Educational Technology: What is its Role in the Education of Student Technologists?

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Today's educator exists in a world experiencing exponential growth in the availability of high tech educational media and there is no end in sight. The effects of this phenomenon will influence the way teachers teach and learners learn, possibly to a degree rivaling the impact of Gutenberg's press. Educators are obligated by the moral responsibility of their position to critically evaluate this growing technology, determine what if any advantages the new technology possesses, and then select from among the available alternatives the methodology that will most consistently meet their educational objectives. It is questionable whether adequate information exists to make an informed decision. Therefore, educators are encouraged to ask difficult questions, analyze the responses and be wary that nearly all new technologies have unanticipated outcomes.

Key Words: educational technology; computers; student technologists

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We are living in a world today that is experiencing an unprecedented growth in the availability of information and communication technology. Multimedia, the Internet, distance learning, hypertext and the World Wide Web are commonplace terms today that had little meaning to the nuclear medicine community a decade ago. These phenomena are changing the way individuals communicate, the way they spend their time and, quite possibly, the way they think. It would be imprudent for educators to ignore technology's potential impact upon the way they teach.

Educational technology is a widely used term that has many different meanings and connotations. For this writing, educational technology will be narrowly defined to mean the hardware and software involved in various computer-driven technologies such as multimedia, the Internet, e-mail, distance learning and the World Wide Web. An exhaustive evaluation of these media would fill volumes of manuals that would be largely obsolete by the time they went to press. The purpose of this paper is to encourage educators to critically examine the available information and decide what educational technology's role will be in educating student technologists.

HISTORICAL PERSPECTIVE

The use of various media in education began shortly after World War I and grew with the development of radio and film (1). Freeman reported a number of conclusions that still warrant inspection today:

1. Motion pictures are superior to other visual media within a restricted range.
2. The value of motion pictures is not its stimulating effect but its ability to furnish a particular type of experience.
3. The teacher should still be responsible for the organization of the educational experience.
4. Actual demonstration is superior to film in teaching how to do or make something (2).

Further research on the educational uses of media was uneventful until the World War II era when Hovland, Lumsdaine and Sheffield conducted extensive research into the effects of media upon attitude and its change (3). Both Freeman and Hovland et al. restricted their investigations to the use of media as communication and learning tools. The technology enabling interaction did not yet exist.

The 1960s witnessed the simultaneous evolution of computer technology and cognitive psychology (4). Skinner believed that an extremely serious problem with classroom instruction was the relative infrequency of reinforcement. He felt that immediate reinforcement would motivate students to be attentive (5,6). The popularity of computer assisted instruction (CAI) during the 1960s was made possible by new technology and was driven in part by researchers such as Skinner (7).

The ability to incorporate video images was limited by technological availability until 1977 when the first videodisc was produced (8). More recently, breakthroughs in fiber optics, digital technology, laser disc technology, software and hardware capabilities have allowed educational technology to evolve to where it is today.

CURRENT STATE OF AFFAIRS

The idea of doing more with less is a common theme throughout the health care industry. This trend has not left educators unaffected and they find that they must search for more effective means of delivery. The PEW Commission Executive Summary Report feels that one challenge facing the...
health professional work force is the need to restructure edu-
cation and to make efficient use of the resources allocated to it
(9). Humankind has a penchant for seeking technological sol-
tions to their problems. Therefore, one should not be sur-
prised when technology is again consulted.

Generic information regarding educational technology may
be found in great abundance. Whether promotional or aca-
demic, much of the information supports the academic use of
technology. Other sources of information serve a profound
need for the dissemination of product information while main-
taining an apparently neutral perspective. Lastly, a few sources
raise doubt regarding the alleged benefits and question the
inherent safety of technology in education.

The literature available on the application of educational
technology in the health care professions is not as abundant.
As with generic educational technology, most of the available
information is of a positive nature but some results are ambiv-
alent in their measures of educational technology’s effective-
ness. A small number of neutral, informative writings are
found in health-related publications. Critical review of the
research is difficult since the perceived effectiveness may be
positively or negatively skewed by inconsistencies in the quality
of software, the quality of presentation methodologies and
inconsistent measures of effectiveness.

DISCUSSION

Despite the inherent difficulties of critical review, it is pos-
sible to draw some conclusions regarding the use of educa-
tional technology in teaching the health care professional.
Positive outcomes are reported when educational technology is
used in conjunction with more traditional means of education
(10–12). Effectiveness measures are inconclusive (13,14) when
educational technology used as a substitute for traditional
means.

Modalities within the realm of educational technology can
make tangible contributions. Multimedia productions are able
to recreate scenarios that may be encountered in clinical set-
tings. This gives health care professionals the opportunity to
experience emergencies and learn correct responses without
exposing patients to risk. Video conferencing allows real-time,
face-to-face interaction among colleagues, peers, students and
teachers. Virtual classrooms can overcome the constraint of
physical location and provide an interactive medium for the
exchange of ideas. Assignments can be delivered from students
at remote, clinical affiliates through e-mail. Hypermedia
breaks away from the linear progression of traditional texts and
empowers students to learn in a manner best suited for them.

While each of these technologies possesses certain advan-
tages, one could argue that these media are poor substitutes for
what nuclear medicine technology students and other clinically-
educated students already have. Freeman noted that actual
demonstration is superior to film in teaching how to do some-
thing. Multimedia succeeds to some degree in bringing this
type of experiential learning into the nonclinical setting. How-
ever, anyone that has experienced the need for a patient to be
resuscitated knows that there are some experiences that cannot
be recreated in a nonclinical setting. Olfactory cues, while
typically not pleasant to experience clinically, can be very
informative to the health care professional and this is entirely
omitted from multimedia productions. Lastly, subtle visual and
auditory cues such as goose bumps on the cold patient or the
breathing rate of the dyspneic patient would be difficult to
portray and may ultimately blunt the student technologist’s
sensitivity to these patient signs.

