# Technology and its use in Education: Present Roles and Future Prospects

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**Abstract:**

**(Purpose)** This article describes two current trends in Educational Technology: distributed learning and electronic databases. **(Findings)** Topics addressed in this paper include: (1) distributed learning as a means of professional development; (2) distributed learning for content visualization; (3) usage of distributed learning for educational purposes within other fields; (4) electronic databases and their effect on education; (5) emergence of blended learning and knowledge management as educational fields; (6) issues in the implementation of educational technology; (7) future trends in distributed learning and electronic databases; (8) classroom applications of each technology; (9) future recommendations for the use of distributed learning and electronic databases. **(Conclusions)** Further development and use of educational technology for both teachers and students should be pursued as a worthwhile investment for educational achievement.

## The Role of Technology in Education

The role of technology, in a traditional school setting, is to facilitate, through increased efficiency and effectiveness, the education of knowledge and skills. In order to fully examine this thesis, we must first define several terms. Efficiency will be defined as the quickness by which we obtain knowledge, while the term effectiveness is associated with the amount of imparted knowledge that is operationally mastered. When technology is directly applied to an educational setting, such as a school, both the students and teachers can be viewed as learners. Thus, we can operate under the assumption that any increase in teacher knowledge and utilization has the impact of increased learning in students. Ultimately, technology should serve to increase student achievement in schools.

Technology can aid in educational achievement through two primary methods: the removal of physical barriers to learning and the transition of focus from the retention of knowledge to its utilization. Each of these methods must be examined in the context of their relation to both the student and the instructor in order to see their value and effect in educational settings.

The removal of physical barriers has allowed teachers greater accessibility in regards to professional development and graduate education. Before the age of the internet and the advent of distance learning, engaging in a learning community, such as a workplace network or a school, required a close degree of physical proximity amongst community members. Presently, there are multiple examples of the use of distributed learning technology in the educational field. First, many graduate schools have begun transitioning into programs that allow for distance education. No longer is it a necessity that teachers have geographical proximity to a university in

order to pursue higher education and certification. This trend towards online classes and educational opportunities has even become so prevalent that there are universities which consist of only online classes, allowing a teacher to complete an entire course of study through distance learning (Dempsey & Van Eck, 2007). Second, the use of distance learning is not limited to the university setting, but also found in school site, district, and state levels of professional development for teachers, with the emergence of web-based conferences and seminars.

In addition, internet based technology allows for teachers to form their own learning communities that are not confined to the local school site. For example, science teachers may use a wiki or content delivery system to network and share information with teachers at other schools both within and beyond their local school district. Even more exciting, is the premise that teachers can not only receive information and training from a central authority, such as district or state personnel, but that teachers may develop content and share their information amongst their peers. This leads to situations of reciprocal teaching and mentorship that are part of a larger informal learning community. In terms of design, online learning communities allow for a multitude discussions and socialization that adhere to a constructivist learning principle, in which people effectively learn information when experiencing and defining knowledge through social contexts (Dempsey & Van Eck, 2007).

Students also benefit from the removal of physical barriers through distance learning technology. In contrast with their teachers, who are focused on professional development related to their job performance, students are often learning new content and that content is often removed from their daily lives. This separation between the content being disseminated and the students' daily interactions and prior knowledge is even more prevalent in lower grade levels. For

example, students may learn the math necessary to balance a budget, before they even get their own checking account or have a checkbook.

However, technology can assist students in the visualization of previously unfamiliar content in a manner which assists in learning. For example, multimedia presentations, which utilize multiple formats of media, such as images, narration, and text, can be used to assist students in concept visualization. Other formats, such as simulations and games can add an extra level of interactivity between the student and the content, which turns the educational process from a passive to an active process. Proponents of multimedia adhere to a cognitive learning philosophy and view the primary advantage to multimedia learning as the usage of multiple learning channels, under the assumption that any one sensory channel can only process a limited amount of information at once (Driscoll, 2007).

