Investigating the Screwdriver: 25 Years of Technology Change

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Abstract

Technology can be defined as the utilization of theory, processes, information, and materials to improve the knowledge, skills, and attitudes of a society. Since 1973 there have been many technological changes in the field of vocational education. This article offers a broad look at some of the technology changes in the last 25 years, as well as strategies for implementation and planning in the new millennium.

What is Technology?

"The Industrial Age has given way to the Information Age"
(Pritchett, p. 5).

As we begin this discussion of technology and occupational education, the first question that becomes apparent is: What exactly is technology? Technology is a vague word that can be confusing. It can be defined in many ways. First, broadly, "Technology is a system that applies the best techniques of sciences to a subject matter" (Gilbert, 1992, p. xiii). 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.

Each of these definitions presents a different perspective of technology; yet each definition assumes that technology ultimately serves to enhance human performance. If technology does not enhance human performance, it fails to become a common tool for use in our society.

Investigating the Screwdriver

"There is no reason anyone would want a computer in their home."
—Ken Olson, president, Chairman and Founder of
Digital Equipment Corp., 1977

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How can a screwdriver, technology, and occupational education be connected? As you look over this journal into your office, home, classroom, or lab, you see numerous examples of technology. Take a minute and list as many as you see. Since 1973 there have been many technological changes in our society. In 1973 the Internet was in its infancy; the desktop computer was a good idea; the fax machine was a novelty; and computer-aided drafting unheard of. In 1998 the Internet is truly a global communications system; the desktop computer is usually used before a pencil each morning; the fax machine is a way of getting a hard copy almost anywhere in the world; and computer-aided drafting and virtual reality are common tools for drafters.

What is the real difference between a traditional manual screwdriver and a technologically-advanced electric screwdriver? Not much. Technology is never static. The advancements in screwdriver technology have improved some aspects of the manual screwdriver. The technologically-advanced screwdriver turns a screw in a clock-wise or counter-clock-wise direction, but at a much faster rate. The manual screwdriver is still useful and is a better choice in many instances. But the next time you hang 8' x 4' sheetrock, take a moment to make this choice: a manual or electric screwdriver for driving sheet rock screws? The technology that we use everyday will change, yet in spite of these changes, the principle remains the same. A screwdriver still turns screws.

Classroom Technology: Past and Present

Occupational education classrooms have changed substantially during the past 25 years. Many technologies have been created and implemented in hopes of better facilitating learning. As in industry, technology implementation is driven by customer need. The technical classrooms, with high capital investments, demonstrate these changes most effectively.

In 1973: The drafting classroom was a classroom where triangles, H and 2H pencils, erasers, T-squares, French curves, and chalkboards were commonplace. The latest accepted technology of the time included an electric pencil sharpener, parallel bar or mechanical arms, Kroy lettering machines, technical pens, and drafting templates. Students in the classroom spent a large part of their classroom training time learning Gothic lettering, scales, line weights, and blueprint machine operation. A secondary or postsecondary curriculum would include classes or segments of learning in basic drafting, blueprint reading, civil drafting, technical illustration, mechanical drafting, and architectural drafting.

In 1998: The drafting classroom is filled with computers, floppy disks, and plotters. Technology in the Computer-Aided Drafting (CAD) lab includes high resolution monitors, input devices (mouse, digitizing pads), high-speed plotters, CD-ROM drives, Zip drives, and CAD/CAM manufacturing simulations. Students spend a great amount of their time learning 3-D coordinate systems, the creation of macros, disk management, and software use. The secondary curriculum continues to have similar types of courses, but technology has changed the emphasis of knowledge and skill taught in these courses. The courses in 1998 may include basic drafting (utilizing CAD systems), technical illustration (3-D modeling), civil drafting (contour mapping, with GPS systems), mechanical drafting (mechanical desktop and solid modeling), and architectural drafting (utilizing parametrical design).

The drafting classroom of the future is difficult to envision. The description is yet to be written, but there are a few hints. Drafters of the future will need greater visualization skills due to the 3-D modeling and virtual reality environments. In addition, they will be required, more than ever, to possess documentation skills and the ability to design and analyze projects. The physical components are yet to be developed, but the basic component of communication and visualization will remain essential.

Teaching Methods: A Changing Technology

Under the broad definition of technology, that is, a system that applies the best techniques of sciences to a subject matter, there have been many changes in the technology of teaching methods, practices or strategies employed in the classroom over the past 25 years.

