Changing Teacher Education Faculty: Mission Possible

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Abstract

This study evaluates a Preparing Tomorrow's Teachers to Use Technology (PT³) project that endeavored to improve teacher educators' uses of technology so as to influence future teachers. This PT³ project sought to build on a foundation of key characteristics of teacher education programs thought to be exemplary in the use of technology throughout their programs. The authors evaluate the progress of teacher educators in the integration of technology in their classes. The data analysis reveals that a critical mass of faculty used technology with students in their courses and that the uses were aligned with the National Educational Technology Standards for Teachers (NETS•T).

Four years ago, the faculty of the College of Education at Arizona State University West (ASUW) sought reasons why our graduates did not feel prepared to teach with technology. We found: (1) they did not see consistent or extensive modeling of the use of technology by faculty in their preservice classes (Lewallen, 1998), and (2) they did not see exemplary practices in K–12 classrooms during field experiences (B. Carlile, personal communication, 1998). In response, we developed a unified program to advance technology integration supported by Preparing Tomorrow's Teachers to Use Technology (PT³) funding. One of the PT³ project goals was to "infuse technology throughout teacher education courses preparing new teachers to integrate technology into their K–12 classroom teaching." This article focuses on the first issue (modeling of technology by faculty) and describes the integration of technology in teacher education classes. In this article, the authors evaluate the effectiveness of this PT³ project to prepare faculty to incorporate technology in their curriculum.

Importance of Faculty Members' Integration of Technology in Courses

Faculty members' modeling of technology in their courses appears to be an important contribution to new teachers' abilities to integrate technology in their classrooms. Several studies attest to this. In their analysis of student teacher survey data, Brent, Brawner, and Van Dyk (2003) found that more than half of the student teachers reported that teacher education classes and course assignments were helpful in preparing them to use technology in the classroom. Specifically, when asked what influenced their classroom technology use, student teachers frequently cited their methods classes in disciplinary areas as well as specialized courses in integrating technology. Based on their study of factors influencing student teachers' use of technology, Brent et al. recommended that experiences with technology should be included in methods classes and integrated throughout the entire preparation program. In another study, Pope, Hare, and Howard (2002) surveyed preservice students who were enrolled in four methods courses. They found that in addition to faculty modeling of technology, preservice students "must be offered instruction and practice in integrating technology into their instructional methods and practices" (p. 201). One explanation for this finding is that teacher education faculty members serve as role models for their students; faculty uses of technology and attitudes toward technology have significant impact on student teachers' implementation of educational technology (Huang, 1994).

Our project sought to increase faculty use of technology in preservice courses and evaluate the effectiveness of our strategies. The project investigators recognized that change must occur both at the college of education level and in the COE classroom. Strudler and Wetzel (1999) examined colleges of education thought to be exemplary for their integration of technology across their programs. They found common characteristics of these exemplary programs. They had

- Committed and informed leadership
- Curriculum that addressed standards, e.g., ISTE/NCATE teacher technology standards
- Adequate technical and curriculum integration support
- Various forms of professional development available
- Adequate access to hardware and software for faculty and students
- Critical mass of faculty who implement technology in their classes
- In addition, change must occur in the classroom. ISTE (2002) explained the elements necessary to support technology integration in the classroom include
- Shared vision of proactive leadership and administrative support
- Access to current technologies
- Educators skilled in the use of technology for learning
- Professional development opportunities for technology skill development and reward structures for participation
- Timely technical assistance
- Content standards and curriculum resources that address subject matter content standards

These factors guided the project development team consisting of key ASUWest faculty and PT³ staff as they designed the program.

Method

Program Description and Implementation

The program description will be organized around these implementation factors: critical mass and ongoing participation, committed and informed leadership, and departmental planning.

