

Putting the Pieces Together: Systemic Change for Technology Integration in Teacher Education

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Abstract: Today's schools must prepare students to use computer-related technologies well in a range of tasks. For K12 schools to prepare their students, colleges and universities must prepare teachers to integrate technologies well for learning. Thus, reform in teacher preparation must become a high priority. Research has shown that lasting reform must be systemic—in other words, the parts of an educational system must synergistically support one another. In efforts to reform teacher education at an urban public university, we have tried to ensure that policy, curriculum, field experiences, and faculty teaching practices all support the meaningful integration of technology. Our efforts to sustain systemic change along these lines have been greatly enhanced by a "technology and learning center" and a Preparing Tomorrow's Teachers to Use Technology grant. We show through a case study and vignette how these pieces fit together for reform towards the integration of technology in teacher preparation.

Introduction

The Need for Technology-Using Teachers

Today's workplaces are increasingly computerized and networked; hence, schools must better prepare students to use these technologies flexibly and creatively in their lives, for tasks ranging from problem solving to information gathering to communication (SCANS, 1991). In order for K12 schools to prepare their students, colleges and universities must prepare teachers to integrate technologies well for learning. But colleges, schools and departments of education have lagged to date in their integration of technologies for learning into teacher preparation. Thus, reform in teacher preparation must become a high priority if real change is to take place in schools (Darling-Hammond, 1993).

Historical and Theoretical Background: Change Studies

Research on educational change has shown that lasting reform must be *systemic* (e.g., Brown, 1992; Fullan & Miles, 1992). In other words, the various parts of an educational system must synergistically support one another. A sociocultural (Wertsch, 1998) perspective on human action provides some guidance as to how to explain and plan for systemic change. Wertsch shows how the multifaceted, interrelated aspects of human activity in complex social settings can be captured using Kenneth Burke's "pentad": the act, scene, agents, agency (or cultural tools), and purpose. The meaning of an *act* is simultaneously constituted by the *scene* or location in which the act occurs, the knowledge, role, and personal history of the *agents* involved, the properties of the *cultural tools* or mediational means used to accomplish the act, and the *purposes* which the act served. In our reform, we are making an effort to change the "scene" at the College of Education to include use of technology as a cultural tool for teaching as a normal matter of course. The relevant agents in our case have been the dean and faculty members, supported by staff working on a Preparing Tomorrow's Teachers to Use Technology (PT3) grant. The scene began changing with policy and curriculum changes and the opening of a state of the art "technology and learning center." Through a curriculum reform, the teacher preparation activities supported by faculty in their courses have been reexamined to more adequately integrate technology while simultaneously serving the many other purposes of individual courses. In this paper, we explicate how we have put these pieces together for systemic reform towards the integration of technology in teacher preparation.

Background at the College of Education

The College of Education at the University of Missouri-St. Louis prepares a large number of teachers for K12 schools in our region. Prior to 1995, technology was not an integral aspect of the college's life. Although all faculty had computers in their offices and a few Educational Technology courses had been offered for years, few faculty members used technology for their instructional work. For instance, approximately 2% of our faculty was using email and online discussion groups with their students, and about that same percent referred their students to web resources and taught using technology. There was neither a technology course requirement nor an expectation of teacher education students demonstrating technology integration competency prior to certification.

A New Dean and a New Teacher Preparation Curriculum

With the entry of a new Dean and statewide certification changes in the second half of the 1990s, the situation changed. Paper copies of "The Dean's Weekly Update" were banished upon the dean's arrival in 1996—faculty members who did not use email before his appointment were forced to begin using it soon after. Innovations and grants involving technology were encouraged. A "futures" planning process resulted in a college-wide commitment to the importance of technology to the preparation of new teachers for the 21st century, and in a redesigned curriculum that required both a larger field component and technology integration in courses at all three "levels" (Level 1: Exploration, followed by Level 2: Analysis and Level 3: Professional). And finally, the state of Missouri instituted new performance-based (rather than course credit-hour based) standards for teacher certification, which included the need for all new teachers to demonstrate competence at integrating technology.