In the 1970s the instructional technology of team teaching entered the classroom. Collaborative planning, complementary teaching styles, and agreements on evaluation criteria were implemented. Also during the 1970s, the incorporation of student learning styles was another instructional technology that began to grow. Learning style inventories were completed on each student, and this information indicated that learners were either left-brained, whole-brained, or right-brained in terms of their preferred method of learning. Going hand-in-hand with learning styles was the utilization of cognitive mapping, which was the charting of specific learning-style strengths and needs for a specific student in order to use appropriate instructional strategies.

In order better to serve the needs of students with disabilities, the 1970s saw the advent of resource teachers to individualize instruction for

those students who were identified as having special needs. These resource teachers were utilized as an instructional strategy to support the classroom teacher and the needs of special education students.

As part of teacher education programs across the United States, the incorporation of micro-teaching and reflective teaching became the wave of the future. Micro-teaching became the new technology in teacher preparation programs and was designed to be a scaled-down, simulated practice teaching exercise used in teaching methods classes to replicate actual classroom situations. The idea was founded on the premise that teaching methods were best taught in a classroom environment where feedback, both positive and corrective, could be made available to the practice teacher.

Reflective teaching also grew as one of the new technologies in teacher preparation programs during the 1970s. Reflective teaching, born out of research conducted at Ohio State University, was the process of giving students enrolled in teacher preparation classes the opportunity to decide how best to teach new information by first teaching that information to themselves, reflecting on that learning process, and selecting the most appropriate delivery and evaluation strategy to teach the content to others.

The 1980s saw the dawn of brain-compatible teaching, computer-based instruction, and peer tutoring as the new instructional technologies. Brain-compatible teaching was accomplished through the use of instructor inventories to determine whether students were right-brained, whole-brained, or left-brained learners, and teaching was directed to that mode of preferred learning.

Computer-based teaching was one of the new instructional technologies that incorporated the use of computers in the classroom. This hardware, and supporting software, was utilized in a wide variety of classroom applications. Much like today, teachers used computer-based programs to introduce new concepts and theories or to supplement and support the teaching-learning process.

Peer tutoring emerged as an instructional technology during of the 1980s. Primarily out of the need to reach students who were having learning difficulty in the classroom, peer tutoring programs developed as support for the classroom teacher. Peer tutoring was founded on the principle that many students learn best from their peers. At the same time, the students who were serving as peer tutors were also learning as they re-taught their fellow students.

The 1990s began with a number of new instructional technologies to complement the classroom teacher. For example, the consultant teacher

replaced the resource teacher of the 1970s. Thinking that it was perhaps better to serve students within the existing classroom, consultant teachers became involved in the collaborative planning process and were utilized to provide supportive instruction and services to special education students in the regular classroom. This was different from the 1970s idea of taking students out of the regular classroom and sending them to a resource room for supportive instruction. Active learning as an instructional technology became popular as a means of providing students with relevant action-oriented, hands-on learning activities within the classroom.

With the passage of various federal legislative mandates, the linkages between education and the local community were strengthened. Business and community mentors have become part of the new instructional technology of the 1990 classroom. Community leaders and business professionals are utilized in the classroom as guest speakers or mentors to assist students in the development of employability, leadership, and socialization skills. The 1990s can easily be identified as the decade of collaboration as business and education partnerships have developed across the country. But this decade of collaboration has not been limited to the business community alone. Interdisciplinary teams have been formed to bring the total school curriculum in concert to better serve all students.

Technology Change: The Factors

"Technology is not the first, second, or third wave.
It is the permanent wave"
(Barrett, cited in Noori, 1982, p. 70).

No single article or series of articles can hope to summarize each technology development in occupational education. Yet educators and researchers must have an understanding of technology change.

Typically, education is not interested in the invention of new technology, but in the use of accepted technology. Industry is interested in the invention of new technology in the hopes of gaining a greater market share. Occupational education, historically, has fought to keep an up-to-date classroom environment and a curriculum that offers students a competitive edge in the job market.

