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Introduction

Technology in education has existed for centuries for the prime purpose of making the process of learning more efficient. Some technologies such as writing, pencils and printed matter have been so successfully embedded in education that we no longer think of them in this regard, as they have been the very foundation of education for centuries. Language, a very powerful tool allowed accumulated knowledge to be passed from one generation to the next. This was followed thousands of years later by written language and then moveable type. For centuries, teachers have taught a variety of subjects using the same tools of spoken language and writing materials. So, to a certain extent, teachers have always used some form of technology.

Educators have always been drawn to technology because of its promise and potential. The twentieth century has been obsessed with the idea of new forms of communication such as radio, film, television and computers. Educators too have seen this form of communication as making a significant impact on education and that audio and visual aids should then raise the level of achievement of students. In addition to providing exciting learning experiences for students, technology is a tool that can streamline administrative operations and make it easier for teachers and other education staff to do their work. Technology is the subject of so much attention in education today, first because of its prevalence; second, because it promises to provide education at lower costs; and third, because technology can help some people to participate more easily in education, to learn more effectively, and to enjoy learning more (Spencer, 1999). Although there are problems connected with

using technology such as lack of skills in using technology and lack of access for those without adequate finances to acquire it, technology will continue to be important in education because it will allow learners to access knowledge in their homes and in their workplaces at times they want to learn.

This paper will then outline briefly the use of technology in education by examining the implementation and effectiveness of some technological advances throughout history This will be accomplished by looking at writing, sound films, television, distance education, audio cassette recordings, radio, the use of the computer, and online education.

Keywords: *education technology, audio, television, distance education, computers, future*

Technology of Writing

When we look at the history of technology in education we must first explore the emergence of writing itself. Just like the telegraph and the computer, writing itself was once an innovation strongly resisted by traditionalists because it was unnatural. Plato was one leading thinker who was very much opposed to the use of writing in fear that it would weaken our memories (Clanchy, 1993). One can see the comparison today with spell and grammar checks on word processing programs as many educators believe that students lose the ability to spell and write grammatically correct sentences on their own. Those who believed in how the technology of writing could change lives for the better, however, balanced these pessimistic views. According to one school of anthropology, the invention of writing triggered a cognitive revolution in human development (Street, 1984). In order for writing to spread to the general population in the ancient world, it had

to first gain acceptance by approximating spoken language. Once writers in the more "modern" sense of the word discovered what writing could do, there was no turning back. Of course, writing never spread very greatly in the ancient world. One reason for this must be that writing was both cumbersome and expensive: writing instruments, paints and inks had to be hand made, and writing surfaces like clay tablets, wax tablets and papyrus had to be laboriously prepared. Writing therefore remained exclusive until cheap paper and easy to use writing tools became available.

One such tool was the invention of the pencil. The pencil, like writing, was not initially designed as a writing tool; rather the lead-pointed stylus was used to scribe lines for marking off measurements of woodworkers. The modern pencil, which is a piece of graphite en-cased in wood, did not come on the scene until the 1560's. Because carrying pens and ink pots outdoors was cumbersome, early pencils had knobs at the end so that they could be fastened with string or chained to a notebook, creating the precursor to the laptop computer. One of the major technological advances in pencil making occurred in the early twentieth century. Manufactures learned how to attach rubber tips to wood pencils by means of a brass clamp. In fact, the eraser substance (caoutchouc, the milky juice of tropical plants such as ficus) was called rubber because it was used to "rub out" pencil marks (Spencer, 1990). At first, some educators were against this achievement in technology arguing that students would do better, more premeditated work if they didn't have the option of revising (Baron, 2000). With the invention of moveable type, which allowed for the mass production of books, things did not change technologically in education for almost 500 years. Teachers taught a variety of subjects using basically the same tools, books and writing materials.

The Use of Sound Films

With the advent of sound films for educational purposes in the early 1930's, it was natural for researchers to compare the relative effectiveness of lectures and filmed recordings of such lectures in the classroom. Hoban and Van Ormer summarized this research in their report subtiltied Rapid Mass Learning (1950). They found that the following conclusions recurred from the research. First, when using sound film to replace live lectures or demonstrations, instruction time was reduced with no significant sacrifice of instructional results. They do strongly note however, that the use of films should not be interpreted as meaning that films could eliminate the need for instructions, only that it enhanced the effectiveness of average or below average instructors. One experiment conducted in 1947 by P.E. Vernon, showed that 50 minutes of a film demonstration appeared to be as effective as three hours of weak instruction. Second, researchers found that using sound film projected on a large screen can increase the viewing group with no loss in instructional effectiveness.

