INTRODUCTION

This overview briefly reviews the history of educational technology and surveys relevant learning theory. In order to understand fully computer-based learning in the United States, one needs to have a more general sense of the history of educational technology (Berg, 2003). Common learning theories that have been applied to computer environments also need close examination because they provide the rationale for specific approaches and learning strategies. In this review, one sees the important influence behavioral and constructivist theoretical models have had on educational-software design in America. Finally, cooperative learning and learning-styles theories are outlined because of their relevance to specific computer-based teaching methods.

Many scholars trace the use of educational technology, broadly defined, to early symbolic systems. According to Paul Saettler (1990), one of the leading historians in the field, educational technology in a broad sense can be traced back to when tribal priests presented systematized knowledge and used early sign writing to pass on knowledge. He points out that the more advanced the culture, the more complex educational technology became. Saettler observes that there is wide disagreement concerning theories in the field of educational technology. However, learning theory is a key to the field because behavioral sciences applied to problems of learning and instruction are fundamental to evolving educational technology. One might trace the beginning of educational technology in America to the use of lantern slides for educational purposes in the American Lyceum and Chautauqua movements, early continuing or extended education programs. Particularly in the Chautauqua educational programs aimed at adults wanting to continue their education, the slides were an integral part of the way programs were presented to large audiences.

Later, what became known as the visual instruction movement promoted visual approaches to teaching to combat what they labeled “verbalism” in the classroom. One influential figure in this movement was Edgar Dale, who developed a schema he called the “cone of experience,” a notion emphasizing experiential learning over verbal symbols. The visual instruction movement was concerned primarily with the use of specific media, while educational technology is oriented more toward psychological principles and the total teaching-learning process.

In addition to the visual instruction movement, the Lancasterian method of instruction involving systematic instruction around memorization and drill was an early influence on educational technology, particularly behaviorist approaches. Behaviorism emphasized the behavior of the learner and reinforcement, and was first introduced by John B. Watson and then developed most extensively later by B. F. Skinner. Skinner saw curriculum as forming behavioral objectives, or arranging contingencies of reinforcement. In relationship to the progressive and constructivist learning theory, Thorndike was probably the first modern instructional technologist, replaced only later by John Dewey in his broad influence on American education. The Dewey-inspired progressive movement provided the philosophical grounding for what later became constructivism. So we can see that early on there were two main techniques for the use of media in the classroom: one concentrating on behavior, and another focusing on process and experience-based learning.

A pioneer in film technology and an intellectual interested in education, Thomas Edison was one of the first to produce films for classroom use. In addition to Edison, many colleges and universities were involved in educational film production as early as the 1910s with Yale University and the University of Minnesota being large players in this early film production. Demand for training films during World War I led to an increase in educational film production. However, by the late 1920s and early 1930s, educational film companies had financial troubles.

World War II was a turning point for educational film both in terms of number and technique. The use of educational films was part of the official policy
of the war department, and consequently this led to
the production of six times more educational films
than had been created up to that point. After World
War II, additional universities became involved in
educational filmmaking including the University of
Chicago, USC, Ohio State, University of Wisconsin,
NYU, the University of Indiana, University of Min-
nesota, Iowa State University, University of Michigan,
Boston University, and Syracuse University. The first
academic research on instructional films was done in
1912. The research on educational use of instructional
film is remarkably thin.

The use of recorded and broadcast sound was another
important type of educational technology used in the
United States. Thomas Edison was also responsible for
the invention of the tinfoil phonograph in 1877, which
made the first language laboratories possible. After
World War I, university-owned radio stations became
a common phenomenon, and by 1936 there were 202
such stations across the country. Federal regulation,
the rise of commercial radio networks, limitations of
the broadcast signal, lack of a target population, and
minimal faculty involvement were reasons identified
for the failure (Pittman, 1986; Saettler, 1990).

The use of videotapes and broadcast video were
also important developments in educational technol-
ogy. In the research literature, educational television
usually refers to programs that have a broad cultural
purpose such as Sesame Street, while instructional
television (ITV) is generally used to describe whole
videotaped courses. The University of Iowa started
the first instructional television station in 1953. The
1958 National Defense Education Act (NDEA), Title
VII, specifically provided for presenting academic
subject matter through media and thus encouraged
its development. In the 1970s, community colleges in
America developed telecourses to deliver course work.
Television eventually lost the interest of funders who
instead turned in more recent years to the delivery of
education through computers.

As early as the 1950s, educational technology began
to incorporate the computer. The programed instruction
movement revived individualizing instruction notions
and although it declined, its influence lived on past
the 1960s. Computer-assisted instruction (CAI) was
first used in the 1950s, with much of the early work
done at IBM. CAI growth occurred in the mid-1960s,
but faded quickly by the late 1960s. The typical CAI
program modes were drill and practice and tutorials
with a strong degree of author or instructor, rather than
learner, control. Later, intelligent computer-assisted
instruction (ICAI) or intelligent tutoring systems (ITS)
were developed from a cognitive science approach
to educational technology. These computer-based
instructional movements were influenced by specific
learning theories.

LEARNING THEORY: BEHAVIORISM
VERSUS CONSTRUCTIVISM

Both behaviorists and constructivists have sung the
praise of technology, and to some extent, probably
exaggerated its promise. For constructivists, comput-
ers may finally provide the means by which the very
labor-intensive educational philosophy of Dewey
may be put into practice. In more recent times, those
interested in concept mapping, the value of learning
computer programming, and full-immersion simul
ations have all to some degree based their approaches
on constructivism. When considering cognitive mod-
els, the task of educational technology is to focus on
knowledge construction and to understand what cogni-
tive structures users bring to the learning environment.
On the other hand, behaviorists have long held sway in
the field of computer-based training (CBT), with the
tireless repetition and utilization of clear behavioral
learning objectives as a key element of these training
programs. A brief summary of the behaviorist and the
constructivist positions on technology in education and
the key theorists is useful for charting future directions
for technology-enabled education.

Piaget

Jean Piaget, a primary influence on constructivist
theory, developed a theory of learning connected to
human development through his observation and study
of children. Piaget’s background was in science and
thus notions of Darwinian evolution in understand-
ing learning in children heavily influenced him. After
studying adaptation of organisms to their environ-
ment, Piaget reasoned that an organism’s intelligence
was embodied in structures with latent tendencies for
development that could be brought out by appropriate
interaction with the environment (Gardner, 1973). The
research problem of intelligence for Piaget was to try to
discover the different methods or tendencies for think-
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