The Final Pieces: PT3 and the TLC

Our dean and development officer also envisioned and secured funding for a Technology and Learning Center (TLC) for our College and an Endowed Professorship of Technology and Learning. In the Winter of 1999, the Endowed professor and another full-time faculty member (the first author) were hired, and plans for the building of the TLC began in earnest.

At the same time, a group (headed by the second author) who had worked on technology integration with teachers in local K12 schools (the MINTs—Multimedia Interactive Networked Technologies—Project) submitted a grant proposal to the U.S. Department of Education's PT3 program. We proposed adapting the professional development practices utilized in MINTs to support change towards technology integration in active teaching and learning projects among cadres of university faculty, and using the MINTs classrooms as fertile sites for future teachers' field experiences.

During the Fall of 1999, the PT3 grant was awarded and the TLC plans were also finalized. The TLC was planned as a “hothouse” for educational technology, to mirror and model the possibilities for technology integration in K12 schools. It includes work clusters, a model classroom space, a seminar room with interactive whiteboard, and a “cyberlounge” with wireless networking (see Figure 1). The reconfigurable work clusters are set up to allow for solo work or collaboration on projects involving the Internet, standard office suites, and multimedia technologies including graphics and digital video. The classroom space is meant to allow discussion without computers between people as well as computer workstations and tables for discussion or work offline.

The pieces had all come together for the Winter semester of 2000:

- policy at the state and college level that encouraged technology integration,
- a new curriculum that allowed for introduction of new activities and tools in courses,
- requirements for field experiences as well as sites that integrate technology well,
- a PT3 grant to support university faculty in changing their teaching to incorporate technology, and
- a technology and learning center with staff and infrastructure to support technology integration

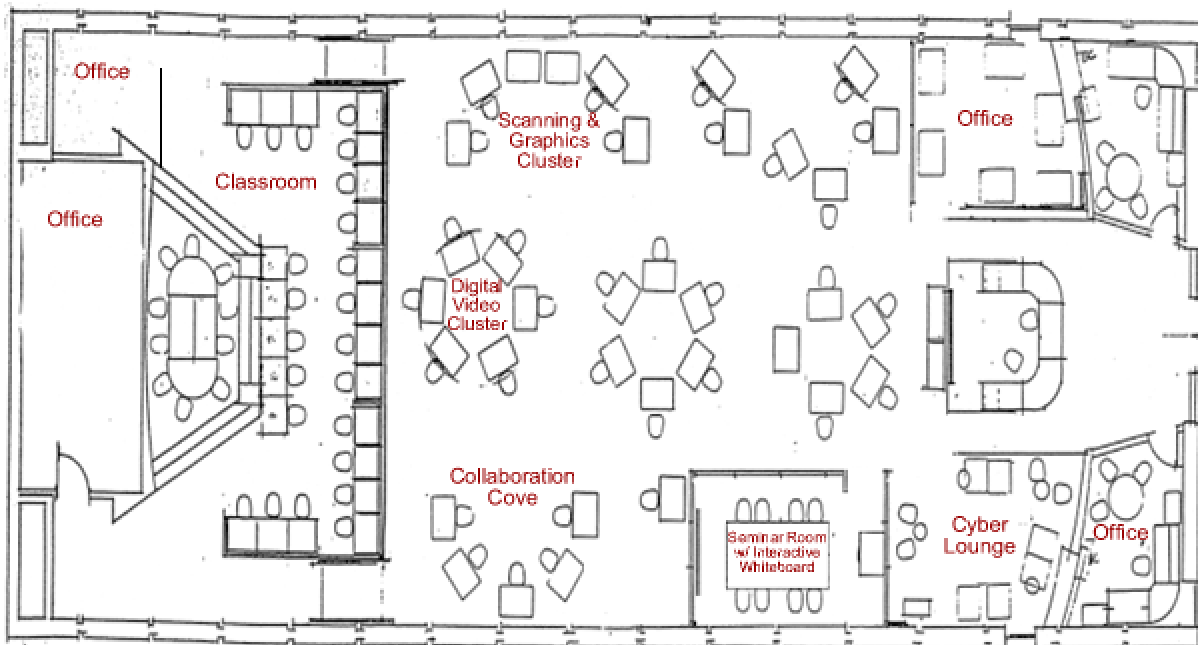


Figure 1: Floor Plan of the E. Desmond Lee Technology & Learning Center at the University of Missouri-St. Louis College of Education.