Early Television Research

As television began making headway in the 1950's, it was only natural for educators and researchers to turn their attention to a medium that offers all the potentialities of film, but at a much lower cost. Initially, the first research effort used television to expand the total audience for any given lecture. This enabled a single teacher to communicate with hundreds of students at one time. L.P. Greenhill of Pennsylvania State University first used this method in order to cope with the mounting enrolments and the lack of faculty to teach the

required classes. In his research, during the period of 1956-57, Green-hill concluded that this method would raise the standard of instruction by:

1. using the best professors to large numbers of students
2. making it possible for these professors to present demonstrations and other teaching materials that would be impossible or impractical to use under normal classroom conditions

During the 1950's and 60's television was viewed as the remedy for all the educational ills of the time, resulting in an onslaught of research studies into its effectiveness in education. Two compilations of this research were done, one by D.W. Stickell in 1963 and the other by G.C. Chu and W. Schramm in 1968. Stickell's report found that, overall, 75% of the studies showed no difference in favoring educational television over face-to-face instruction. Five years later, in Chue and Schramm' s report showed that out of 421 separate comparisions taken from 207 published reports, 308 showed no difference, 63 showed television to be superior and 50 found conventional instruction superior. The research reviewed was so wide-ranging that they concluded that TV can be used efficiently to teach any subject matter where one-way communication will contribute to learning. However, most research undertaken in this area during this time showed that new media such as film and televison showed no significiant diffence in student performance because it was used with traditional ways of teaching (May and Lumsdaine, 1959).

The industrial age of education finds the hardest working person in the classroom to be the teacher. It is the "sage on the stage" approach to teaching. There often seems to be more focus on what the teacher is doing rather than what the learner is doing. This method finds the learner in the passive role, whose job is to absorb the content presented

by the teacher. Thus, these forms of communication basically replaced the teacher, providing the same passive information. Today, many educators believe that learning is the result of what learners do and make not what you tell them. "Telling isn't teaching".

Distance Education

With the new technology available today comes a new wave of interest in distance education. Much of this is a reflection of the information age and the dynamics of the Internet as a source of information and a tool for business and education. Worldwide there are also millions of people in search of skills and credentials for employment who do not see traditional institutional programs and classroom attendance as a solution to their needs. Distance education is no new phenomenon, as colleges have offered correspondence courses since the late 1800's. The first educational television programs were created in the 1950's, and the uses of audiocassettes for language courses have been commonplace for many years. However, the emergence of on-line education removes the one-way communication of teacher to student, to two-way interaction useful for linking students with teachers and with other students.

Historically, distance education was based on the demand for education, skill development or credentials from people who were outside urban education centers. Although a hundred years separates the development of correspondence courses from online education there are interesting similarities between then and now. Both met the market model requirements, a demand, a product and a delivery system. In the late 1800's and 1900's technology also played a key role. Efficient printing presses and skilled course writers developed corre-

spondence course programs. The computer is currently the number one tool of highly skilled on-line course designers. In the late 1800's the US Postal service efficiently delivered correspondence, in the 2000's the Internet provides high speed delivery of on-line education (Bates, 1995).

Within distance education there has always been competition between the private and public providers of "correspondence school" programs. Traditionally this is an educational standard or accreditation issue. In the past it has been suggested that the private training programs were a "rip off" and the public programs offered through universities were credible. Mail order degrees were often described as not as "valuable" as lab and classroom degrees (Middleton, 1997).

Audio Recordings

Within the context of technology in education and distance education, one must examine the use of audiocassettes, which is often seen as the "big-little medium". Though print material remains the base medium for use of audio cassettes, it is often undervalued. It is perplexing why so little attention has been given to this medium by researchers, considering its wide use throughout the world (Power, 1990). One great advantage of the audio cassette is that it can be designed to be used on its own or with visuals. Other advantages of the audio cassette include the number of traditional production styles that can be employed. For example, drama, documentary, docudrama and narratives which can be used in any number of disciplines. There are no time restrictions imposed on programmes, the learner can work at his or her own pace, and finally, the learner has complete control over the playback hardware. One problem educators have found with

this technology is that audio cassettes may require up-dating of certain material when used in a course of study (Durbridge, 1984).

