

Educational Technology

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“Educational technology” refers to a field of study and practice that is conventionally conceived in light of its two constituent words. First, it is concerned with the educational applications of technologies and not the myriad uses of technologies in modern society. Second, it examines those aspects of education that are crucially dependent on (usually new) technologies.

This conventional conception tends to lead along a path focusing on techniques: Research studies compare learning through the use of some new tool versus learning in a traditional way. Cost/benefit analyses are done to measure overall value of the new tools. Training in the use of new technologies is advocated as necessary and sufficient for educational reform. Not surprisingly, behaviorist models of learning have provided the conceptual framework for much of this work; more recently these have yielded somewhat to cognitive or constructivist models, but often still with an embrace of techne over reflection or critical analysis.

Despite widespread use of the term, the delineation of “educational technology” is fuzzy at best. Can we say definitively that specific technologies are educational? One way to consider that question is to look at the common use of the term in different historical situations. Today, the “technology” in educational technology is usually assumed to refer to new communication and information technologies, but prior to the advent of the World Wide Web it meant stand-alone computer systems or programmed instruction. Before that, people spoke of educational technologies as including film strips, television, tape recorders, globes, and other media. In some discussions, educational technology includes any device, medium, or artifact that is used for instruction, thus both the familiar chalkboard and the textbook. In

others, that meaning is extended to include lesson plans, assessment procedures, essentially any form of codified educational practice. As educators have employed more tools in the classroom and as they have looked to the technologies of work practices, it is difficult to identify any technology that cannot at some time be considered potentially educational. For example, the advent of low-cost digital telescopes and the ability to access astronomical photographs through the Web has made the telescope an educational technology in many classrooms.

Alternatively, can we say that technology use is a separable aspect of educational practice? The profusion of courses, graduate programs, journals, conferences, and texts on educational technology suggests that such is the case. However, the characterization of what counts as educational technology is often left unexamined, and the uses of the term are inconsistent. A case can be made that all education involves technologies; indeed, the development of writing systems is often conceived as one of the major technological advances in human development. To the extent that education has evolved along with writing, changes in education can be characterized as the successive emergence of new forms of teaching and learning through the use of new writing tools and systems—manuscripts, printing, typewriting, word processing, email, hypertext, and so on.

It is useful to turn to work in the field of technology studies. There, at least three layers of meaning for technology are typically identified (see MacKenzie & Wajcman, 1999). First, there are physical devices, such as automobiles, telephones, or oil pipes. Second, there are the procedures, activities, or organizational systems that incorporate these devices. These may be represented in user manuals, but also in daily habits of users of the technologies. Third, there is the technical knowledge that enables particular activities, for example, the accumulation of experiences by a midwife constitutes a technology for assisting in births. The line between these layers is not sharp: Devices

can reify procedures, organizations are mutually constituted by their artifacts, and activities can be viewed as both knowledge and practices. This is in fact precisely the reason why people studying technology cannot restrict their view to physical components per se.

Returning to the question of what aspects of education, if any, are technological, the layered conception of technology suggests that technology is not a separable component of educational practice, but rather, a perspective, or set of perspectives, one may adopt on all educational activity. Some of the major perspectives are these:

First, educational technologies can be viewed as texts, as symbol systems to be interpreted by users. This perspective has led to a variety of analyses in the tradition of literary criticism. The prevalence and power of technologies as bearers of meaning leads for example to Heidegger's question concerning the essence of technology. His concept of *Gestell* (enframing) inscribes technology as a mode of thought prior to the scientific revolution, one which "reveals being" in a particular way. Thus, people are defined by the technological way of thought, and not simply users of technological devices.

More recently, Reeves and Nass present a different notion of reading in their concept of the media equation. They argue that people treat computers, television, and new media just like real people and places. They carry over to the technological realm the social norms of gender, language, honesty, politeness, and so on, that they employ in social interaction.

As different as the Reeves-Nass analysis may be from Heidegger's, both recognize that technologies are cultural formations, and that their design, distribution, use, and interpretations need to be considered within a sociohistorical perspective and not merely a technological one (see Bruce and Hogan, 1998).

A related view sees educational technologies as bearers of power relations in society. The essays in Bromley and Apple's collection address this point across issues of gender and class and in terms of the teacher as a worker using technologies. Disembodied power is implicit in Heidegger's analysis, and perhaps most strikingly in Ellul's notion of *la technique*. By "technique,:" Ellul means not simply particular methods for employing a given technology, but the inexorable force of a technical way of thinking that threatens humanistic values. Foucault of course is widely associated with the notion of power as exercised through discursive practices. The layered account of technology then accords well with his analyses of the devices, activities, and knowledge needed to maintain institutions such as prisons.

Not all analyses of power in computing take the bleak road. In fact, the beneficent use of "power" and "empowerment" in the discourse about education technology is striking. For example, a widely-read US government report (*Power On!*) makes a deliberate play on the idea of electrical power for computers as a way to empower learners. Interestingly, both those alarmed by the uses of new technologies in education and those enthralled by them see a strong linkage between the tools and their meaning, sometimes to the point of becoming technocentric.

Another view of educational technologies argues that the context of use is critical for understanding. This perspective leads to the idea of cultures of computing (Star, 1995), as opposed to tools with effects that can be considered in isolation from the beliefs, values, norms, roles, and other practices inherent within a social system. It also argues for situated evaluations (Bruce & Rubin, 1993) of technology use, in which the first task is to determine what a technology is, not to assume that it can be specified independent of a specific sociohistorical context.

In the last decade, a number of writers have extended the biological concept of ecology to that of information ecologies (see Nardi & O'Day, 1999). From this view, a particular technology, say a computer connected to the Web, must be understood as operating within a complex system comprising people with different bases of knowledge and purposes, organizational rules and procedures, physical components such as walls of a room, tables, and chairs, and various other devices such as clocks, lighting, paper and pencil, and other computers. Here again, the benefit of the technology cannot be ascertained independent of a larger system.

Perhaps the dominant view in current discourse about new communication and information technologies is that of media. Not only are there obvious links from the book to television to the Web as media for conveying information, but also many educators are drawn to the mediational function of these new media. Extending Vygotsky's sociohistorical theory, they see new technologies providing affordances for learning. They mediate between students, between student and teacher, and among task, resources, situation, and student.

One of the most productive views of technologies, especially educational technologies, comes from Dewey (see Hickman, 1990). For Dewey, a technology can be seen as a means for resolving a problematic situation, including any impasse on a path of inquiry. That means for resolution can be a physical device, such as a calculator, a representational device, such as the exponent to indicate raising a number to a power, a revised procedure, or a new conception. The appeal of this view is that it provides a unified account across artifacts, procedures, and knowledge. In addition, it shows a way to think of educational technology use in relation to technology use beyond the classroom.

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Encyclopedia of Philosophy of Education

19/07/1999