Case Study: Introduction to Learners and Learning Course

The new undergraduate teacher preparation curriculum at UM-St. Louis consists of three levels, the first of which is Exploration. At this level, there are three courses: Introduction to American Schools, Introduction to Teaching, and Introduction to Learners and Learning. In order to illustrate how the pieces of our reform efforts fit together, we describe the technology component of the latter course as implemented in the Winter 2000 semester.

The fourth author instructed this course, and groups of her students developed web sites about child development topics of their choice. The primary goal for the project was learning about psychological development, but secondary goals included gaining an appreciation of the range of resources available on the World Wide Web, learning how to find those resources, and beginning to learn how to make web resource pages (which we expect technology-using teachers at the K12 level to utilize to support learning activities in the classroom). The construction of a set of resource web pages about development, with

synthesis and annotated links to related sites on the Internet, was an ambitious project for an introductory education class, and many students began the process with considerable trepidation. As one student stated, “learning how to create a web page was very stressful to even think about” at the beginning. Student reactions to the technology were somewhat related to their level of experience with technology, with beginners feeling more overwhelmed at the beginning despite recognizing the relevance of technology skills for classroom applications.

In order to support the preservice teachers in the achievement of this complex, ambitious project, a variety of supports were utilized. During class meetings held in a computer classroom, two PT3 staff acted as guest facilitators along with the instructor. The PT3 staff introduced the class to web page editing basics using Netscape Composer (a free web page editor included with Netscape Communicator), and distributed a handout describing the basics. Using a web page template on disk, the facilitators assisted the groups in adding and modifying text, a digital photo of themselves, and links to resources on the Internet. Several classes were devoted to completing the assignment. The computer expertise and comfort in the class varied widely, from a couple with extensive experience including web page editing, to quite a few with word processing, email, and web browsing, to several with little experience and a good deal of fear. The instructor created groups of three or four students and made an effort to place at least one student with stronger technology expertise as measured by a skills survey administered online with a system called Profiler (<http://profiler.scrtec.org>). The in-class orientation and the handouts proved to be scaffolds of some use to the students, but more in-depth background and detailed written reference materials were desired by many. Not surprisingly, the people provided the most effective scaffolding: the multiple facilitators during class meetings provided by PT3 helped, as did the more expert peers spread among the groups. Nonetheless, many students wished for more in-class time with facilitators, and some lamented the difficulties of groups meeting outside class at a largely commuter university.

Several students wished for more staff support in the computer labs between classes. Frustration at the lack of support at the drop-in labs is notable, because at the time the assignment began, the College’s Technology and Learning Center had not opened (it opened mid-way during the semester). The staffing model of the traditional “computer labs” on our campus probably reflects the norm on most campuses—staff are hired mainly to control access into and out of the area and maintain the equipment. The staffing level is typically one “monitor” per lab. In contrast, the TLC’s mission is explicitly to support the educators—and all are future or current educators—who use the facility in their use and learning of technology for education. In addition to the scheduled workshops we offer to students and faculty, our staff “on the floor” offer as much assistance and guidance as they can give to our customers, although on-the-spot, extended individual tutorial sessions are not practically feasible with our large numbers of users (hundreds per month in the spring of 2000, thousands in the fall). We have worked hard to cultivate an atmosphere in which our customers feel free to ask questions and seek assistance. This is facilitated by having two staff on duty at most times we are open.

In reflection papers submitted after the assignment was complete, most students expressed agreement with the notion that teachers should be prepared to integrate technology. As one student said, “I believe it is very important for our class as college students and also as future teachers to be aware of and comfortable with the technology available.” But some expressed frustration at a technology assignment they did not expect in a psychology of learning class. This frustration may have been exacerbated by the fact that some sections of the introductory class during this period were not being offered in the new curriculum model, and thus did not include the technology work—therefore, students were aware that some of their peers were not required to complete the difficult work involved in a web site. As the new curriculum is more fully implemented, students who do not use technology in their courses will be more the exception than the rule.

