Historical Evolution of Instructional Technology in Teacher Education Programs

by Anthony K. Betrus and Michael Molenda

Contrary to popular perception, technology is not new to teacher education programs in the U.S. Skills in using technological media in teaching have been included since the early 1900s. We will review the evolving content and methods of technology training in American teacher education, tracing the changes from the 1920s to the early 2000s. We will show that this evolutionary process was dramatically affected by the popularization of computer technology in the 1980s, leading to a situation in which we now have the co-existence of two rather different types of pre-service instructional technology courses-those that feature a balanced treatment of the various traditional and computer-based media and those that focus primarily on computers. Although we do not have good information about what media are being used and how they are being used by teachers and students, there are indications that the "computer-focused" courses may be neglecting an area of training that is still needed by teachers-how to successfully integrate traditional media into classroom instruction as well as computer media.

EARLY VISUAL INSTRUCTION COURSES: 1920S AND 1930S

While it is not clear when the first course that focused on the use of technology to support instruction was taught to pre-service teachers, "Probably the first official credit course in visual instruction was given at the University of Minnesota in 1918 by Albert M. Field" (Saettler, 1990, p. 149). In the 1920s, Anna V. Dorris analyzed survey results from 30 normal schools and 37 universities regarding their provisions for teaching visual instruction. She determined that the normal schools were beginning to teach separate courses in visual instruction in summer sessions, although the content of these courses had yet to become consistent. Film collections were also beginning to proliferate, especially in universities (Dorris, 1928).

In the next decade, Stracke (1932) documented the number and content of introductory courses in visual instruction, and five years after that, Starnes (1937) conducted a similar survey at the end of what he referred to as the "pioneer stage" of the visual instruction movement. The purpose of his study was to "determine

the present status of the visual instruction courses in the United States [as] the instructors in these courses have little to guide them in preparing their syllabi" (p. 315).

After conducting a survey of the instructors who taught visual instruction courses, Starnes made recommendations for the course content based on the most frequently taught topics, including a sample course outline. In this course outline, the first topic he proposed was "a brief history of visual instruction," followed by "the psychological background for the use of visual aids" and then "a discussion of results of experimentation with visual aids" (Starnes, 1937, p. 13). After foundation was placed, the 10 units that followed were related to the use of various media , including flat pictures, globes, object-specimen-model materials, motion picture, and others (Starnes, 1937, p. 13).

Starnes found that visual instruction courses also included some non-device-related topics such as "the history of visual education" and the "psychological justification for the use of visual aids," as well as many device-related topics (p. 316). Some of these device-related topics included

"technique in using the stereoscope," "technique in the use of motion pictures," "technique in the use of lantern slides, film slides, and opaque projectors," and "mechanics of projectors and projection" (Starnes, 1937, p. 316). Another major consideration was the advantages and limitations to using the various instructional devices. These devices were assumed to be used primarily by teachers in the classroom setting, rather than by students. There were a few notable exceptions that called for involving students in using technology, including pupil-made glass slides, photography, and models (Starnes).

A GRADUAL EVOLUTION OF CONTENT: 1940s, 1950s, AND 1960s

In the ten years following Starnes's 1937 study, there were many changes in the landscape of media in education. Access to technology grew as did the use of media in schools. New technologies emerged, especially those associated with audio recording and playback. This evolution is reflected in the name of AECT's predecessor organization, which began in 1923 as the Department of Visual Instruction (DVI), a unit of the National Education Association. DVI changed its name to the Department of Audio-Visual Instruction (DAVI) in 1947 (Saettler, 1990). Not surprisingly, the content of the introductory technology course taught to pre-service teachers also expanded to include audio materials.

