Education & Technology

An Encyclopedia

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Editors

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Introduction

It has never been easy to define educational technology or the scope of the profession. Educational technology has roots in the broadly defined disciplines of education, psychology, and communication, as well as more specialized areas of interest such as organizational development, business and management, and computer sciences. As a result, individuals with different professional training experiences often find that they share similar goals and methods, though they may use different words to describe what they do. Educational technology may also refer to specific technological devices and machines. When used in this way, educational technology describes a particular method: the use of a technology or a technique toward achieving an educational outcome. Without an educational focus, the technology in question is only a device. And as if this weren't confusing enough, in some cases the technology may provide educational value only because it is the most convenient and efficient delivery medium, or because only one of its characteristics serves a specific teaching or learning goal.

Although there may be no singular definition for educational technology, any definition is likely to include reference to the use of technology for instruction, training, learning, or teaching. In practice, definitions serve to focus the interest of associations of individuals by emphasizing a particular scope of interest. From 1990 to 1994, Barbara Seels and Rita Richey (1994) led members of the Association for Educational Communications and Technology (AECT) in an effort to update one definition of the field. The AECT definition highlights the scope of activities of member individuals who share common interests in the systematic

design and development of instruction and instructional resources using education technologies. These activities are: design, development, utilization, management, and evaluation. More recently, Robert A. Reiser (2001) has suggested a redefinition of the field along with a shift in emphasis, from "instructional technology" to "instructional design and technology." His proposal highlights the numerous ways in which educational technology is regarded as a framework for action. Though not necessarily synonymous, terms such as "instructional technology," "instructional systems design," and "instructional media" have all been used to describe topics relevant to educational technology. To understand this dynamic nomenclature is to understand the historical development of educational technology as a discipline-based effort to establish a consistent and comprehensive set of methods for the use of technology as an educational tool. Yet each new technological invention presents a new set of possibilities as well as challenges for integrating practices with past achievements.

In short, educational technology may describe a process, a product, or a profession defined by a shared knowledge base. Selecting terms that accurately demonstrate the history, achievements, and accomplishments of the field is an effort fraught with ongoing debate and discussion. In this encyclopedia, we have elected to focus on an enduring vision of educational technology. This is a vision that defines educational technology by its service to learning. As such, education provides a framework for selecting and using technology, regardless of whether the technology in question is a machine, a technique, or an innovative idea.

A number of excellent books already exist that offer insight into educational technology as a domain of knowledge. David Jonassen has edited the *Handbook of Research for Educational Communications and Technology: A Project of the Association for Educational Communications and Technology* (1996, 2001), a comprehensive overview of educational technology research and scholarship. Paul Saettler's *The Evolution of American Educational Technology* (1990) provides a historical look at educational technology's evolution as a profession and its supporting institutions and industries. Tjeerd Plomp and Don P. Ely's *International Encyclopedia of Educational Technology* (1996) includes more than 100 in-depth articles that together represent educational technology's global influence as a domain of practice across many academic disciplines. Most recently, Robert A. Reiser and John V. Dempsey have edited *Trends and Issues in Instructional Design and Technology* (2002), an exploration of past and current trends and issues in the field that emphasizes the junction of instructional design, instructional technology, and performance technology. Although these reference books are written for those with a professional or scholarly

interest in the field, this encyclopedia is written for a general, nonpractitioner audience.

The broad sphere of influence of educational technology means that this volume should be considered as a complement to the other excellent reference handbooks cited above. In this encyclopedia, we aim to provide an opportunity for those who have had little or no formal introduction to the field of educational technology to learn about its numerous applications and to recognize the relevance of educational technology to many endeavors. We have tried to present concise entries written in layperson's terms that include avenues for further exploration for readers. Where possible we have chosen to highlight the ways that new technologies, enabled by the wide adoption of the personal computer, demonstrate the core principles of educational technology. Though we've tried to ensure a contemporary focus, the history and foundations of the field are critical to understanding its current value and purpose. Therefore, we have included references to established concepts, principles, tools, and individuals that have shaped the field as a professional discipline. For example, we have included such entries as Analysis because the use of educational technologies nearly always requires this professional competency. It is through analysis that we select appropriate technologies and define methods of addressing learning or training needs. We've documented the multiple perspectives found within the field with entries such as Wilbur Schramm, which is a biographical sketch of a pioneer in research on the utilization of television; his work shaped early uses of broadcast technologies as tools for educational and social change. And we have included long-standing approaches to good practice (see Instructional Design and Performance Support). It is on the basis of these foundational concepts and practices that such current applications as Open-ended Learning Environments, Virtual Reality, and Probeware have their significance.

Another challenge that we share with many authors writing on this topic is the never-ending effort to stay current. The multifaceted quality of educational technology means that it is a field on the go. Thus our challenge is compounded not only by the effort to stay current with the pace of technological change but also by the need to stay current with what we know about educational processes—in short, all the activities that we associate with teaching and learning. This became a particularly pressing challenge in the 1990s as the Internet and personal computer became common tools for education and industry; this challenge continues in the first decade of the twenty-first century. Consider, for example, the shifting fortunes of Virtual Universities (see the entry of that same name, as well as the entry Western Governors University), or the impact of changing delivery technologies on the development of educational resources as described in the entry *Who Built America?* Finally, the many entries that reference

technologies and strategies that support online communications and collaboration suggest that, even though such topics have been vital to the educational process, we are examining their significance in new ways using new tools.