Despite the frustrations, most students were pleased with their accomplishments. As one put it, “while I did have a hard time working on this website, ... I did learn a lot about the Internet, computing skills, and all the support websites that are available.”

In the Fall 2000 semester, the developmental web site project was repeated and extended to three sections of the new curriculum course, two of which are taught by part-time instructors. Most of the class meetings on technology were scheduled in the TLC classroom space, and facilitators were once again available for those meetings. Students during this second round had very similar reactions to the project as those in the second round—a mixture of excitement at using technology which is recognized as important for education and some trepidation at the newness and complexity of the task. Students have made more

considerable use of staff support in the TLC after spending time in the space with their class, and in reflection papers, no requests for additional supportive staff were made.

Vignette: Technology Overcomes Achilles

A vignette from early in the Fall 2000 semester serves as an example of the promise of readily available information technology settings such as the TLC as learning resources. One of the instructors involved in PT3, who we will call Ann, injured her Achilles tendon before the second class meeting of the semester, and was consequently unable to attend her Introduction to Instructional Methods class. On the day of class, Ann called up the PT3 project director, Ms. Mastin, and asked her to take over the class for the day by leading the group in an assignment Ann had prepared. Ms. Mastin asked the faculty member if they were using the new university online course material system, a version of CourseInfo's Blackboard. The system had just been installed on campus in the summer, and many of the instructors and students, including Ann and her class, had not yet had training or experience using it. Ms. Mastin suggested they give it a try anyway. With Ms. Mastin's help over the phone, Ann posted an announcement for her students, and posted the assignment document in the area reserved for that. Ms. Mastin met Ann's class and took them to the TLC to read and work on the assignment. The class completed the assignment in the TLC, with Ms. Mastin acting as the facilitator, and also with the support of discussions with their neighbors about both technology and content.

The TLC and the technology infrastructure facilitated this successful adjustment of a class meeting in several important ways. Ms. Mastin's availability to advise Ann on the capabilities of technology to enable work on the assignment was essential. The relative ease of posting announcements and assignment documents on the Blackboard system was also key—if Ann had wanted to post her ideas to a standard web site and had not yet attended a training session, she would have been unlikely to succeed in a timely enough fashion for class that very evening. And finally, the availability of a space in the TLC for individual class meetings to work with staff facilitation, a projector for display and walk-through of technologies for first-timers, and a classroom space that allowed for students comfortably working with one another all created new possibilities for successful technology integration into university coursework.

Next Steps

At this point in the implementation of our reform, we are expanding our scope in multiple ways. The new curriculum is being phased in at the same time new groups of faculty are being supported in technology integration. In the Winter of 2000, one section of the three Level 1 courses was offered. In the Fall of 2000, three sections of each Level 1 course is being offered, and one section of each new Level 2 course. In the Winter of 2001, Levels 1 and 2 will be offered in more sections, and new Level 3 courses will be offered. At the same time more introductory level courses are being offered in more sections, we are recruiting faculty members to participate in PT3 professional development activities in order to get extra support in integrating technology, and make use of the Technology and Learning Center. In addition, we are attempting to build in sensible articulation of technology competencies across courses and levels of the curriculum, but we have a great deal of progress yet to make. The change over the past year has been tremendous, however.

Conclusion

Researchers have demonstrated that the adoption of symbolic aspects of reforms such as trendy descriptors ("multiple intelligences", "brain-based instruction") or new textbooks can prove more symbolic than substantive (Ball, 1990; Fullan & Miles, 1992). At the University of Missouri-St. Louis College of Education, we have attempted to provide a whole new "scene" (Wertsch, 1998) where university instructors and students preparing to be teachers try out new ways of acting. Maybe this exciting new play they are constructing will have a longer run on the educational scene than other reforms.

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