# Making Informed Decisions about Educational Technology

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## Abstract

The recent explosion of educational technologies reminds educators that we need to make informed decisions about when and how to use these technologies in our classrooms. In this paper, I construct a framework that defines educational technology, summarizes the teaching and learning process, and explores the theoretical perspectives that underlie much of educational technology decision-making. I also provide a brief historical overview of educational technology in the past century, and then discuss some e-Learning instructional design trends and impacts on student learning. By breaking down the teaching and learning process and identifying the individual components that make up that process, I provide educators with a solid foundation to make informed decisions about using educational technology in an effort to improve student learning.

# Making Informed Decisions about Educational Technology

Today, I find myself huddled in front of my computer screen reading an article entitled, "E-books in Higher Education: Are We There Yet?" (Nelson & Haines, 2010) As an instructional technologist for the e-Learning Center at Northern Arizona University, I find that I have to spend more and more time researching educational technologies. With the explosion of technology over the last 100 years, educational technology has undergone serious transformation. It gets increasingly difficult to decide when to jump on the bandwagon when you have a stream of emerging technologies continuously bombarding you. Navigating this hay stack requires that we couch educational technology within an evaluative framework that informs our decisions. Consequently, I will make an effort to position educational technology within a framework of teaching and learning by briefly summarizing the social, historical, and educational foundations of technology in American education. After that I will present some e-Learning instructional design trends, and I will briefly discuss the positive and negative impacts of e-Learning on society.

## Defining Educational Technology

Defining educational technology should seem like a relatively easy task; however, similar to most definitions in academia there is a wide range of accepted meanings. While I came across many definitions that equated educational technology with instructional technology (Ely, 2008), I prefer to use the following more holistic definition that does not exclude the educator nor the technologists provided by The Association for Educational Communications and Technology (AECT, 1994), a national organization responsible for starting the field in 1963, seems to provide.

> "Educational technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (AECT, 1994).

Here, the term technology refers specifically to the hardware, software, management systems, and other computerized material human innovations of more recent historical periods such as audiovisual presentation tools, personal digital assistants (PDAs), media, projectors, Xerox machines, laptop computers, and calculators. Following this line of thought, educational technology encompasses any technology used within the context of student learning.

**Framework of Teaching and Learning**

Positioning educational technology within a framework of teaching and learning allows educators to evaluate the effectiveness of these technologies in a variety of learning contexts. Consequently, educators rely on learning theory to inform the educational processes that these technologies serve. To begin, we will break down what constitutes the teaching and learning process by examining the components that make up an effective learning environment. Then we will summarize the role technology can play in that process.

The teaching and learning process involves just that – teaching and learning. Let us begin with defining learning. Learning is broadly defined as the transfer of knowledge and skills from one body of knowledge to a learner. Successful communication is the foundation of an effective teaching – learning process. How teacher and student individual components interact such as cognitive style, learning style, intelligence, and psychological variables combined with the physical learning environment all determine the overall success of the teaching – learning process. Communications theory frames much of how we view the field of educational technology. "The fact that teaching and learning occur in a 'sender-receiver' framework using 'communication media' frameworks to create interaction ('feedback') between the two entities

confirms communication as a theoretical base" (Ely, 2008). Nonetheless this broad communications foundation to the teaching and learning process can be broken down into the more specific Behaviorist, Cognitive, and Constructivist theoretical perspectives that truly explore the processes of how an individual learns and underlie much of the educational technology literature. These theoretical domains enlighten educators to make informed decisions about how and when to use different technologies to achieve different learning objectives.

Next, I provide a brief summary of these theoretical perspectives. First, the Behaviorist asserts that external stimuli is responsible for all behavior where rewards often determine when and if a behavior will repeat itself. Reward types include positive, negative, and no reinforcement. Learning is a passive experience where the learner reacts to the external environment. In contrast, the Cognitivist thinks that behavior is the sum result of cognitive processes, and behavior is not just a product of external stimuli. Cognitivists tend to focus on how an individual thinks through problem-solving. And finally, the Constructivist (both cognitive and social) builds off the cognitive approach and suggests that learning is unique to each individual and not just a product of cognitive processes. Learning happens when individuals construct knowledge based on their own personal experiences. As a result then, the communication foundation is broken down into various theoretical perspectives that inform the teaching and learning process. I find that I draw from my toolkit of various learning theories to design the best possible learning event for my students depending on the content, learning objectives, and individual students in my classroom.

The second step to the teaching and learning process involves knowing each learner's individual cognitive (how one thinks) and learning styles (the conditions under which best they learn) in addition to a learner's inherent ability to learn (Gardner, 1993). While I will not go into

all the different ways you can determine how one thinks and learns. I will tell you that one of the most popular tests used to determine how an individual student thinks is the Myer's-Briggs assessment. In addition, it seems that Howard Gardner's (Gardner, 1993) work on multiple intelligences enlightens many educators assessment of how students learn. Once you have determined these two important components of the teaching and learning process, then you need to assess how you think and learn as an instructor, and how your teaching style manifests itself in the classroom.