Take but one example of the pervasiveness of educational technologies: expectations for their use in K-12 schools as evident in the standards developed by professional organizations such as the International Society for Technology in Education (ISTE) and the National Council for Accreditation of Teacher Education (NCATE). These organizations have now established indicators and criteria that define effective uses of technology for instruction, outline adequate levels of access to technology within the schools, consider planning, implementing, and assessing technology usage, and attend to the social, ethical, and human concerns related to technology. Likewise, content-specific associations, such as the National Council for Social Studies and the National Council of Teachers of Mathematics, call for the use of technology to advance content-area learning.

The amount of technology available in schools has increased dramatically in only a few years. Unfortunately, a disproportionate amount of money has been spent on professional development for teachers, technical support, and curricular support. This often results in a lack of technology use, the use of technology in additive, nonessential ways, or the use of technology to replace traditional instructional methods. Many of those traditional methods are grounded in solid pedagogy and research but often do not require the use of expensive hardware and software. This volume thus provides an overview (see the entry Technology in K-12 Schools) of the current status of uses of technology that enhance student learning experiences, encourage higher-level thinking skills, and promote interdisciplinary understandings; another entry on strategies (Curriculum Integration) complements this overview.

As a result of the amount of technology now common in schools, teacher professional development has received increased attention at both the state and national levels. In addition to strengthening teachers' content and pedagogical knowledge, current efforts include expectations for preparing teachers to use information technologies effectively in the classroom. In the entry Teachers: Preparation and Training, the authors review the status of teachers' professional development relative to technology integration. This includes preparing teachers to use technology as an administrative tool, as a productivity tool, and as an instructional tool.

Even with sufficient technical resources and increased attention to teachers' professional development, technology integration may be hindered by a lack of vision (see School Reform); another entry (Technology Planning) contains concrete steps for implementing a school's vision. Part of preparing a vision for technology in K-12 schools includes consideration

of social factors. Many of these are addressed in this encyclopedia in entries such as Internet Safety, Digital Divide, and Assistive Technology.

Although there is much progress to be made relative to the integration of educational technology in the K-12 environment, many exemplary projects and activities can serve as models for others. These include the entry Electronic Emissary, describing a resource designed to bring together mentors who are experts in various disciplines with K-12 students; and Learning Circles, an initiative to facilitate collaboration among groups of classrooms around the globe.

Colleges and universities have always valued technology as a research tool to support data analysis and as an administrative tool to support instructional management activities such as student registration and facilities scheduling. Furthermore, within various disciplines, technologies have always been a part of curricula focused on professional and applied sciences such as engineering and broadcast journalism. Within the physical sciences, technologies have long served to model and simulate data analysis and natural phenomena. However, such academic uses of technology often were limited because they required expensive initial investments and their maintenance required highly specialized knowledge; allowing novice learners access presented significant risks. With the introduction of the desktop personal computer and the Internet, access to technology tools and resources has become an expected feature of the postsecondary experience. See the entry on Campus Computing Project for ample evidence of technology's increasing importance in post-secondary education.

The integration of technology into postsecondary environments as an educational support tool has presented three primary challenges for colleges and universities. The first is the organizational change required to ensure the sufficient financial, technical, and human support for educational technology. Traditionally, support for educational technologies has been provided by separate service units; for example, slide projectors and videotape players were distributed by the library, statistical computing support came from the survey research center, videotaping was provided by a media productions unit associated with marketing and publications, and so on. Support was typically device-centered, that is, defined according to the type of media or technology delivery system. As networked computing environments became the norm, the technologies used within these separate units have converged. The management and utilization of educational technology within the postsecondary environment is now less device-centered and more service-centered as the desktop computer has become the predominant gateway to digital content. The ubiquitous nature of networked computers means that less emphasis is placed on managing a particular device and more on providing services to design, create, deliver, and use digital content in an appropriate format. Thus the entries on Learning

Objects and Virtual Library underscore how technology resources and services crisscross the postsecondary environment and present challenges for the effective design of learning experiences and the usage of specific technology tools.

The second challenge that those who teach at colleges and universities face—similar to those who teach in the K-12 level—is defining the role of technology as an educational tool. This is essentially a question of good instructional and curriculum design and often teaching or instructional support units exist within colleges and universities to assist university faculty in developing effective teaching skills. Unlike K-12 teachers, who often learn their profession as students seeking a degree in the field of education, postsecondary faculty typically have little formal exposure to educational theory. Rather, they study to become specialists in a particular discipline. Consequently, they must learn not only to skillfully use technologies but also to use them in ways that enhance and support learning. Teaching and instructional support units are often charged with the responsibility of assisting faculty in gaining the basic teaching skills important to the effective use of technology as a presentation tool and to author and design content for teaching and learning applications. The entries on Computer-Mediated Communication and Web-Based Instruction describe effective principles for designing and delivering content via digital technologies.