Through four national surveys of educational media courses-in 1947, 1957, 1967, and 1977, DeKieffer & DeKieffer (1977) documented this expansion, along with other changes in

Table 1. Ranks of Various Items of Content Included in Introductory Courses in Educational Media

Item	Rank			
	1947	1957	1967	1977
1. History and philosophy of educational media	5	5	7	11
2. Operation of equipment	3	1	3	1
3. Production of audio-visual materials				
a. Photographic materials	8	8	10	10
b. Non-photographic materials	7	6	5	4
c. Radio script writing, transcriptions and recordings	9	9	8	6
d. Video	10	10	12	9
e. Other types of productions	-	-	13	12
4. Selection of materials	2	4	2	3
5. Utilization of materials	1	2	1	2
6. Evaluation of materials	4	3	4	5
7. Administration of educational media	6	7	11	13
8. Theory of communication	-	-	6	7
9. Instructional systems	-	-	9	8
10. Other items	11	11	14	14

the course (Table 1).

The period between 1947 and 1957 saw a rapid increase in the number of institutions offering an introductory course in audiovisual instruction. Initially extension divisions offered these new courses, and later schools of education offered them (DeKieffer & DeKieffer, 1970) . In 1957, the Soviet Union launched the first space satellite, Sputnik. Together with other influences, this resulted in the United States Congress passing the National Defense Education Act (NDEA) in 1958. This proved to have a significant influence on the introductory technology course. The NDEA spurred momentum for teaching with technology, with a primary focus on winning the "space race" with the Soviet Union. The federal grant funding opportunities associated with the NDEA during the "golden years" of the 1960s were discussed at "systems" conference held at Syracuse University in 1964 (Ely, 1998, p. 14). Along with discussing various federal funding opportunities, a national trend was identified, recognizing that: "With an increasing interest in a comprehensive approach to instructional development, a systems approach was being advocated by leaders in the field" (Ely, 1998, p. 15).

By 1967, recent innovations in communications technology, along

with advocacy for the systems approach in the professional field, were reflected in the introductory technology course through the addition of two new topics. Neither "theory of communication" nor "instructional systems" were listed as being taught in the introductory technology course in 1957, but were ranked six and nine respectively in 1967 and seven and eight respectively in 1977 (DeKieffer & DeKieffer, 1977, p. 61).

Concomitant with these changes was a significant drop in popularity in the topic "history and philosophy of educational media" from number 1 in 1937, to number 5 in 1947 and 1957, to number 7 in 1967, and finally to number 11 in 1977. DeKieffer & DeKieffer's interpretation was that "In the area of history and philosophy of education media, there appears to have been a de-emphasis with the increased importance on the theory of communication and instructional systems" (p. 62). They also noted that that "... over the years there has been very little shift in the ranking of the four basic ingredients, namely, operation of equipment, selection, utilization, and evaluation of materials" (p. 61).

Thus, you could say that by the late 1960s the educational media course had assumed an archetypal form: focusing on teacher utilization of audiovisual media, with an emphasis on the skills of utilization, selection, operation, evaluation, and production of audio and visual materials; all of which was animated by theoretical notions drawn from communications and systems theory. This template is still visible in the older or "classic" form of the introductory instructional technology course.

The Information Age: 1980s and 1990s

Throughout the 1980s and 1990s, there was an increase in digital technology innovations. The proliferation of the computer in society during this time accelerated the transition from an industrial age to an information age. Teachers began to incorporate a new tool in their classrooms. Saettler (1990) articulated this point:

> A new hope for the use of the computer in education arose in the late 1970s when the first microcomputer became available to a growing market. By the early 1980s, school systems began to invest heavily in microcomputers for classroom use, and, by 1985, it was reported that there were at least one million microcomputers in American elementary and secondary schools. By 1988, the estimate was as high as three million! (p. 457)

McCutcheon conducted a survey in 1984 just as this trend started to have ramifications in the content of the introductory technology course. He surveyed instructors in the Midwest to determine what factors determined the content of introductory media courses. He found that the topics taught in the course focused on teaching pre-service teachers to produce materials, operate equipment, and apply materials and equipment to instruction (McCutcheon, 1984). One topic of interest was "Computer-assisted instruction," which instructors covered in two-thirds of the courses. This placed it at number 40, tied with "How to produce demonstration and display boards" and "How to operate the spirit duplicator." Another topic not listed in the top dozen was "How to operate a microcomputer/printer," which instructors covered in just over half of the courses they taught. This topic ranked at number 46, tied with "Instructional research related to the use of media".

