TECHNOLOGY, CURRICULUM AND PROFESSIONAL DEVELOPMENT

ADAPTING SCHOOLS TO MEET THE NEEDS OF STUDENTS WITH DISABILITIES

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About the Editors

John Woodward is a professor in the School of Education at the University of Puget Sound in Tacoma, Washington. He received his bachelor's degree from Pomona College in Claremont, California, in 1973. He holds master's and doctoral degrees in special education from the University of Oregon in Eugene. He received his doctorate in 1985. From 1977 to 1982, he was a special education teacher at the elementary and secondary level in Kodiak, Alaska. His interest in technology began in 1980, when he had the opportunity on far too many evenings to write BASIC programs on a TRS-80 with 4 kilobytes of memory and, with occasional success, to save (and load) them on cassette tapes. That observation alone suggests that even though schools and classroom teaching may look the same after 20 years, technology seems to have made some progress.

Woodward's main professional interests include technology-based instruction, mathematics education, and school reform. He has conducted a number of research and curriculum development projects in these areas over the past 15 years. These projects have been funded by the U.S. Department of Education, Office of Special Education Programs; he is immensely grateful for their support. He has published more than 60 articles in professional journals on various topics, almost all of which address the instructional needs of students with disabilities.

Larry Cuban is a Professor of Education at Stanford University. He teaches courses in the methods of teaching social studies; the history of school reform, curriculum, and instruction; and leadership. He has been faculty sponsor of the Stanford/Schools Collaborative and Stanford's Teacher Education Program.

His background in the field of education prior to becoming a professor includes 14 years of teaching high school social studies in ghetto schools, directing a teacher education program that prepared returning Peace Corps volunteers to teach in inner-city schools, and serving 7 years as a district superintendent.

Trained as a historian, he received his bachelor's degree from the University of Pittsburgh in 1955 and his master's degree from Cleveland's Case Western Reserve University 3 years later. On completing his doctoral work at Stanford University in 1974, he assumed the superintendency of the Arlington, Virginia, public schools, a position he held until returning to Stanford in 1981. Since 1988, he has taught semester-long courses in U.S. history and economics three times in local high schools.

Cuban's major research interests focus on the history of curriculum and instruction, educational leadership, school reform, and the uses of technology in classrooms. His books include *Oversold and Underused: Reforming Schools Through Technology, 1980-2000* (in press); *How Scholars Trumped Teachers: The Paradox of Constancy and Change in University Curriculum, Research, and Teaching, 1890-1900* (1999); *Tinkering Toward Utopia: A Century of Public School Reform* (with David Tyack, 1995); *The Managerial Imperative: The Practice of Leadership in Schools* (1988); *Teachers and Machines: The Use of Classroom Technology Since 1920* (1986); *How Teachers Taught, 1890-1980* (1984); *Urban School Chiefs Under Fire* (1976); and *To Make a Difference: Teaching in the Inner City* (1970).

About the Contributors

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A. Edward Blackhurst is Professor Emeritus in the Department of Special Education and Rehabilitation Counseling at the University of Kentucky. He is the author of numerous articles, chapters, books, and monographs, and his 1965 article in *Exceptional Children* was the first in the professional literature to address the potential of technology for educating students with disabilities. Since that time, he has conducted seminal research on a host of technology applications in special education, including the delivery of instruction via communication satellites, computer-assisted instruction for teaching spelling and math, an expert system for selecting single-subject research designs, use of technology productivity tools to facilitate teaching, software tools to collect direct observational data, hypermedia programs for teaching about assistive technology, models for making assistive technology decisions and developing assistive technology programs in schools, and Web-based teacher preparation programs, among others. He also has directed master's, educational specialist, doctoral, and post-doctoral programs to prepare special education personnel for careers involving technology. He is Past President of the Association for Special Education Technology and the Teacher Education Division (TED) of the Council for Exceptional Children (CEC) and was the recipient of TED's Excellence in Teacher Education Award. In 1999, he received a Career Distinguished Leadership in Special Education Technology Award from the Technology and Media (TAM) Division of CEC. He continues to consult, conduct research, and write about technology topics.