Even more beneficial is the use of educational technology, in particular multimedia and simulations, to remove physical barriers such as location and financial limitations. For example, students can view images, which may even consist of videos, of distant landmarks and geographical locations, in lieu of physically traveling to the site. While it may be unfeasible to arrange a field trip for even a few students, all students with access to the internet can use three dimensional and geographic programs to figuratively walk through a distant area. The cost of this aforementioned geographical technology is one of its great advantages, as this technology can be readily accessed for no cost through technology provided by the corporation Google and their web based map tools.

Besides the visualization of content in which they have low prior knowledge, students can also benefit from distance learning, much like their counterparts in the teaching profession. Technology can be used for classes to communicate with other school sites and/or allow multiple

classes to attend hosted web conferences and seminars. For example, students studying other cultures may have the opportunity to directly speak with individuals of another nation.

Thus by removing physical barriers such as financial costs and geographical restraints, technology can allow more opportunities for both teachers and students to participate in learning scenarios or to explore content on a level that is inaccessible within their immediate environment. By not only increasing the amount of learning opportunities, but by providing even more enriching learning opportunities through simulation and multimedia we can increase the assimilation of knowledge.

The second impact of technology is one with long lasting effects on the future of education. Technology, through the development of searchable databases that are now even accessible on remote handheld devices, will change the way we define learning objectives. Specifically there is a transition from the memorizing and recitation of facts and information to the utilization of skills and the development of skills that allow for improved research and the evaluation of other sources, such as online databases.

The mass collection of knowledge leads to an evolving technological field known as knowledge management. Rosenberg (2007) defines knowledge management as "the creation, archiving, and sharing of valued information, expertise, and insight within and across communities of people and organizations with similar interests and needs, the goal of which is to build competitive advantage"(p.157). Knowledge management is the basis for an instructional method known as blended learning, where individuals are taught within traditional means such as the classroom, but also through technological means (Rosenberg, 2007). As we develop a greater reliance on technology and the advantages that come with its usage, we can expect traditional

learning for both students and teachers, to achieve a blended status, with increased reliance on technological repositories of knowledge.

For teachers, technology, in accordance with knowledge management principles, can be used to develop databases that will alter professional development. One emerging database technology is known as the electronic performance support system (EPSS). An EPSS provides professional development and job related assistance whenever an individual may need such information (McKay & Wagner, 2007). An EPSS goes beyond the simple information storage functions of a database, and can also provide case studies, templates, and situational examples for use by the individuals (McKay & Wagner, 2007). For example, if a teacher has a question on how to write lesson plans in accordance with school district requirements, they could go to an EPSS provided by the district and find instructions and information on how to perform their task. This support system allows the teacher to receive help in a very time efficient manner, as the teacher is not required to find an individual who has the specific knowledge and the time required to instruct the teacher. In addition, the higher the sponsor of the EPSS, such as a federal government sponsored EPSS, the greater the numbers of individuals that can be served by a single database and adhere to the same standards of job performance.

With the increasing prevalence of the EPSS and other such information databases that are focused on job performance, professional development will undoubtedly be changed. With information being readily available, there would be little need to mandate professional development that is primarily focused on content delivery. Cost saving methods can be utilized when a professional development activity, such as the delivery of new standards, laws, rules, or procedures, can be placed into an electronic database and a memorandum be sent regarding the updated information in lieu of the time and financial costs of requiring personnel to attend an off-

site meeting. Ideally, online databases can be used to assist teachers with professional development that is primarily based on skill usage derived from content knowledge. Given that there is only so much time that is able to be devoted to professional development, this focus on the use of knowledge rather than simply its obtainment will ultimately increase the effectiveness of professional development sessions. With more time effective professional development and the ability for teachers to quickly receive job assistance, technology can increase student achievement through the development of a highly skilled teacher.