In summary, the teaching and learning process scaffolds based on how the following components of the teaching and learning process interact: communication, external environment, individual and instructor cognitive processes, and individual and instructor learning and teaching styles. When you add technology into the process, then the teaching and learning process represents the interplay between teaching, learning, and technology, which consists of all the factors defining the learning environment. Consequently, the number one idea to remember is that technology should ONLY be used when it supports teaching and/or learning. Referring back the AECT's definition of educational technology (1994), then, we can now position educational technology within this teaching and learning framework by taking a closer look at the social, historical, and educational foundations of technology in American Education.

**Social, Historical, and Educational Foundations of Technology**

Many researchers have attempted to summarize the social, historical, and educational foundations of technology in education (McLester, 2005). One thing that became clear in their work is that it became difficult to delineate learning from non learning technologies (McLester, 2005). Consequently, I am going to focus on the work of the AECT because they have served as a national organization for the use of educational technologies as a means to improve learning

since 1923, and they provide a wonderful historical overview of their work on their website (AECT, 2010).

Starting in the 20th century, sudio-visuals (from silent movies to fully fledged colorized and audio driven educational films) dominated the educational technology landscape from 1923 to the present. Audio-visual materials combined with “visual instruction” slowing competed with “verbalism” and the sole use of books for classroom instruction. The primary difference between audio-visual materials from the early 20th century to the present has to do with the delivery and format of the materials from film reel to tape to our present day digital format. Radio developed alongside movies, increasing the use of current event news and information in the classroom. With the advent of television in the 1950s and 1960s, teachers spent a considerable amount of professional development time learning how to operate, select, utilize, and evaluate the educational media and audio-visual materials to improve their instruction.

In the 1970s and 1980s, educational technology exploded with the development of video camcorders, digital CD-ROMs, and VHS video. Moreover, personal computers made their first appearance on the stage of educational technology. As a result, teachers and students could design rich learning experiences via video, audio, and the personal computer to address the multiple learning styles.

It was also during this time when I first played the role of student. While my earliest years in elementary school consisted of a teacher-centered classroom with enhancements using educational video, it really wasn’t until my 11th grade year in 1983 when my experiences with educational technology began. Having grown up in rural New Mexico, I did not have much exposure to personal computers. My boyfriend’s family had purchased one of the first Apple computers, but it wasn’t until I moved to Connecticut that I took my first computer course. I

joined my peers in the new computer lab, which was located in a separate room where we learned keyboarding and how to program in BASIC. Computer class was an elective. The teacher walked around the room as he tried to engage us with keyboarding and programming. I graduated high school without ever using a computer to type, research, or print a paper.

It wasn't until my junior year in college in 1986 that I again encountered a personal computer. Back in 1985, I took a PASCAL and COBOL programming class on a large university mainframe, but I was not intrigued by the technology nor enthralled to change my major. Computer class was dominated by men, and I was basically told not to "worry my pretty little head" over all the programming details because I would never join the ranks of computer programmers. While at that time, I did not join the ranks, it was in 1986 when I engaged in my undergraduate research project on Neanderthal thumbs. A graduate student showed me how I could use an Apple personal computer to crunch all my data. All of a sudden personal computers became a useful educational technology tool. Nonetheless, I graduated college with my Brother typewriter in hand, and once again I had never typed a paper on a personal computer as an undergraduate in college.

I returned to school in 1991 to learn Geographic Information Systems. I learned to program in a proprietary G.I.S. programming language, and I designed and analyzed complex geographic databases on both a mainframe and personal computer. G.I.S. like many fields was just one of a whole slew of technologies on the horizon. In 1995, as a graduate student in archaeology, I was taught all the desktop applications that I was expected to use throughout my career as an archaeologist.

In 1997, I changed my career to educational technology and started designing internet-based, VHS enhanced correspondence courses. Then, in 1998 I learned how to program in Flash,

Microsoft Visual Basic, Java, ASP, DHTML, and JavaScript, so I could develop rich, interactive, multimedia, educational experiences for web delivery. I also took many of the courses to become a Microsoft Certified Engineer and Software Programmer. I managed several small LANs and a web server. I had finally joined the club.

In more recent years, all of the client-based applications are slowly being replaced by internet-based and Web 2.0 applications. Consequently, the explosion of technologies has certainly impacted education across disciplines in so many different ways. Yet it is the similarities in how educational technology is used in each field that can help us to position educational technology within this framework of teaching and learning. Prior to Web 2.0 applications, educational technologies were primarily used by teachers and students for content creation, research, data analysis, synthesis, presentation, interaction, and higher order thinking. With the introduction of Web 2.0, Siemens and Tittenberger (2009) argue that the new educational technologies are primarily used to a**ccess** resources, declare or state **presence** (as currently online or in declaring physical proximity through GPS), **express** through tools such as Second Life or profile features of most social networking site, **create** new content and resources through blogs and wikis, **interact** with others through asynchronous and synchronous tools like discussion forums, Twitter, Skype, ELGG, and **aggregate** resources and relationships through Facebook, iGoogle, or NetVibes (Siemens, G. & Tittenberger, P., 2009).