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Barbara J. Terry has been with the Juniper Gardens Children's Project for more than 20 years, working on many of the educational research grants in researching, developing, and evaluating programs that enhance the educational achievement of young children and students at risk. As a former elementary school teacher, Dr. Terry has always liked the area of teacher training and staff development as it relates to implementing techniques and programs that have been researched and shown to be effective. She travels the country training teachers and administrators how to implement research verified effective programs developed at JGCP.

Bonnie Todis is a Research Associate in the department of Special Education, College of Education, University of Oregon. Her area of expertise is brain injury and individuals with physical disabilities. She has conducted extensive qualitatve research in the area of augmentative technologies.

Cynthia L. Warger is principle of Warger, Eavy & Associates, a communications firm in Reston, VA, which specializes in education print and media. Dr. Warger received her Ph.D. in educational psychology from the University of Michigan. She also holds a master's degree in special education. She has taught in the public schools, directed teacher education programs at the university level, and served as an education association executive. While editor of *Teaching Exceptional Children,* she won national EdPress awards for excellence. She edits the *TAM Connector,* the newsletter of the Technology and Media Division of the Council for Exceptional Children.

Yong Zhao is Assistant Professor of Technology in Teaching and Learning at Michigan State University. His interests include design, development, and dissemination of technological innovations in educational contexts.

Judith M. Zorfass is Senior Director of Strategic Planning within Education Development Center's Center for Family, School, and Community. Since joining EDC in 1986, she has served as the project director, principal investigator, and/or technical monitor for six OSEP-funded projects focused on integrating technology into the curriculum to benefit students with disabilities. These projects have involved carrying out research, providing technical assistance, and developing online and offline products for dissemination. She is the lead author of *Make It Happen!,* a professional development approach for supporting middle school students with disabilities in technology-rich, inquiry-based learning. In addition to *Teaching Middle School Students to Be Active Researchers* (ASCD, 1998), she is the author of numerous book chapters and journal articles. She is a frequent presenter at national conferences. Her doctorate from the Harvard Graduate School of Education is in reading and language development.

Dedicated to:
David Malouf,
U.S. Department of Education,
Office of Special Education Programs
Ellen Schiller, ABT Associates

Contents

Introduction

Special Education Technology and the Field of Dreams

DAVID B. MALOUF
U.S. Department of Education,
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Educational researchers, innovators, and reformers tend to suffer from excessive levels of optimism. They often feel that their findings or ideas are so self-evidently beneficial that they will propel themselves into widespread and effective use in the schools, requiring only moderate levels of dissemination in practitioner-friendly formats. In a sense, this is a "Field of Dreams" view of educational change: "Produce it and they will implement."

Technology is particularly problematic in this regard because it is so compelling and has advanced so dramatically and has become such an essential component of modern life. Introducing technology into education gives the impression of innovation and effectiveness for no reason other than that technology is involved. Attention tends to be focused on the technology itself, and important aspects of appropriate implementation and proof of effectiveness are often overlooked. Furthermore, the allure of technology is unlikely to diminish anytime soon. Instead, it seems to be renewed with each new technological advancement.

Given the high expectations people have for technology, it is not surprising that millions of dollars have been spent for the acquisition and implementation of technology in schools. For students with disabilities, federal laws such as the Technology-Related Assistance for Individuals with Disabilities Act of 1988 and the 1997 Amendments to the Individuals with Disabilities Education Act (IDEA) have attempted to ensure that these students have full access to instructional and assistive technologies. For example, the 1997 amendments to IDEA introduced a provision that all teams developing individualized education programs for students with disabilities must consider whether the child requires assistive technology devices and services.

Substantial amounts of money and effort have been spent on research and development related to the use of technology with students with disabilities. In some cases, these efforts have developed and tested new products, such as assistive devices or instructional software. In other cases, these efforts have developed and tested new approaches for using existing technologies, such as word processors, multimedia, or the Internet. These efforts often have demonstrated improved educational outcomes for a sample of students and thus offer meaningful and productive ways to use technologies with these students. Disappointingly, however, there is little evidence that these efforts have engendered broad or sustained improvements for a substantial number of students or schools. Technological innovations often are abandoned as soon as the project that introduced them exits the school, and there are very few instances in which such innovations have been widely adopted or have become common practice.