In terms of databases and their direct impact on students, changes can be expected, as educational standards begin to focus less on the memorization of knowledge, but more on how to find and evaluate knowledge. For example, an assignment that has students recite definitions from memory on an assessment could instead have students choose the correct definition for a certain context from an electronic source which may contain multiple definitions. Students may also be asked to perform tasks that require a high level of skill, such as setting up and running a complex experiment, by utilizing support from a database to assist in the process. Thus, content leaders can develop highly complex tasks for students, knowing that the students have information available to assist them if needed. These types of activities are much more realistic, as outside of school, individuals such as engineers are not faulted if they need to reference a statistic or mathematical constant from a database. Given how expansive the world's knowledge has become, we as educators should not lead our students into inefficient endeavors aimed at creating human databases, but teach students the skills to utilize existing knowledge in their learning tasks.

Thus in regards to the effect of technology on the field of education, technology will continue to have an impact, in terms of both how we train our teachers and how those teachers

instruct their students. Specifically, technology can remove physical barriers to learning, such as geographic proximity and financial costs, through technology that facilitates distance learning. In addition, the increasing prevalence of databases can be used for job performance assistance as well as changing the way we teach students, giving a new focus on skill based performance over knowledge retention.

## Major Issues in the Use of Technology

However, to truly understand the future of technology in education, and in order to give any recommendations for the future usage of technology, we must come to an understanding of the major issues pertaining to the use of technology. Primarily, the major issues in technology can be divided into three main areas: the integration of modern technology into existing learning theory, the evaluation of the effectiveness of technology within instructional settings, and the trials of successful technology integration into similar fields. Unless technology can be supported by previous learning theories, then technology is merely a distraction to the educational process and will ultimately be needlessly costly in terms of both time and finances.

Historically accepted learning theories have a great deal of research and design principles exploring their assumptions and tenets. It is of great importance to the validity of its use that technology is compatible with previous learning theories and methodologies. Learning theories provide insight into how individuals learn and thus provide methods for designing effective lessons. Thus, technology can be used most effectively for educational purposes if it is compatible with previously developed learning theory frameworks.

Traditionally, behaviorism, cognitive learning theory, and constructivism have been recognized as the three primary learning theories in education; each theory, respectively, focuses on learning as a change in behavior, learning as an internal process followed by an application, and learning as information constructed by the learner (Driscoll, 2007). As previously mentioned during the discussion on the role of technology in an educational setting, technology, through the facilitation of social interaction, can be used in both cognitive and constructivist methods. For example, multimedia projects, simulations, and technology assisted lessons can be used to overcome the assumed cognitive load limitations addressed under cognitive learning theory (Driscoll, 2007). Furthermore, the use of online social experiences as a learning community, such as wikis and discussion boards, helps achieve the social requirements associated with learning, as designated by both cognitive and constructivist learning theory (Ravenscroft, 2011).

It should be noted that one possible limitation of previously developed learning theory is that those theories may not keep up with the increasing technological developments of our modern age. However, as long as technology serves an educational purpose, which focuses on results based in learning, then any new developments in technology should be compatible with existing learning theories. It is only when technology fails to serve an educational purpose that technology would fail to meet the standards and principles of all established learning theories. Thus, learning theory can provide an important tool for determining if technology is being used merely for the sake of technology or for an educational purpose.

However, just because the use of technology can be justified in terms of current learning theory, we cannot merely assume that the use of technology immediately and solely brings about an increase in effective learning. The use of technology within the framework of education, specifically instructional design, must be evaluated using certain empirical methods. One such

method is an evaluative method focused on training programs, known as the Kirkpatrick Four Level Model; this model consists of four broad phases of a training program: reaction, learning, behavior, and results (Kirkpatrick, 1996). When faced with a new educational program, for example, one aimed at the professional development of teachers, we can analyze its effectiveness in changing the teachers' behaviors and related job performance, through Kirkpatrick's model. Much of Kirkpatrick's model focuses on the difference in training subjects before and after the training sessions. Thus if technology is used in an effective manner within a training program, there should be quantifiable differences in terms of the knowledge learned and behavior exhibited by trainees in comparison to experimental control groups (Kirkpatrick, 1996).

