.
Some strategies to follow:

- Upgrade the expertise through professional development such as employment in the field, college courses, or other training opportunities.
- Teachers can assume the responsibility of becoming aware of and taking advantage of training including but not limited to professional development.
- Career and technical education teachers should participate in professional improvement conferences sponsored by business-related associations, professional associations, state education agencies, and Association for Career and Technical Education.
- Develop project partnerships with technology vendors to minimize obstacles to blending curriculum and technology.
- Secondary career and technical education should consider sharing classrooms with business and industry.
- Career and technical education teachers may attend training with local and regional businesses in order to stay current in the occupationally related skills.

Technology and Program Evaluation

How will the efficacy of technology implementation in career and technical education be measured? According to Gaines et al. (1996), evaluation must be built into the technology plans and continuously monitored. Evaluation should be designed to answer issues such as effective implementation and student achievement as well as serve as feedback to the community. If high-quality student achievement is not demonstrated, then the response should be — Why do it? (Gaines et al., 1996).

Evaluation has always been an essential component of education; with the impetus of technology plans, evaluation is becoming an essential component for assessing efficacy in career and technical education. Because technology plans are a relatively new phenomenon, little research has been published on this matter. However, the literature does indicate that evaluation should encompass all phases of planning and be incorporated into technology plans; evaluation should measure individuals schools as well as entire districts (National Center for Technology Planning, 1997). As of yet, no formal or national surveys have been developed for evaluation at these levels; districts seem to be developing their own instruments based on the elements of their technology plans.
As such, various methods and instruments for evaluating technology plans can be found by performing a simple search using a search engine on the World Wide web. Often, evaluation of technology plans attempts to answer these questions:

- How is technology implemented into the curriculum?
- Has the implementation been cost-effective?
- Has student performance improved?
- Do all students have access to the technology? (National Center for Technology Planning, 1996 & 1997).

These questions only scratch the surface of areas targeted by evaluation; as with any evaluation effort, a litany of questions can be developed to ensure adequate evaluation of technology implementation. As national standards for educational technology are developed, perhaps so will the evaluation instruments.

The evaluation of technology efficacy must include the involvement of business and industry advisory boards for program implementation and curriculum development, occupational mentors for students, and an evaluation process that includes the employer, students, and teachers. Through the cooperative education method of career and technical education programs, educators are provided the unique opportunity effectively to evaluate the efficacy of technology utilization by students in work-based applications. Furthermore, through cooperative education, educators can modify the curriculum to increase the transfer of knowledge (behavior/results) while students remain in school. As previously stated, the support of employers is vital for educators when evaluating the efficacy of learning beyond Kirkpatrick’s (1996) reaction or learning levels.

Phillips (1991) identified one of the common myths that keeps professionals from measuring program effectiveness: “I don’t need to justify my existence, I have a proven record” (p. 4). Career and technical education is rapidly changing; these myths will no longer suffice to assure the continuation of many programs. According to Jones (1994), society and industry are demanding that classrooms increase learning effectiveness. Additionally, Seldin (1995) asserted that the demands for accountability have sent legislators and governing boards into action to correct the accountability problems.

The field of industrial training and development provides educators and technologists with numerous tools to evaluate the effectiveness of teaching and learning. One of these tools is Kirkpatrick’s (1996) four
level framework for evaluating training effectiveness: **Level 1** (Reaction) — How did the students like the course? **Level 2** (Learning) — What knowledge, skills, and attitudes were learned or changed? **Level 3** (Behavior) — What changes in job behaviors resulted from this course? and **Level 4** (Results) — What were the measurable production results (on-the-job performance) based on this course? The details of Kirkpatrick’s framework are beyond the scope of this document, but they are described to offer a basic evaluation structure as education reviews the utilization and effectiveness of technology usage in the curriculum.

The system of education is well versed in evaluating student learning outcomes, learning styles, and classroom environmental factors (reaction and learning levels). However, improvement is needed when evaluating the transfer of technology knowledge to industrial practice (behavior and results levels). Behavior and results evaluation must involve the employer. Without assistance from employers, educators cannot determine the efficacy of technology utilization for classroom learning.

**Trends in Career and Technical Education**

What knowledge and skills does industry want students to possess? What are the essential competencies? These are common questions asked by educators. As noted by Gaines, Johnson, and King (1996), the Edison Project Report identifies a shift in thought, in which technology is a second language; accordingly, employees must acquire technological skills with a certain level of user comfort that enable them to effectively communicate and develop creative uses for the technology. Even so, technological needs have always been a moving target. Labor trends project that by the year 2030 the majority of jobs in the United States will require technical competence, transferable skills (interpersonal skills), sensitivity to a diverse population, and problem-solving skills (Reece & Brandt, 1996). According to Riel (1994), “What future technology will look like, or how it will work, is difficult to imagine. But its functions are less of a mystery. The technology of the future will deliver more accurate and rapid transportation of goods, ideas, and people” (p. 452).

Traditionally, career and technical education has focused on business and industry (as customers) more than on academic institution preparation. Prior to 1990, this focus was primarily occupational. Since the Carl Perkins Act of 1990, career and technical education has redefined its customers as both business and industry and postsecondary institutions. Daggett (1996) wrote that, “to raise education standards, most leaders
recognize that schools must focus on both the academic knowledge and skills necessary for success in the workplace and society as well as those that prepare students for higher education” (p. 54).

The customers of career and technical education may vary by program based on the career specialization area, the geographical location, and the local economy. The customers of most career and technical education programs include parents, students, business and industry, and postsecondary institutions. Even the advent of total quality management in education has had an impact; many school districts have adopted a customer-oriented perspective.

Career and technical education faces a challenging future in the information age. Occupation and job definitions are changing on a yearly, monthly, and weekly basis; therefore, one must begin to look at career and technical education programs as the beginning of a learning process that prepares students for additional learning in the postsecondary institution or in the organization that hires the graduate. Today, this target is moving faster than at any time in history. Secondary institutions must frequently survey their customers, industry and postsecondary institutions, to determine current and future needs (Allen, 1996; Sneider, 1995).

Summary

Business trends suggest that by the year 2030, the majority of U.S. jobs will require problem-solving skills, interpersonal skills, the ability to work with a diverse population, and technical competence. Additionally, individuals in the workforce must utilize technology as a common workforce tool.

The professional development of teachers in technology is vital to the success of career and technical education. Business and industry are encouraged to share in the training of career and technical education teachers to ensure the preparation of students with requisite foundation skills and competencies. The evaluation of technology implementation in career and technical education will involve business and include students, teachers, and employers. Everyone involved in the learning process must be accountable for the foundational skills and competencies deemed essential to the future of an American workforce and society.

Technology is utilized in every facet of society to improve human performance. However, if technology does not enhance human performance, it fails to become a common tool for use in society. The use of
technology to meet human needs and extend human capabilities defines the parameters for student achievement in career and technical education.

References


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