Clearly, if we intend to continue exploring better ways for using technology with students with disabilities, we must be concerned not only with the effectiveness of innovations but also with their adoption and implementation. In this book, accomplished researchers in special education and technology discuss various facets of this issue. Cuban's chapter examines a number of recurrent and popular explanations for why technology is underused in education. His observations set the stage for many of the themes that appear in subsequent chapters. Woodward, Gallagher, and Rieth review the research on technology in special education and discuss the problem of studying implementation and how it might be addressed through alternative research strategies. MacArthur and Todis describe two naturalistic studies with some surprising findings about how technology is actually implemented with students with disabilities. Blackhurst discusses the key factor of professional development, and Greenwood et al. describe a classroom intervention that has evolved to incorporate technology in a meaningful way. Okolo and Ferretti, Zorfass, Englert and Zhao, and Halpern and Benz reflect on their current and past work, focusing particularly on the implementation and sustainability of their innovations. Finally, Pugach and Warger's chapter aptly summarizes the main points from each of the book's contributors and puts these points in the broader context of curricular and technological reform for students with disabilities.

There are two primary audiences for this book. One comprises persons involved in the implementation of technology with students with disabilities, including teachers, administrators, and policymakers. For this audience, the book highlights some important considerations for making technology implementation meaningful and enduring. A second audience includes researchers and developers working in the area of technology for students with disabilities. For this audience, the book suggests important design considerations and provides ideas for giving research a more powerful voice by expanding its vocabulary of real-world implementation.

Special education technology will never be a field of dreams in which innovations can be cast to the winds to find widespread and meaningful implementation. Scaling up and sustaining these innovations always will be a challenging job, but one that also promises possibilities.

CHAPTER ONE

No Easy Answer

The Instructional Effectiveness of Technology for Students With Disabilities

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A natural starting point for thinking about the use of technology in special education settings—or, for that matter, in all educational settings—is its impact on student learning. There are, after all, other significant ways in which technology is used in special education, from routine administrative tasks and individualized education plan (IEP) management to novel attempts to use expert systems for diagnosis and qualification for services (Cuban, 1993; Hofmeister, 1986; Hofmeister & Ferrara, 1986). However, finding ways to improve learning for students is the predominant focus for most educators.

One key reason for this focus on student learning has to do with the way some technologists conceptualized the use of microcomputers when they first appeared on a large scale in the early 1980s. Bork (1981), Papert (1980), and others offered dramatic visions of how microcomputers could change education and move students toward much deeper levels of critical and creative thinking than what traditional instruction typically provided. A similar level of enthusiasm for microcomputer-based education was apparent in the special education literature at the time (e.g., Hofmeister, 1984). Microworld simulations, LOGO, and the initial promise of artificial intelligence all fueled the hope that the microcomputer and other technologies would transform learning for all students. This kind of hopeful thinking about technology-based instruction persists today in some quarters, due in large measure to the increasing availability and power of microcomputers and other technological devices, as well as to the growing influence of constructivist theories of learning and instruction (e.g., Cognition and Technology Group at Vanderbilt University, 1997; Jonassen, 1999).

Virtually anyone remotely familiar with the evolution of microcomputer use in education over the past 20 years is aware of the fact that these lofty visions have not been met. At the same time, the actual uses of technology are much more varied than originally anticipated. Cuban (1993) characterized the kind of thinking during the early 1980s as a "technophile's" vision of education. He argues that radical, transformative attempts to break outside of traditionally inflexible patterns of teaching are unlikely given the way schools have been structured historically. Factors such as age-graded classrooms, the segmentation of knowledge into skills and specific content areas, and deep-seated assumptions about the educational process (e.g., teaching is telling, learning is listening) greatly inhibit innovation in schools.

Most certainly, there is an enormous gulf between the possibilities for how computers could be used to advance learning and the mundane ways in which they have been used by students in schools over the past 20 years. This is a legitimate topic of concern and criticism in its own right, and Cuban, among others, has addressed this issue in critical and thoughtful ways over the past 15 years. More germane to the intent of this book, however, are the surprisingly varied ways in which special educators actually have researched the instructional uses of technology. Some of their efforts have been predictable and in keeping with mainstream instructional uses of computers (e.g., computer-assisted instruction, or CAI). Other efforts, such as the use of expert systems for ongoing assessment, have been novel.