The final major issue in the use of technology for educational purposes pertains to the use of technology within the educational endeavors of other fields. It should be noted that education in our world is not the sole monopoly of our primary, secondary, and university educational systems. Education is a lifelong process, and much like our teachers who must attend professional development, other professionals in fields often unrelated to the educational world must develop and attend educational seminars, professional development, and training sessions to improve their job performance, advance their careers, or learn important new information. Career fields such as healthcare, the military, and business have found novel methods of using technology to meet their constituent's needs, as well as faced unique challenges associated with using technology for educational purposes. An analysis of these fields, along with their corresponding uses of technology for educational purposes, may serve as evidence to help justify the increasing use of technology within the educational field.

The military constantly faces the challenge of delivering educational resources and training during warfare or to students with schedules and locations incompatible with traditional

classroom instruction. Thus the use of technology within the military has had to adapt to the point where there is a great degree of focus on the use of distance learning. In fact, the military has pioneered an initiative known as the Advanced Distributed Learning Initiative, which has served to increase the development and delivery of education for soldiers and staff regardless of their location (Bratton-Jeffery, Hoffman, & Jeffery, 2007).

Within the business field, the use of educational technology is focused within training and staff development programs and is following two trends: the increased use of technology in training and the global use of training (Richey, Morrison, & Foxon, 2007). The increased prevalence of technology within training programs is often associated with the need for fast development and delivery of training sessions in the business world (Richey, Morrison, & Foxon, 2007). In addition, as many companies have branches in different regions or countries, technology is allowing for the development of customizable lessons that are edited to fit into and be effective within local cultures (Richey, Morrison, & Foxon, 2007).

In terms of healthcare education, which primarily takes place in medical schools, medical education has seen an increasing use of technology designed for educational purposes. For example, technology databases, such as those hosted by the National Institute of Health, allow for easy access and communication between students and an evolving research field. As Locatis (2007) notes, "the knowledge explosion in medicine mandated the use of information systems to teach problem solving, to keep physicians current, and to facilitate lifelong learning" (p. 200). There are also reports, such as *Physicians for the Twenty-First Century*, that recommend the use of technology within the classroom setting in order to further facilitate the development of problem based learning techniques (Locatis, 2007).

Thus when examining these three fields for trends in educational technology which may be reflective upon the use of technology in traditional educational settings, such as a K-12 schools, certain similarities emerge. The first similarity is the focus of the military to meet the needs of its professional staff through distributed learning. The advantage of distributed learning in both the educational and military fields is a reduction of physical barriers, such as geographical proximity to a training center. The business world and medical schools are also following similar trends to that of the educational field, such as an integration of technology into the classroom and training sessions, as well as a reliance upon databases to facilitate a transition from information based learning to problem based learning.

## Future Prospects for Educational Technology

Given how much impact has already occurred from existing technology in a multitude of fields, further successful developments and applications of educational technology can be expected. These developments will serve to benefit any field which has incorporated technology into their educational mission. In fact, giving the aforementioned existing trends, recommendations can be made regarding the future use of technology, in order to ensure the next wave of development and innovation.

The first recommendation relates to distance learning for professional development. While it has been mentioned that distance learning may result in cost saving, especially when teachers are no longer required to travel to receive additional training, such savings may be nullified if multiple agencies are responsible for the same training content. The leaders of our profession need to establish a single entity for training delivery. For example, in the case of an

EPSS, it would be both redundant and inefficient for each school, district, or state to have their own EPSS.

In particular, the educational field should look to the military for structural and organizational guidance in the assignment of responsibility regarding professional development content. The military does not assign each individual unit of troops the responsibility of developing their own professional development. Instead, there is a higher authority devoted to the development of training, so that those in the field are not burdened by responsibility, and also to avoid the inefficiency that comes with having each unit develop similar, if not the same, content to be delivered. Utilizing technology allows one entity to develop content and training exercises and then distribute that information to all individuals who require it. The federal government, perhaps through the Department of Education, should take the initiative to develop internet based training and databases that individuals across the country can access.

Second, educators should develop assessments where student utilization of technology is not considered an unfair advantage or academic dishonesty. Much like how many professionals have access to computers and internet databases at their workplaces, students should be free to access such information during exams and assessments. This would require those responsible for developing exams to focus more on the synthesis and application of readily available knowledge than simply the memorization and recitation of specific facts and figures. However, by instituting this change in assessment focus, students can be presented with more authentic and relevant assessments.