Noori (1982, p. 71) offers a model for technology adoption in the industrial environment (Figure 1). Noori states that the need for new technology stems from three factors:

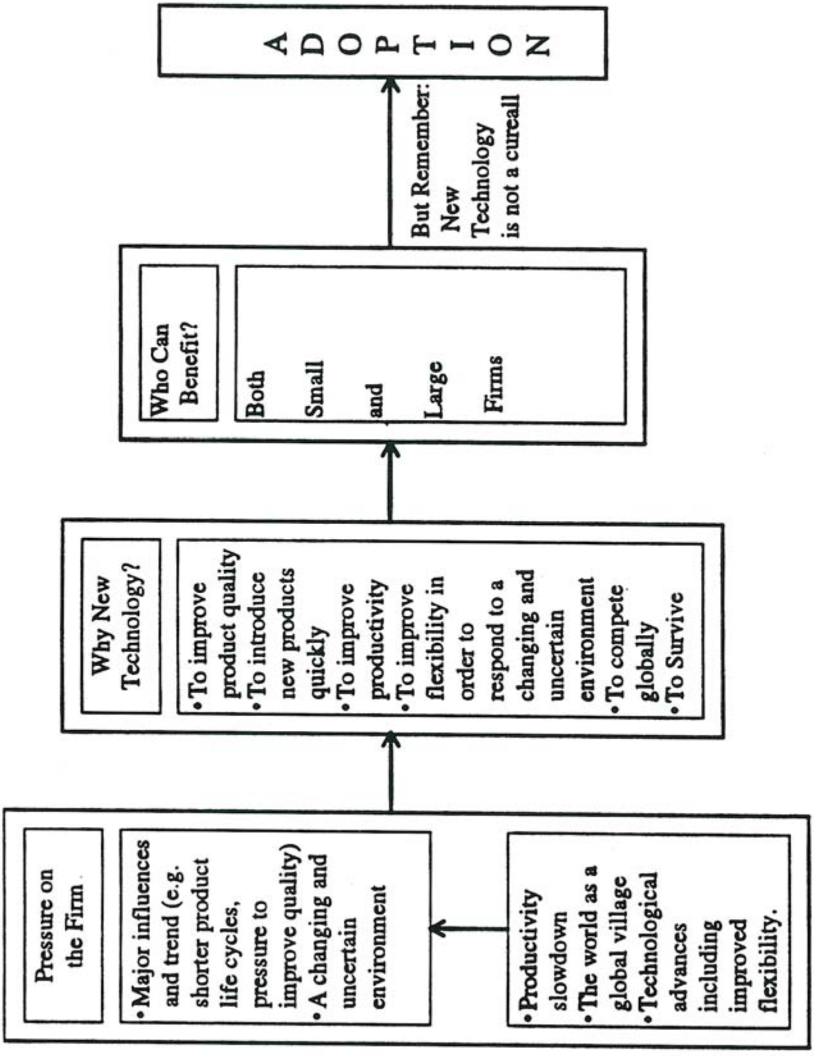

Figure 1. The impetus for technology adoption.

1. A slowdown in productivity and growth.
2. Increased international competition.
3. Advances in technology. (p. 71)

Noori's (1982) model is useful to educators, but the need for new technology in education stems from five factors:

1. Industry has adopted new technology or work practices.
2. Students are not competitive in industrial career placement.
3. Technology knowledge and skills learned in the classroom cannot be transferred to the next grade level, or occupational position.
4. There have been advancements in classroom learning or teaching technology.
5. Job competition has increased.

The difficulty that most educators face is not the determination of technology need, but of technology planning. Since the early 1970s technology has become a vital tool in the occupational classroom. Only since the early 1990s has an effort been made to plan for technology. Allen (1997) discusses five separate considerations in the technology planning process: a) student technology; b) teacher technology; c) teacher training; d) planning cycle; and e) technology cost.

Both the need for technology adoption and the planning of technology implementation are growing concerns in today's occupational classroom. Technology will continue to change during the next 25 years at an even faster rate than in the previous 25 years. Educators cannot keep up with all new technology; rather, they must be prepared to make decisions on practical and appropriate technology that will prepare students to better compete in the corporate workforce.

References

Allen, J. (1997). Strategic planning of technology for education: A beginning framework. *Occupation Education Forum, 23*(2), 13-21.

Gilbert, T. (1992). Forword. In H. D. Stolovitch & E. J. Keeps (Eds.), *Handbook of human performance technology* (p. xiii). San Francisco: Jossey-Bass.

Noori, H. (1990). *Managing the dynamics of new technology: Issues in manufacturing management.* Englewood Cliffs, NJ: Prentice-Hall.

Pritchett, P. (1997). *New work habits for a radically changing world.* Dallas: Pritchett & Associates.

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