Web 2.0 technologies including blogs, wikis, social bookmarking, podcasting, image sharing, video, open educational resources, micro-blogging, social networking software, aggregation software, games, virtual worlds, and simulations are finally making headway into the field of educational technology. Consequently, this brings us in full circle to my original dilemma. How do I navigate my way through these emerging technologies and decide if any of

them will aid the teaching and learning process? First, I use the teaching and learning framework outlined in this paper to determine whether or not I want to use a particular educational technology for my instruction. And finally, I constantly evaluate the effectiveness of the technology to establish if its use will have a positive or negative impact on student learning.

**Technology, Society, and e-Learning**

When consulting with faculty as they design their online course, I draw from the teaching and learning framework outlined in this paper as well as use Wiggins and McTighe's (2005) backwards design to frame our conversations. In addition, I encourage professors to create a safe and welcoming environment with a high degree of instructor-student, peer-peer, and student-content interaction. I also encourage faculty to serve as highly visible motivating facilitators, or guides on the side, who state clear expectations and encourage participation in this learner-centered environment. As a result, courses tend to materialize as technical manuals or books filled with bits of digital knowledge that are pieced together for delivery. (Downes, 2005) The design is organized in a standard way, "as a course divided into modules and lessons, supported with quizzes, tests and discussions." (Downes, 2005) The course is delivered through the university's learning management system (hereafter, LMS), Blackboard Vista, which the university manages and controls using the university authentication system. Students do not choose what they want to learn. "Content is organized according to this traditional model and delivered either completely online or in conjunction with more traditional seminars, to cohorts of students, led by an instructor, following a specified curriculum to be completed at a predetermined pace" (Downes, 2005).

The online course, as described above, is the prevalent model in the United States; however, the model is evolving beyond this course presentation model toward a creation model.

Building on a constructivist, learner-centered design, e-Learning is putting even more control of the learning into the hands of the learner through the development of personal learning environments (hereafter, PLE) (Downes, 2005; Ferriter, 2009; Lubensky, 2006; Green, H., Facer, K., Rudd, T. with Dillon, P., & Humphreys, P., 2005; Webinar,). The learning management system becomes an environment where learners aggregate collections of Web 2.0 applications that support the student's learning goals based on their own needs and interests. It is an environment, rather than a system, much like a personal portfolio tool, in that it represents a collection, interpretation, and reflection of their work. Much more than an e-portfolio, it also is a place where they have a conversation with networks of people via multimedia, texts, or any other digital content, and it is a place where they demonstrate how what they have learned is personally relevant. Schools and individuals will still have to face copyright, intellectual property, accessibility, security, and privacy challenges, but the face of e-Learning is changing (Downes, 2005; Downes, 2008).

PBS Frontline recently aired *Digital Nation life on the virtual frontier* (2010). While watching students sit in a lecture hall, face booking, micro-blogging, texting, commenting, viewing, creating, and posting digital content that had nothing to do with the professor's lecture, I could not help but think that the students are rejecting the passive lecturer. They are not tolerating this type of instruction at the university-level. If we want to prepare our students to be successful, informed, critical thinkers, then we better think about how to change this LMS-managed learning environment. In doing so, we still need to use this solid teaching and learning framework to inform how best to design our instruction. Following this line of reasoning, the PLE in conjunction with mobile computing are a logical next step for best practices in online

instructional design. The evaluative framework supports the idea of moving away from a presentation model to a more constructivist creation model.

Regardless of the model used, the positive impacts of e-Learning on society and student learning are tremendous. As an online faculty member for the University of Phoenix, I can confirm that students who would have not had the opportunity to earn a degree are being given that opportunity. I have more non-traditional students enrolled in my online courses than the traditional 18-21 year old high school graduates. In particular, mothers who are returning to school after raising their kids dominate my online discussions. These non-traditional students are taking advantage of the time and place independence of an online degree. On the other hand, the negative impacts are not as obvious. Unfortunately, online learning is not for everyone. If courses are not designed to address different learning styles, then that segment of the population tends to drop out. Moreover, to be successful in the online environment, you must have access to the technology as well as be a self-motivated learner with excellent time management skills. Many online programs are designing first year sequences to retain these students. Yet I would argue that this is not just an online phenomenon. Resident campuses also face the same retention challenges for many of the same reasons. In any case, e-Learning is not going away, and yet how we create and deliver content continues to evolve. To conclude, I argue that the evaluative framework presented here can still inform us on how to make decisions about the use of educational technologies in any learning context. Marc Prensky sums it up nicely in his appearance on *Digital Nation* (2010):

> "The reason a lot of people are stuck…is because they confuse the old ways, the best ways of doing something once with the best ways of doing those things forever. It is not that kids shouldn't learn to communicate. It is not that they shouldn't learn to express

complex ideas. Of course, they should still learn all those things. Those are what we call the verbs. The nouns that they use, whether it is the essay, or the paper…the video, or the podcast, that is what changes. The learning may stay the same, but we invent new ways of teaching. And I don't know that the book, which was for a long period of time...the way that people did this… is the best way in the 21st century" (Digital Nation, 2010).

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