Already in some educational settings, such as medical schools, we can see a trend towards devaluing information, which can be readily accessible through technology, and instead placing focus on problem based learning. This trend shifts the responsibility of a student from

that of merely regurgitating information to that of an individual who is responsible for the use of knowledge in a real world scenario. Hopefully, through the use of technology in this manner, we can arrive at a situation where students are being evaluated on their mastery of skills. Once this trend has developed into a concrete framework and has been demonstrated as a successful method of educating our nation's medical personnel it may be brought into earlier levels of education. With this integration of technology, as modeled by its use in medical education, we can expect to increase the skills and problem solving ability of our students in elementary and secondary education.

By following these recommendations, the aforementioned present-day trends in technology can see their effects on the field of education accelerated. This in turn may lead to new unforeseen developments and truly take our field to the next level in terms of effectively having our students learn and utilize knowledge. If present technology, such as distributed learning and informational technology systems, are to realize their potential impact in the future, we must continue to develop and support those technologies.

## Conclusions

In terms of its present status and use for educational purposes, technology is fulfilling an ever increasing role in both the traditional education field, and in other fields which are utilizing technology for educational purposes. Within the educational field we can see technology as a means of removing barriers for students and teachers alike. First, technology can remove financial and geographical barriers through distributed learning. This allows students and teachers to experience educational opportunities that they might have otherwise never been able

to encounter. Second, technology is bringing about a new focus on problem and skill based learning. Information databases, such as EPSS, are being used to assist teachers in the acquisition of new knowledge and provide professional support outside of the traditional professional development seminar. In addition, information databases are assisting students in making the transition from knowledge retention to real world problem solving.

Furthermore, technology has been shown to have sound theoretical foundations within the educational field. Various learning theories have been shown to be compatible with the usage of technology in education, especially those that attribute social interaction and simulation to forms of learning. Evaluative frameworks, normally reserved for traditional training programs, have also been successfully applied to technology based training. In other words, while providing benefits for students, the use of technology does not detract from the effectiveness of education or violate long standing educational principles. Technology can work within the educational system and does not need to be viewed as in conflict with the historical precedence of the field.

As further evidence of the educational effectiveness of technology implementation, other fields have adopted technology for their own educational and training programs. Corporations are integrating their training sessions with technology. The military has served a large role in advancing distance learning technology and delivering training to those far removed from the classroom setting. The healthcare field is using technology to prepare doctors for a future in an age of excessive information, where skills related to research and knowledge application are valued at a higher level. Each successful implementation of educational technology into other fields only serves the argument for integrating technology at every level of the traditional educational process. If technology is successful in assisting the continued development of our

doctors, soldiers, and business leaders then it is certainly able to assist the development of more effective teachers and more skilled and knowledgeable students.

Thus from examining the present usage of technology, both within the educational field and in other fields, we arrive at a need for future recommendations. In regards to future action, we should continue to utilize the successful trends in education as a means to fulfill their developmental potential and see increased impacts on our field. In particular, we should continue the use of distance learning as a means of professional development for teachers, by providing more opportunities aimed at improving their job related performance. Distance learning for students should also be an area of focus by providing software that allows for increasing authenticity in simulations, multimedia content, and social connections. We should continue to focus on technology that allows students to interact with other students and environments located outside of their current environment, locality, and culture. Information systems are also in need of continual investment. Information systems perform two important roles for the educational system: performance support for teachers and knowledge support for students. Given the large amounts of information and continuing focus on problem based learning and assessment, an increased reliance on information systems to assist in tasks is justified as a means of assistive technology. Through continued usage and development, information systems may be accepted on the level of calculators, a technology tool designed to remove excessive memorization and lengthy calculations.

In conclusion, technology has already served an important role in education in multiple fields. Specifically, technology has been of great use to the educational field in terms of its focus on improving the effectiveness and efficiency of the educational experiences of both students and teachers. Continued use and development of technology can serve to further benefit the

educational field and recommendations based on the development of existing trends in education should be pursued for great gains in educational achievement.

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