When a significant distance separates student and teacher,
video conferencing, virtual classrooms and e-mail can all help
overcome that distance by supplying an interactive medium
between the two. However, these media are emulating an
interactivity that already exists between the student and edu-
cator in the classroom. Additionally, none of these technolo-
gies yet possesses the ability to communicate the subtle visual
cues that educators rely upon to enhance the delivery of their
material.

Hypertext allows the reader to progress through the text in
a nonlinear fashion and replaces the need for using the index
during reading. As with indices, hypertext quality may be good
or bad depending upon the author’s ability to anticipate what
words or topics are likely to set off a reader inquiry.

An argument could be made that teachers are performing a
disservice to their students if the curriculum does not include
an exposure to the tools of educational technology. Teachers
must recognize that technology will play a significant role in
the professional, academic and personal lives of most of their
students. For example, cumbersome card catalogs are all but
gone and today’s students will be unable to locate resources
unless they use technological data searches. E-mail is becom-
ing an efficient and inexpensive means of communication that
is gaining social acceptance. Electronic bulletin boards are
unconstrained by physical location and are a popular means of
communication between health care professionals of similar
interests. Digitized audio and video information is increasingly
available from numerous sources and the World Wide Web is
becoming an increasingly popular source for information of all
sorts.

Given the above information, it would be difficult to come to
any conclusion other than educational technology can posi-
tively influence the effectiveness of technologist training pro-
grams. This is especially true if face-to-face meetings between
student and teacher are not always practical. However, a lack
of negative measures should not result in a purely positive
conclusion. One should wonder why there are few reported
negative measures of educational technology coming from the
health professions. Could it be those seeking employment in
the health professions are aware of medicine’s dependence
upon technology? Hence, only those individuals that believe
they are technologically competent apply for admission.
Health care is a technologically driven industry and it is rea-
sonable to assume that health care professionals may hold
certain beliefs regarding that technology. Is it possible that
investigators from the health care professions are systemati-
cally biased in their orientation to experimental design, mea-
sures of outcome, and interpretation of results? Could it
be that researchers and publishers are reluctant to print neg-
ative results since questioning the efficacy of one technology
may lead to questions regarding the efficacy of other technologies including those that drive medicine? Could the use of technology in health care education alienate or systematically eliminate those individuals whose measures would significantly alter the data collected? Lastly, one should consider that maybe the results are genuine and that there are few detrimental effects resulting from the use of educational technology in the health care industry.

Some realities regarding drawbacks to educational technology can be found in literature outside the health care professions. Perhaps the most obvious is that not everyone can afford the equipment. Access to a modern computer is the very minimum needed to take advantage of educational technology as defined in this article. Additionally, a high-speed modem, CD-ROM drive, video camera with microphone, additional hardware modifications and various software packages would be needed to take full advantage of the existing technologies. For those students attending a program with university affiliations, much of this expense may be obviated through the use of the university's equipment. Those that attend a hospital-based program or are engaged in distance learning may or may not be afforded that luxury.

Monetary factors aside, other groups having inequitable access to computer technology include minority, female, inner city, rural and handicapped students. In her analysis of a decade of research, Sutton concludes these inequalities have been maintained and exaggerated by computer use (15).

Ecological factors may be a concern given the rate at which components become technologically obsolete. A limited ability to upgrade many of these components further exacerbates the situation. Other ecological considerations include the effects of the manufacture and disposal of cabinet housings, the effects of silicon in the environment, and the disposition of heavy metals in discarded components. While one may argue that this technology poses little ecological threat in comparison to other ecologically abusive habits, the argument itself does not alter the effects.

It is not enough for the educator to examine the available information before making decisions regarding the use of educational technology. The educator must also attempt to project both the expected and unexpected outcomes of their choices regarding its usage. History is replete with circumstances where uses of technology have lead to unforeseen occurrences. Would physicians in the 1950s be so eager to prescribe radiation therapy for children with supposedly enlarged thymus glands if they knew it would result in significantly increased rates of thyroid cancer in those individuals? Would Henry Ford have been so eager to develop assembly line technology if he could have foreseen the effects of mass-produced vehicles on the environment? Postman (16) had this to say about the effects of a new technology:

A new technology does not add or subtract something. It changes everything. In the year 1500, fifty years after the printing press was invented, we did not have old Europe plus the printing press. We had a different Europe. After television, the United States was not America plus television; television gave a new coloration to every political campaign, to every home, to every school, to every church, to every industry. Therefore, educators need be wary because the road of educational technology may very well be a one-way street with no turning back once the journey has begun.

CONCLUSION

Educators of health care professionals teeter on the brink of revolution in the way that their students will accumulate knowledge. As with any revolution there will be victories and there will be defeats. Armed with an imbalance of supportive versus critical information, the educator is compelled to forecast the outcomes of certain educational technologies and then decide which alternatives will best meet their educational objectives. Once their decisions are made, it is likely that the wisest among them will feel like they have been fools stumbling backwards into the future, always seeing the past and only occasionally catching a glimpse of the future from over their shoulders.

This article is not written in an attempt to sway educators toward or away from educational technology. It is an attempt to reach fellow educators and convince them of the need to ask the tough questions, to analyze the answers and to remember that nearly every decision will have unforeseen consequences.

REFERENCES