Six years ago, faculty in the ASUW COE started to lay the foundation for the three-year PT³ project that began in the 1999–2000 academic year by addressing several of the enabling factors noted earlier, such as leadership, access, and K–12 partnerships. For example, key faculty leaders established a technology committee that created the support and vision for a permanent position within the college for a technology support analyst. Also, most faculty and students had access to technology for teaching and learning. In addition, faculty leaders wrote

small grants leading to partnerships with K–12 school district partners. These small projects provided technology integration workshops in which mentor and student teacher pairs created curricular units and implemented them in the mentors' classrooms. These actions laid the foundation for the College applying for a PT[3] grant, one goal of which was to increase the faculty use of technology in preservice courses.

Two broad strategies that supported the infusion of technology goal were faculty preparation and technology integration support. Although the foundation had been establish through earlier initiatives, the ASUWest PT[3] program provided a unified approach so that 41 fulltime faculty would be prepared to integrate technology in their classes and thus model for preservice students the integration of technology in K–12 classes. Preparing faculty was the first key. Each Spring for three years, faculty members were presented with individual questionnaires listing proposed technology training topics (e.g., Inspiration, web page design, web quests), complexity (e.g., beginner, intermediate) and alternative dates and times. Analysis of the survey data was one factor in arranging summer professional development before and after the summer school sessions (see http://www.west.asu.edu/ PT3/assessment/survey.htm for examples of the surveys and http://www.west.asu.edu/PT3/awards/netsaward.htm for the menu of workshop opportunities).

Subjects' Participation

The implementation of the project's staff development strategy was robust. The number of faculty participating in staff development in each of the past three summers is shown in Table 1 below. In addition, the number of hours that faculty participated in workshops is shown in Table 2.

Fifty-eight percent (24/41) of full-time faculty completed professional development workshops during the three-year project. The percentage of faculty participating each year is reported in Table 1.

Table 1. Percentage of Full-Time Faculty Participating in Professional Development by Year

Year	Fulltime Faculty	Return Participants
2000	20 of 33 (60%)	
2001	18 of 33 (54%)	17
2002	19 of 26* (73%)	18

The number of full-time faculty varied from year to year depending on sabbatical leaves, resignations, and new hires. Across the three years, 41 fulltime faculty participated in the PT[3] staff development, but only 18 - 20 per year.

The number of hours that full-time faculty participated in professional development workshops varied from 3–119, with the largest group of faculty participating 20–49 hours. (See Table 2). Faculty participated in workshops lasting from a half-day to a week.

Table 2. Number of Hours Full-Time Faculty Participating in Professional Development across Three Years.

Workshop Hours	Number of Full-time Faculty Participating over Three Years
3-6	3
7-19	5
20-49	8
50-79	4
80-119	4

Implementation Factors

Critical mass and ongoing participation. The high percentage of faculty participating in professional development opportunities for extensive periods of time and the subsequent uses of technology in their classrooms points to a critical mass of faculty who implement technology in their classes. "Critical mass of participation" was a factor Strudler and Wetzel (1999) noted in their study of Colleges of Education thought to be exemplary for the integration of technology across their programs.

Another variable that appears to be important is technology integration support. After completing the workshops, many faculty members wanted to implement their newfound ideas and skills in their classes. To assist faculty, two project educational technology specialists met with individual faculty as requested to help them develop activities and assignments. Often the specialist would take the initial lead in such areas as requesting the wireless laptop carts with 30 computers and modeling the procedures for student use of technology to accomplish a task (e.g., create a mind map using Inspiration or initiating cross-class student collaboration through threaded discussions). Subsequently, faculty would take the lead and the specialist would assist. Finally, outside support became unnecessary as faculty became comfortable with the technology and procedures.

Once again, the implementation of the project's support strategy was robust. During the three-year project, 73% (30/41) of faculty requested and received one-on-one support. The authors note that faculty in this project were prepared through extensive summer workshops and through one-on-one support to implement the NETS•T in their classrooms. In this PT[3] project, two technology integration specialists, located in the College of Education, had duties that were similar to the building resource teacher. These support actions are consistent with the importance of the second-level change facilitator identified by Hall and Hord (2001) with functions that included reinforcing, providing technical coaching, mentoring, following up, training, providing resources, and telling others.

