

A Quick and Easy Guide to Educational Technology History

I. Major Issues with Teaching and Technology

Using technology as the teacher. Historically, in the field of instructional technology, it has been the technology itself that has facilitated instruction. For instance, earlier research focused on technologies like filmstrips or computer assisted instruction systems like PLATO (Programmed Logic for Automatic Teaching Operations) and TICCIT (Time-shared, Interactive, Computer-Controlled Information Television) that removed the teacher from student learning. This early instructional technology research from the 1970's corresponded with popular behaviorist learning theory that was being examined at the same time.

Developing instructional design system models. In the late 1970's and for much of the 1980's, research focused on developing efficient instruction design system models in which computers were used as a tool to automate an instructional design task. For example, the Dick and Carey model (1978) and the Gelach and Ely model (1980), provided a specific process oriented method to manage instruction in classrooms using technology. As the availability of computers to the general public and classrooms increased in the late 1980's through the mid 1990's, there was still not much evidence of teachers using computers in another way than direct instruction. Most research assessments showed that teachers were using technology mainly for drill and practice.

Access to technology and the Internet refocus research. As the Internet began its boom in the mid 1990's, there as a definitive debate that changed the focus of future research. Many researches have come to refer to this debate as "the great media debate." This marks the last

time where cross media comparisons were debated in the research. Thus, the focus of research has moved away from which instructional strategy is better, teaching with or without technology. Beginning in the late 1990's and continuing today, research now focuses on what pedagogy a teacher uses with a particular technology tool.

Using the appropriate pedagogy with the technology. It became clear that the capabilities of technology allow instructors a new wealth of instructional tools that were not possible without the use of the specific technology. The research focuses on how teachers facilitate student use of technology to construct meaning. For instance, instructor interact with rich forms of media like networked database, multimedia tools (ie hypermedia, and interactive demonstrations and exercises. Specific student-center instructional approaches were researched.. This included Jonassen's "mindtools" examples and problem based learning. Unfortunately, despite this call to use technology in innovative student-centered ways, critics like Cuban clearly show to gaps between how researches suggest teachers should use technology and how teacher are in fact using technology in classrooms. Currently research continues to explore ways that technology can be used to transform instruction still teachers are using technology to replace traditional instruction. Some researchers are suggesting that until teachers teach with constructivist learning strategies in mind technology integration will be effective in changing teaching strategies.

II. Research Methodology in Educational Technology

Specifically, the research methodologies in the field have been split between experimental (quantitative) research and observational qualitative methodologies. Typically, the experimental research focuses on how a particular technology tool is being used as an intervention into classroom practice. This method has been used quite frequently, but it

doesn't provide much detail at how an instructional strategies is being used in the classroom. Consequently, the area of qualitative research is becoming more accepted as a way of observing the use of technology in instructional strategies to depict an overall picture of the classroom environment with technology.

III. Research questions specifically tied to Education Technology

The field of educational technology reaches into every subject matter area. Following the "great media debate" the focus of the research questions has moved away from cross media questions, and moved to research questions that investigate how instructional strategies are used with specific technologies. The capabilities and uses of early technologies in the 1970's were very directive in nature, but because newer technologies are more constructive in nature, research focus on teachers pedagogy with a specific technology.

IV. Influences on how Research is Conducted in Educational Technology

The driving force on how research has been conducted in the field has been the invention and adoption of technologies themselves. As new technology was developed, new research was conducted. For example, research was conducted with audiovisual media in the 1970's in such journals with titles as *Visual Communication Review*. This gave way to current research incorporating new types of technology in such journals as the *Educational Communication and Technology Journal* started in the early 1980s. The interests then moved to conducting research on how instructional systems design can be used to modify teaching strategies in journals like the *Journal of Instructional Development*. As microcomputers became prevalent in classrooms, research was conducted in such journals as *TechTrends* that focused on the uses of these different technologies. When the field moved away from examining one technologies benefit over another in cross media research, the journals once again changed its

name to Educational Technology Research and Development. The fluctuation in different media used has created change in the names and types of journal the field uses. Consequently, the research focus has changed several times in the past thirty-five years

V. Areas of Interest

Although the field of research seems to have moved away from cross media debates, it doesn't seem that the fields of practicing teachers have. Much of the technology infrastructure is already outfitted in classrooms, but many teachers seem to use technology to teacher in same manner they always have. It makes one question, if it wasn't for efficiency, would the teacher use technology at all. Although the field of research has focused on the affordances of various technologies and their influence on instructional strategies, there is still a disconnect between what is being reported in research as best practices and how teachers are currently using technology in their classrooms.