Through the late 1980s and 1990s the personal computer continued to proliferate in public schools. By 1995 the number one trend in educational technology was: "Computers are pervasive in schools and higher education institutions. Virtually every student in formal education has access to a computer" (Ely, 1996, p. 15). The proliferation of the computer in education and society at large spurred an important evolutionary step in the changing nature of the introductory media course.

Two Categories of Introductory Course

Prior to the proliferation of the computer in society and public schools, there were many schools of education that did not have an introductory media course. As the computer became more and more ubiquitous in society, societal forces caused many schools to start an introductory technology course to teach pre-service teachers to use the computer. These societal pressures led an American Association of Colleges for Teacher Education (AACTE) task force on technology to produce a paper outlining "The Challenge of Electronic Technologies for Colleges of Education" (Uhlig & Tucker, 1988, p. 5). This paper attempted to help deans of colleges of education to address the issue of electronic technologies in their teacher education programs. Often this led to the creation of a new introductory technology course, focused on computer technology, and with no ties to the introductory courses that had evolved earlier in the twentieth century. Along with these new courses emerging to teach the computer, the content of the older or "classic" introductory technology courses shifted to include computer technologies, as was seen in the addition of computer-based topics in newer editions of textbooks used to teach the introductory media course.

Thus, there are two types of courses, which can be categorized by the time that they were initially offered and their relative focus on computer-based technologies. The "classic" course evolved from previous courses introduced from 1922 through the 1970s and can be associated with interests of members of the Association for Educational Communications and Technology (AECT), successor to DAVI. It maintained a balanced concern for all sorts of media, including computer-based media. The "new" course emerged in the 1980s, and 1990s primarily to teach computer technologies, ignoring the earlier technologies, and is more closely associated with the content interests of the membership of International Society for Technology in Education (ISTE).

In a survey of a large national sample of instructional technology instructors in 2000, Betrus found that about one-tenth of their introductory courses could be classified clearly as the classic type, with a low emphasis on digital media; another seventeen percent had a "moderate" emphasis on digital media. So, at most, only about one-quarter of all current courses would fit the classic mold.

Both courses continued to be offered through the 1990s and into the early 2000s. After the introduction of the computer into society came the introduction of the Internet. The computer, along with the Internet, helped the acceleration toward a global competitive economy. Participation in this worldwide community and access to the information contained in computer software and on the Internet required a new set of skills. Societal forces urging the teaching of computer skills in public schools also encouraged pre-service technology courses to inform teachers how to teach their students how to use computers. These forces affected the content of both types of courses.

The most recent and comprehensive survey of pre-service instructional technology course content at the undergraduate level is Betrus' 2000 study, in which he provides a list of the dozen most popular content items, as shown in Table 2.

Of these 12 topics, 9 were computer-based topics, with the top 7 all being computer-based topics. The remaining three topics were instructional design, technology integration, and trends/ethics/issues. In the last national

survey of the undergraduate introductory technology course conducted 23 years ago by DeKieffer (1977), there were no computer-based topics taught. Sixteen years ago, McCutcheon (1984), in his study of 39 mid-west institutions, showed that no computer-based topics had broken the top 12. This demonstrates a dramatic change in the introductory technology course—a nearly complete shift towards an emphasis on computer-based topics—in just 16 years.