Radio

Beginning in the 1920's instructional radio was widely used in the United States and Britain, but with the advent of television, its use has dwindled in the United Sates. However, it is still widely employed today in Britain by the BBC schools services. The same can be said about other countries as well. An example can be seen in Japan's NHK radio English language course. Developing countries are making increasing use of radio; its principal attraction is its low cost compared with television. It is also an effective instructional medium, as much of the research has confirmed. Foresythe's review of radio research concluded: "Research clearly indicates that radio is effective in instruction. Experimental studies comparing radio teaching with other means or media have found radio as effective as the so-called "conventional methods" (Forsythe, 1970). For teaching with radio or audio recordings, it is generally accepted that essential graphic information, usually in the form of printed material, must be provided in order to exploit the potential of this medium.

Radio is seen as beneficial in education for several reasons; it can be used or enriching courses, particularly in the arts; it offers the opportunity to transmit general interest programming which effectively heightens the awareness of the population, and for larger audiences, it is cheaper than the reproduction and mailing of audio cassettes (Power, 1990). However, one major problem of the use of radio is its ability to transmit programming at appropriate times to its listening audience. Transmission times should accommodate the majority of learners'

lifestyles. If listening to radio broadcasts becomes too inconvenient for learners because of unreasonable transmission times, the merits of using this medium could rapidly decline (Bates, 1984).

Computers/On-Line Education

Writing was not initially speech transcription, and pencils were first made for woodworkers, not writers. Similarly, the mainframe computer, when it was introduced, was intended to perform numerical calculations too tedious or complex to do by hand (Baron, 2000). During the 1980's, students, faculty, and institutions embraced the use of computers for writing across the disciplines, and for financial analysis in business and statistical analysis in the social sciences. Midway through the 1990's, there was a shift in emphasis from the computer as a desktop tool to the computer as the "communications gateway" to the world. Data bases, libraries and other information sources have become increasingly accessible via computer networks to both faculty and students. Thus, it goes without saying that all over America communities are rushing to infuse technology into schools so that all students enjoy the benefits of technology and provide learning experiences geared toward developing the skills needed in the twenty-first century.

Computers are beginning to become an important technology for the conduct of on-line distance education. They provide a tool for delivering instruction, often incorporating video, sound, animation and graphics. The computer is programmed to provide feedback to student responses and can control learner routes through the course. It also can be designed to test and maintain a record of student learning. The benefits of computer based learning are that there is a consistency

in quality across training settings, and students can work at their own pace, review segments of the lesson repeatedly, interact with the computer and receive immediate feedback on their progress.   As with the audio language lab "revolution" of 40 years ago, those who expect to get magnificent results simply from the purchase of expensive and elaborate systems will likely be disappointed.   But those who put computer technology to use in the service of good pedagogy will undoubtedly find ways to enrich their educational program and the learning opportunities of their students.   As pointed out by Garrett (1991), "the use of the computer does not constitute a method.   Rather, it is a "medium in which a variety of methods, approaches, and peda-gogical philosophies may be implemented."

Impact of New Technology on the Learner

Many recent studies have stressed the importance of learner auton-omy in the learning process.   Even in the most structured classroom settings, learners are no longer perceived as receivers and processors of instruction and information, but as individuals more directly and indi-vidually responsible for the ways they learn.   In many ways, this conceptualization of learners as active contributors to the learning process echoes much of the philosophy of the information age of education.   The new technological advances in education seem to promote individualized learning, and thus create motivation to learn and succeed.   Predictions that the teacher will become the "guide on the side" not the "sage on the stage" are likely to be proved correct. The new technology in education will allow content-rich, attractive, authentic language into the classroom, and the teacher will change from being the only source of knowledge, to someone whose role is to

help students manage their own learning, set and facilititate activities and provide a framework within information can be learned, rather than merely taught (Eastment, 2000).

Conclusion

Although not all-new technologies are good, what is needed is the wherewithal to dramatically, substantively, and positively improve education at all levels. Achieving this is not, however, without costs and dislocations. It depends on a widespread sense of both excitement and commitment within academic and educational communities generally. We must begin to accept that what takes place in the classroom can be replaced by a whole host of alternative media, without deterioration in student performance.

And teachers, what will become of them with the wave of new technology? Teachers will always be needed, because of the human touch; however, their role will undoubtedly change. Teachers have always used educational technology: whether the written word, on a blackboard or in a book, represents technology which is so embedded in teaching that we hardly acknowledge its presence. The new technologies soon too will become ubiquitous, and so totally embedded in the educational context that they will become transparent, in much the same way that written communication is hardly noticed as an embedded technology today.

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