A Summary of Reviewed Articles and Text arranged chronologically

Using Technology in a Directive Manner

Commission on Instructional Technology (1970). To improve learning: An evaluation of instructional technology (Vol 1). New York: Rowker

Developed by the US government, this report provided a historical perspective of how Instructional Technology had been used to improve learning up until 1970. It investigated audiovisual instruction, especially instructional television. The report concluded that media “had a minimal impact on educational practice.” For instance, such instructional examples were as mediocre as a teacher delivering a lecture on film.

Pagliari, L. A. (1983). The history and development of CAI: 1926 – 1981, an overview. *Alberta Journal of Educational Research*, 29(1), 75-84.

Pagliari’s article highlights two examples of Computer Assisted Instruction, PLATO (Programmed Logic for Automatic Teaching Operations) and TICCIT (Time-shared, Interactive, Computer-Controlled Information Television). In each of these examples, the teacher and traditional classroom model was replaced with a computer assisted instruction. These two projects received a combined \$60 million from the National Science Foundation, and were both evaluated by the Educational Testing Service (ETS).

Suppes, P. & Macken, E. (1978). The historical path from research and development to operational use of CAI. *Educational Technology*, 18(4), 9-12.

This article keeps the focus on computer assisted instructions impact on the field. This article highlights other research projects that were developed at the same time as PLATO and TICCIT. The article highlights an unknown future for CAI because many of the projects began with great promise to improve instruction but nothing significant had developed.

Lockee, B., Moore, D., & Burton, J. (1996). Foundation of programmed instruction. In D.H. Jonassen (Ed.), *Handbook of research for educational communications and technology*, 2nd Ed. Mahwah, NJ: Lawrence Erlbaum Associates.

Relying on much of the research Skinner did with behaviorism. This article discusses how programmed instruction continued to be an influential part of the instructional technology research.

Instructional Technology Design and System Models

Dick, W., & Carey, L. (1978). *The systematic design of instruction* (1st ed). Glenview, IL: Scott, Foresman

Gelach, V.S, & Ely, D. P. (1980). *Teaching and media: A systematic approach* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

The field of instructional systems design began to influence the field of educational technology. In addition to these two prescriptive models on how to design instruction, nearly forty other similar models were developed. As microcomputers became available to the general public, computers began to be used as tools to automate some instructional design tasks. Such models continued in prevalence through the 1980’s as computer based instruction took charge.

Office of Technology Assessment (1995). *Teachers & technology: making the connection*. Washington, DC: Author.

Anderson, R. E., & Roonkvist, A. (1999). *The presence of computer in American Schools: Teaching, learning and computing: 1998 national survey (Report #2)*. Irvine, CA: Center for Research on Information Technology and Organizations. (ERIC Document Reproduction Service No. ED 430 548).

By the mid-1990's the impact of computers on instructional practice in schools remained small. Substantial numbers of teachers reported little or no use of computers for instructional purposes. A national average of one computer for every nine students in 1995, was reduced in 1998 to one computer for every six students. Most teachers in primary levels were using computers primarily for drill and practice and at the secondary level the use was limited to computer-related skills such as word processing. Largely, the increased presence of technology in schools did not necessarily mean an increased use of that technology for instructional practice. Because of the increased presence of media in schools it was hard to determine what its impact was on instruction.

The Great Media Debate

Clark, R. E. (1994). *Media will never influence learning. Educational Technology Research and Development, 42(2), 21-29.*

In this article, Clark continued to make his claim that media are "mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" Clark argued that instruction, regardless of what type of media is used (computer, video, or text) is all the same. For example, you can teach addition by 10's by using cubes and rods (groups of 10 cubes). The teacher can use one method to instruct students using this the cubes and rods (media) or use the same method using a different media like a electronic manipulative on a software program.

Kozma, R. B. (1994). *Will media influence learning: Reframing the debate. Educational Technology Research and Development, 42(2), 7-19.*

Kozma argued that instruction is completely tied to the media being used. Instruction is interrelated with the media, method, and situation being used. For instance, take a situation where students are presented with a problem in a video that involves the cleanliness of their water sources around them. Electronic probes are used with instruction to collect data about water samples and emails are exchanged with local governmental officials. The instruction that occurs would be completely different based on the situation the media places the teacher and students in.

Jonassen, D. H., Campbell, J. P., & Davidson, M. E. (1994). *Learning with media: Restructuring the debate. Educational Technology Research and Development, 42(2), 31-39.*

Jonassen said the debate between Clark and Kozma needs to change. The comparison between learning with media or without media can't be made. When making a cross media comparison (ie. learning with a tool or without a tool), teaching and learning are completely different. We should not focus on the value of the tool itself, instead, Jonassen made put the focus on what pedagogy should be used when using a technology tool. Today, the focus in the field of instructional technology research has been focused on how students learn with media and how teachers can influence this.