Additionally, the project offered the Teacher Educator Classroom of Tomorrow Today (TECOTT) option. Five faculty participated in the intensive six-day summer workshop sponsored by Apple Corporation and met one day per month during the academic year to learn new technologies, implement them in their classes, and provide a community of ongoing support for each other. For example, they designed curriculum units for their courses and edited digital video clips to enhance their instruction.

Committed and informed leadership. The second year of this PT[3] project, the Elementary Education Department (which includes Early Childhood, Bilingual Education, and English as a Second Language) became the largest COE department. Due to college reorganization, the early childhood coordinator became the department chair for elementary education. This person, a participant in the TECOTT training program, worked to bring faculty together for departmental meetings, and provided support for the implementation of the NETS•T standards.

Departmental planning. Another strategy was to develop and implement plans for technology integration across courses in each department. The project worked with the departmental chairs in elementary education and secondary education to plan for technology at the departmental level so students would experience a unified and meaningful approach to technology across four semesters in teacher education. Departments met approximately once per month during the semester and technology integration was a topic at the meetings. Faculty asked questions about the best uses of technology in their areas and implementation strategies in their individual courses. ISTE National Education Technology Standards for Teachers (NETS•T) were used to help provide direction for good uses of technology in different academic areas and courses and for sharing their work and expectations for students.

The leadership of the chair of Elementary Education was the key to the planning for technology integration across the curriculum. This was particularly evident in the departmental meetings through the chair's setting of priorities and providing support for faculty struggling with finding the best uses of technology in their courses and across course collaborations. In this way, he demonstrated another characteristic noted by Strudler and Wetzel (1999): informed and committed leadership. Also, the role of the chair is consistent with the description of the first-level change facilitators identified by Hall and Hord (2001). Their func-

tions included sanctioning, keeping priorities straight, providing resources, pushing, approving adaptations, and telling others.

In this project, a number of key elements that are characteristics of colleges exemplary for their use of technology occurred simultaneously: professional development, integration support, and departmental leadership. Further, access—a fourth element—was prevalent as well: ASU West COE faculty and students had good access to software and hardware at the university and at home.

Evaluation Question

The impact of the implementation of these key strategies on faculty integration of technology in their courses is the key question addressed in this study. Specifically, did these coordinated strategies influence teacher educators to plan and integrate more technology into their courses?

Data Sources

To answer this question, faculty course portfolios were compared at the beginning of the project (Fall 2000) and after the program was implemented (Spring 2002). The portfolio contained the course syllabus and other course materials. They were analyzed to determine the number of faculty planning for and implementing technology integration in their courses. There were 33 full-time preservice faculty members in Fall 2000 and 26 full-time faculty members in Spring 2002. The difference is largely due to a freeze on hiring in the intervening time period as well as a few faculty members going on leave in 2002.

Teacher education faculty members were asked to provide a copy of materials for one course of their choosing. Because the course syllabus often does not provide the level of detail needed to determine classroom uses of technology, faculty members were asked to provide a short description of the in-class activities using technology and an explanation of the pedagogy using technology—e.g., lecture using PowerPoint. A set of course materials including the syllabus, assignments, and short description of activities were collected for analysis. A template was provided for faculty to list and describe their classroom uses of technology. An example of a template completed by a faculty member is found in Table 3.

Finally, two technology integration specialists who assisted faculty in using technology in lessons and often initially accompanied them to their classrooms to help implement the procedures confirmed that the faculty uses described were consistent with their observations.

Data Analysis

Using the NETS•T as a guide, the syllabi, assignments, activities, and short descriptions of in-class uses of technology were read and re-read to develop categories for analysis (Strauss, 1987). Categories related to faculty planning for and implementing technology integration clustered around syllabi goals, activities, assignments, Web course support, communications, knowledge navigation, and lesson plans. The categories were easily identifiable because often they aligned with the themes of

faculty workshops that were provided in the summer session preceding the classroom. Eventually, the following criteria were agreed upon by the authors and then used to determine if a faculty element was tallied:

Syllabi Goals: Faculty members included a specific technology goal or standard for students in their syllabi.