The purpose of this chapter is to describe thematically—and, to some extent, historically—research into the instructional uses of technology in special education over the past 20 years. We draw on a wide range of professional literature to make more coherent and comprehensible what initially may appear to be splintered visions of instructional technology research in special education. In the first section of this chapter, we review the complex ways in which technology has been used for teaching basic skills. The educational technology literature often refers to this as using the computer as a "tutor," and CAI is the most common type of software employed for this purpose.

In the second section of this chapter, we continue our review of the instructional uses of computers with special education students, but with a focus on assessment. In particular, we describe attempts to develop computer-based diagnostic systems to help teachers assess student performance in an ongoing fashion. These efforts generally have been ignored in previous summaries of the research literature on special education technology because they fall outside the tutoring conception of computer use. This point becomes apparent shortly in our discussion of past reviews of special education technology research.

The third section describes sobering findings from naturalistic research on how practitioners and students have used computers for instructional purposes. These findings are important for many reasons, not the least of which is the reminder that there is often a significant gap between the researchers' intentions and intuitions of how technology should be used and those of practitioners and students. These findings have implications for a range of technology uses, from augmentative devices, as described by Bonnie Todis (Chapter 2, this volume), to assessment and instruction.

The final section of the chapter builds, in part, on the third section and describes the importance of conducting research in a way that is more sensitive to the world of the practitioner. This kind of research requires a broader vision of technology (e.g., a less dominant role for computers, the additional need for innovative curriculum and pedagogy) and, in many cases, a different disposition toward research itself; that is, investigators often need to go beyond the traditional, experimental approach to research to capture the subtle ways in which innovative methods and materials affect a classroom environment. We argue that changes in methodology are an important step in understanding how technology and innovative methods (curriculum and/or pedagogy) can improve instruction for students with disabilities.

Past Reviews of Technology Research in Special Education

Attempts to summarize the effectiveness of technology in special education have appeared periodically over the past 15 years. This review of technology research differs from those of the past because it takes a broader view of what instructional use of technology means. For the most part, the studies included in past reviews involve the assumption that technology's primary use was to teach content material or basic skills; that is, in those studies, technology was used as an electronic tutor, and the software was best categorized as CAI. Furthermore, past research reviews have used either meta-analytic techniques or broad, thematic approaches to the literature on technology use for students with disabilities.

For example, Schmidt, Weinstein, Niemic, and Walberg (1985) cited a number of problems with the extant CAI research (e.g., anecdotal or poorly written results, use of single-subject as well as group designs); nonetheless, they conducted a meta-analysis of a subset of that literature. Their meta-analysis, which generally supported CAI as a means of increasing academic performance for students with disabilities, was based on global comparisons of CAI and traditional forms of instruction. McDermid (1989) presented a similar analysis of the literature and also highlighted the substandard nature of many research reports of the time.

Ellis and Sabornie (1986) employed another method of research synthesis, one that has continued until today. They organized their synthesis of the technology literature thematically. Specifically, they delineated a series of "promises" that reflected hypotheses or expectations for CAI that either were explicit in individual studies or were widely held beliefs about the potential benefits of technology use in special education. More recently, Shiah, Mastropieri, and Scruggs (1995) used content areas as a framework for reviewing CAI studies. They examined the impact of CAI on mathematics, spelling, reading, and other subject areas. The findings, although mixed, generally supported the potential of CAI for raising academic achievement. Fitzgerald and Koury (1996) offered a similar review of the literature on students with mild and moderate disabilities.

Although these research syntheses may help illuminate the extent to which CAI is effective, they also reflect three fundamental problems. First, as Okolo, Bahr, and Rieth (1993) noted, many meta-analyses and research syntheses (e.g., McDermid, 1989; Schmidt et al., 1985) offer comparisons that are too global in scope. There is a confound between medium and instructional principles, one that Clark (1983) described in a widely cited critique of media research. This problem is apparent in many of the early CAI studies (e.g., McDermott & Watkins, 1983) in which researchers implied that the medium alone can produce significant instructional or cognitive benefits. This issue is compounded further in studies in which the technology incor-