Finding a the pedagogy that fits

Savery, J.R. & Duffy, T.M. (1995). *Problem based learning: An instructional model and its constructivist framework. Educational Technology, 35(5), 31-38.*

This article calls for teachers to make instruction with technology something larger than simple tasks. These are complex problems that require teachers to design authentic tasks that reflect the complexity of the environment which supports and challenges the learner's thinking. New to the role of the instructor is to act as a facilitator and tutor as groups of student interact with one another in small groups. Problem based learning (PBL) requires significant changes in curriculum, student assessment, teacher's role with instruction, student's roles, and school organization.

Clark, R. (1998). Building expertise: Cognitive methods for training and performance improvement. Washington, DC: International Society for Performance Improvement.

Ruth Clark laid out specific instructional styles that correlate with the student experiences from novice to experienced learners. These are detailed below.

- *Receptive – Lecture or an Internet Site where the student is merely provided with information.*
- *Directive – Instruction is characterized by a computer based tutorial where information is presented, the student responds, feedback is provided and this tutorial learning cycle is repeated*
- *Guided Discovery – a computer simulation that allows the student to manipulate some device or environment*
- *Exploratory – an open learning environment in which the student is provided a rich, networked database of information, examples, demonstrations, and exercise from which the student can select whatever is appropriate to their current needs and mental models.*

Jonassen, D.H., Carr, C., & Yueh, H. (1998). Computers as mindtools for engaging learners in critical thinking. TechTrends, 43(2), 24-32.

In Jonassen's article on "mindtools," he moves the focus from learning from a computer, to learning with a computer. Mindtools are technologies that support the construction of knowledge using technologies. For instance, he lists numerous technologies that instructors can use in learning situation like, databases, concept mapping, microworlds, hypermedia, and conversational tools. Teachers are then tasked to help develop these tools and help students use these to construct knowledge with them.

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory*. Mahwah, NJ: Lawrence Erlbaum Associates.

Within a constructivist learning environment, instruction comes in the form of modeling, coaching, and scaffolding. Using modeling an instructor shows or demonstrates the how and why in completing activities and objectives. An instructor also facilitates coaching by motivating learners. Instructors are also called to have student analyze their performance, and provide feedback on their performance. Finally, by scaffolding, an instructor can support a learner by structuring and restructuring tasks to provide assessment.

International Society for Technology in Education. (2000). National education technology standards (NETS). Retrieved October 1, 2007 from <http://cnets.iste.org/>.

With so much technology available in schools, it became apparent there where teachers that just didn't know how to use this technology in learning situations. Consequently, the International Society for Technology in Education(ISTE), developed national educational technology standards that were suggested guidelines on how technology should be used in schools. Although this report is ambiguous in what a model teacher using technology looks like, it's clear that teacher are to "plan and design effective learning environments and experiences supported

by technology.” *Instructional strategies apply technology to support learner-centered approaches, this is quite different than earlier directive approaches.*

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal*, 38, 813-834.

Cuban makes quick order of pointing out the gaps between what the research at the time was investigating and what was actually going on in classrooms. His suggestion is that despite the call to use computers in innovative student-center ways, there are still few examples of teachers changing their instructional strategies when using technology. He points out that teachers are using it as an additional tool, but it hasn't changed their instruction at all.

Ertmer, P.A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53(4), 25-39.

Ertmer recognizes the capabilities of teacher technology uses, but admits teacher use of technology is still focused on teacher-centered instructional approaches. She suggests that effective technology integration comes when teachers align themselves with constructivist pedagogy, have convenient access to technology, are adequately prepared to use the technology, and have some freedom in the development of their curriculum.

Research methodologies

Ross, S.M. & Morrison, G. R. (1996). Experimental Research. In D.H. Jonassen (Ed.), *Handbook of research for educational communications and technology*, 2nd Ed. Mahwah, NJ: Lawrence Erlbaum Associates.

In this report, Ross and Morrison, dictate in the most prescriptive way a “how to” guide on how to conduct research in the field of educational research. This guide includes the use of randomized field experiments and the basic-applied design learning replication. The basic-applied design approach that Ross and Morrison list contains seven specific steps from selecting a topic, indentifying a research problem, conducting a literature survey, stating the research question, design research, determine methods, and determine data analysis techniques.

Once again the use of media comparison experiments is thought of as unproductive to research. Instead experiments are conducted with media. For instance, they success how media differ in their capabilities and instructional strategies and how the instructional strategies are altered or different from media presentations.

Savenye, W. C. & Robinson, R. S. (1996). Qualitative research issues and methods an introduction for educational technologists. In D.H. Jonassen (Ed.), *Handbook of research for educational communications and technology*, 2nd Ed. Mahwah, NJ: Lawrence Erlbaum Associates.

Qualitative research has always been a part of educational technology research. Examples include researchers that basically just observed how media was used in a classroom. Cases studies were also used but they were not capable of being generalized. The field of educational technology has begun to except more examples of qualitative research as long is conducted with “rigor.”