Activities: Faculty members described in-class uses of technology by themselves or their students.

Assignments: Assignments were included if there were one or more assignments requiring students to use technology to complete the assignment or implement technology in field experience.

Web Course Support: Faculty created a Web site or used a Web-based course support system to post resources or guide student experiences using the Web. Courses materials might include syllabi, assignments, readings, and other resources (e.g., video clips).

Communication: Faculty designed threaded discussion for student participation and/or communicated with students by e-mail.

Knowledge Navigation: Faculty taught search strategies/required use of Internet or electronic database for assignments.

Lesson Plans: In methods courses, faculty required preservice students to develop lesson plans incorporating K–12 student use of productivity tools to meet lesson objectives.

Uses of technology by faculty and students were tallied using these categories. The preservice teacher education program included 41 faculty across the three years of the project. However, at the beginning of the project there were 33 and at the end of the project 26 full-time faculty members. At the conclusion of the study there were seven fewer full-time faculty, largely due to a freeze on hiring in the intervening time period and faculty members on sabbatical leave.

The proportion of faculty falling into each category in Fall 2000 and Spring 2002 was compared using a z-statistic for two independent sample proportions, even though the groups are not completely independent. Treating them as independent samples results in a statistical test of significance that is conservative, and any difference that would be significant when treating data as independent would be significant when treating data as dependent.

The authors also determined which categories supported the NETS•T. The process for aligning categories and NETS•T involved a consensus-building model with four of the project team members. Faculty-designed classroom activities may support more than one or only part of a NETS•T and related performance indicator. For example, a faculty member enhanced the learning experience of students by using a Web-based course support system to create threaded discussions, Web-based resources, and to post course documents such as assignments. This example of "Web course support" is aligned with the NETS•T, Standard II: "Teachers [faculty members] plan and design effective learning environments and experiences supported by technology." Faculty participating in the project used the NETS•T to gain ideas and describe

Table 3. Example of Description of Technology and Standards Used in an Early Childhood Class

Technology – Software & Hardware	How Professors and Students Used Technology	NETS –T
Roamer	Use content-specific tools and simulation to support learning, in particular, the teaching and learning of spatial relations and geometric concepts.	IIa - design Developmentally appropriate learning
Kid Pix and Graph Club	Create a technology-based student created product, in particular, a group field trip reflection book.	IIIa – facilitate technology enhanced experiences
E-mail	Use e-mail to participate in communication with students.	V-d – Use technology to communicate
Internet Lesson/activity plan	Students chose one quality science and one quality math lesson/activity plan from the Internet, and identify appropriate tech resources to meet specific teaching and learning objectives, in particular, a problem solving, hands-on approach to math and science.	IIa,c – design learning experiences, identify technology, resources
Digital Camera	Utilize electronic resources to effectively manage a learning activity, in particular, students' experiences are documented and a portfolio (book) created.	IIIb, IVa – use technology to support learning; apply technology in assessing learning

their uses of technology. Although the NETS•T are broad and each one includes multiple elements, the categories identified by the authors align with the standards. However, each category does not address all elements in each standard.

Results

The results of a 1998 survey provide a sense of history of faculty uses of technology and a bridge to the project base-line data. A comprehensive Web-based 1998 survey of ASU West COE faculty revealed that only 22% of the faculty modeled the use of technology "frequently" or "always" in their instruction (Lewallen, 1998). Half of them rarely or never modeled technology. In Spring 2000, baseline data from the class materials (e.g., syllabi) analysis procedures described earlier were collected. The authors found that the number of teacher education faculty incorporating technology in their Spring 2000 classes was mostly consistent with the number revealed in the 1998 survey.

The Fall 2002 and Spring 2000 comparison of the percentage of faculty planning for and implementing technology integration in seven categories is shown in Table 4. In addition, the z-statistic and significance level for each category is presented.

Table 4. Percent of COE Full-Time Faculty Implementing Classroom Uses of Technology by Category: Spring 2000 vs. Fall 2002.