METHODS FOR TECHNOLOGY TRAINING

Since the 1920s, technology training for teachers has typically taken the form of a single, separate course. The nature of this course has evolved over time, but not the assumption that a free-standing course is the best solution. Actually, there have been doubters and innovators throughout the years. In the late 1960s there was movement to integrate technology skills in various components of the teacher education program, particularly the "general methods" course and the "practice teaching" experiences. Experiments of this sort have persisted over the years, but have always remained a minority position, at least in terms of abandoning the freestanding course altogether. As of 2000, fully 80 percent of deans of education reported that technology skills were taught in a separate course. Furthermore, the hours of credit were typically set at 3 hours , a number that has been consistent for many years, even as the potential content of the course has expanded exponentially (Betrus, 2000).

TEACHER USE VS. STUDENT USE

The issue of whether "teacher use" or "student use" of technology was of primary importance has evolved greatly since the time of Starnes's 1937 survey. Betrus found that although 76 percent of courses still emphasize teacher use of technology, half of them also put "strong" emphasis on student use; in fact, if you combine "moderate" and

Table 2. The 12 Most Frequently Taught Topics in 2000

Rank	Topic	% of courses
1	Internet / world wide web	95
2	Presentation software	90
3	Word processing / desktop publishing	87
4	E-mail / discussion groups / newsgroups	84
5	Spreadsheets	83
6	Software evaluation	80
7	Databases	76
8	Trends / ethics / issues	74
9	Technology integration	72
10	Multimedia authoring	66
11	Instructional design	60
12	Hardware installation and troubleshooting	46

Source: Betrus, 2000

"strong" emphasis, fully 84 percent stressed student use. The changing emphasis is consistent with the Constructivist pedagogical theory that was also increasingly taught in colleges of education since the early 1990s. That theory encourages teachers to involve students in activities in which they discover or create their own meanings rather than passively receive meanings given by teachers, textbooks, and mediated materials. Thus a Constructivist approach would emphasize student use of word processing, spreadsheet, and presentation software as opposed to teacher use.

ACTUAL CLASSROOM IMPLEMENTATION

The degree to which various technologies are taught in the introductory technology course is one question. The degree to which they are actually used by teachers is another. This leads to a significant research gap that is often overlooked. Molenda and Harris (2001) reported that overall there has been little research in recent years to track school use of the traditional audiovisual technologies. We really don't have good information on the alignment between what is taught in pre-service technology courses and what teachers do with technology in the schools.

There is, however, fragmentary evidence that teachers do continue to use the traditional media to a substantial degree. For example, Molenda and Harris cite reports from regional media centers to indicate that circulation of video programs was holding steady after a decline from the high point in the late 1970s. In one small-scale survey, a sample of school technology coordinators reported that about one-third of all teachers used video programs, from cable or satellite systems, on a regular basis and that about one-third of all teachers use the overhead projector daily. (Misanchuk, Pyke, & Tuzun, 1999).

Despite these indications that teachers tend to use the traditional audiovisual media at least as heavily as computers, it appears that these media may be neglected in pre-service teacher education programs. A large-scale survey of teachers in Virginia (Center for Community Research, 1999) found that only five percent of teachers reported that they learned how to use video for instruction in their pre-service courses, while 63 percent said they were self-taught. Thus, there is a potential incongruence between what is taught in the introductory technology course and what is being practiced in classrooms.

In summary, we find that there is a long history behind the offering of instructional technology courses to pre-service teachers. The content of these courses has evolved over time as new technologies have been introduced to schools and as societal expectations of student outcomes has changed. This evolutionary process experienced a dramatic jolt in the 1980s as computers proliferated and teacher education programs responded by, in some cases, creating entirely new courses to deal specifically with computer competencies. Today these courses are ubiquitous in teacher education programs; however there may be a discrepancy between what is taught in a majority of pre-service instructional technology courses and what is practiced by teachers in American schools.

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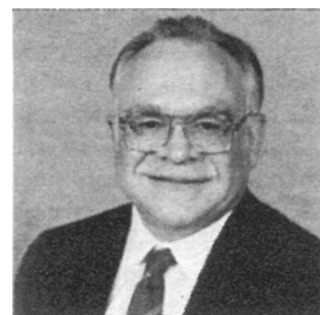
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