Lastly, with the wild popularity of the World Wide Web beginning in 1995, universities and colleges saw technologies as playing a significant role in extending education beyond the physical classroom. The entry on Distance Education offers a detailed consideration of how educational technology has been used to deliver postsecondary learning opportunities in new formats and to new audiences. Numerous entries also address the processes and tools associated with online communication and collaboration. Yet the expectations for using technology for education at a distance have raised many issues for colleges and universities as access to the Internet and levels of technology literacy among potential distance learners are problematic. In addition, the costs of providing quality content to serve distance learner populations while supporting the effective use of technology in the classroom campus can be steep. Effective teaching at a distance often requires a set of skills other than those used to teach in a classroom, where face-to-face student-teacher interaction is the norm.

Educational technologies have also gained a prominent foothold in corporate industry. Employee training and professional development have always been a key concern within corporate environments since they are so crucial to economic productivity. Whether employed for nonformal continuing education or to support ongoing credentialing and skills training, the use of educational technologies within the corporate and industry

contexts is most commonly identified with Just-in-Time Training; the entry on Collaborative Technologies also provides an excellent overview of digital tools used to meet not only the communication needs of end-users within corporate environments but also project management and team-building needs within and across organizations. Finally, the value of using technologies to support formal and nonformal communication that enhances the workplace and serves professional and personal growth is aptly described in the entry on Communities of Practice.

We devised an organizational scheme for including entries in this volume, looking at seven overall categories: (1) Foundations; (2) Implementation (e.g., strategies, methods, processes); (3) Issues; (4) Leaders; (5) Professional Associations; (6) Projects; and (7) Research and Theory. These categories, while useful for organizing the study of educational technology, should not be considered exclusive. In fact, there is considerable overlap among them (see Contents by Category). How a term is categorized is a matter of emphasis. Each of the categories is described below.

Foundations are principles that have sustained educational technology as a professional practice over time. These are the building blocks of the field, and any student of educational technology should aim to grasp the significance of these essential terms. Such terms focus on the theories and concepts drawn from a wide range of disciplines and help to provide an orientation toward educational technology as a discipline.

Implementation includes terms that describe the use of technologies to support general educational outcomes. Such terms represent broad applications of technology, typically implemented on principles described within the Foundations category. These entries note examples of the ways that educational technologies may be used, and they are often applicable to a broad cross-section of educational contexts. Thus we have included a sample of entries that describe implementations characterized by specific educational goals, objectives, learners, or learning conditions. We also include terms that define particular technologies existing apart from any educational purpose but that can be defined by their implementation within an educational context (see, e.g., Interactive Television).

Issues relate to the policies and procedures relevant to educational technology. Many terms (see, e.g., Copyright) have always had an impact on the use of educational technologies. Others, such as Acceptable Use Policies and Web Accessibility reflect emerging concerns brought about by new technologies. Many of these terms relate to the way in which teachers, students, and institutions must manage and organize technologies as resources. Others provide insight into the social and cultural changes that result when new technologies are introduced.

Leaders includes biographical sketches of luminaries in the field, individuals who have contributed in numerous ways and whose work can

serve as references for further study. Selecting leaders is always a difficult task—particularly in a field as broad and dynamic as educational technology. Therefore, the reader should not assume that the entries provided in this category are exhaustive. Rather, we've aimed to sample the contributions that make educational technology an exciting field by selecting scholars and practitioners whom we view as models of the quality of work worth aspiring toward.

Professional Associations are as varied as the disciplines influenced by educational technology. Those selected for inclusion here represent a wide cross-section of the associations in existence today and should not be considered exhaustive. Rather, we seek to highlight the important roles that professional organizations play in advancing the practice of educational technology principles.

Projects includes terms that are intended to draw attention to best practices and exemplify uses of educational technologies. Like those terms in the Implementation category, the projects described here draw on established strategies and methods specific to the foundations of educational technologies. These terms present work that is widely recognized as a model practice, that have spurred a series of research studies to establish standards for ensuring project success, or that have functioned to demonstrate important proof-of-concept applications of strategies or technologies. The entries selected, however, should in no way be considered inclusive of all the noteworthy projects in the field.

Research and Theory includes terms that summarize important intellectual developments that help to define the significance of educational technology as a field of inquiry. Here we include topics that attempt to explain, predict, or describe learning processes tethered to educational technologies. We also include research that serves as a standard of excellence for the scholarly inquiry that takes place within the field.

Given the range of technologies now available to the general public, we thought it useful to also include a glossary of terms to define many of the technologies now commonly found in the educational technologist's toolbox. These definitions provide a basic description of many technologies and how they function. A broader description of the context for the use of many of these terms can then be located within the alphabetized section of the book. In this way, we seek to give readers a solid grounding in the specific technologies referenced by the contributors who highlight educational technology as a set of shared practices.

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