Category	Fall 2002	Spring 2000	Difference	z	Signif. Level
Syllabi	50.0%	15.2%	34.8%	2.990	.01
Activities	61.5%	24.2%	37.3%	2.895	.01
Assignments	53.8%	24.2%	29.6%	2.941	.01
Web Course Support	50.0%	21.2%	28.8%	2.731	.01
Communications	38.5%	21.2%	17.2%	2.426	.05
Knowledge Navigation	50.0%	0.0%	50.0%	2.027	.05
Lesson Plans	38.5%	3.0%	35.4%	1.823	.06

Faculty significantly increased their planning for and implementing of technology integration in the following categories: syllabi goals, activities, assignments, Web course support, communications, and knowledge navigation. However, in the category of "lesson plans" the increase was not significant at the p = .05 level.

In Spring 2000, 20.6% of faculty members planned and implemented technology integration in two or more of the identified categories. In Fall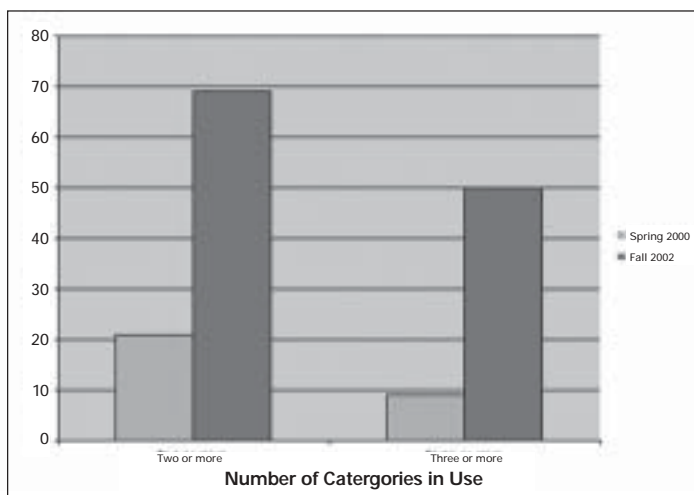 2002, 69.2% of faculty members planned and implemented technology integration in two or more of the identified categories. (See Figure 1). In Spring 2000, 9.1% of faculty members planned and implemented technology integration in three or more of the identified categories. In Fall 2002, 50% of faculty members planned and implemented technology integration in three or more of the identified categories.

Discussion and Importance of the Study

Clearly, this PT[3] project had an important effect on the number of faculty including technology in their courses. At the conclusion of the project, on the average faculty members used technology in more ways. However, it should be noted that in the area of lesson plans (requiring preservice students to include technology standards and objectives in their lesson plans for K–12 students), the change approached, but did not quite reach, significance. This may be due to the nature of the teacher education courses and their requirements. For example, courses such as Child and Adolescent Development did not require students to create lesson plans.

Effective change requires a combination of both pressure and support (Fullan, 1991). In this project, the pressure was the expectation that faculty would integrate technology in their classes. This pressure was noticeable in the departmental meetings that focused on the NETS•T and the types of technology that were most compelling in each faculty member's areas. The chair of the largest department worked to bring faculty together for meetings that made a priority of the identification and implementation of uses of technology in each course that supported curriculum goals. The NETS•T provided pressure for change because they are comprehensive and pointed to the gap between our present state and an optimal state. On the other hand, the project provided many factors that supported change. For example, faculty were prepared through professional development and supported through the follow-up of two technology integration specialists. Each year 54%–73% participated in staff development opportunities and 73% of the faculty used the assistance of the two technology integration specialists to move from studying the technology in the workshop to implementing in their classrooms.

In this project, a number of key elements that are characteristics of colleges exemplary for their use of technology occurred simultaneously: professional development, integration support, and departmental leadership. Further, access, a fourth element, was prevalent as well: ASU West COE faculty and students had good access to software and hardware at the university and at home. During the project, access to technology in the teaching areas improved. For example, at the beginning of the project 20% of the teaching spaces had instructors' stations with a computer and projector, and at the conclusion of the project 80% of the teaching spaces had them.

Fullan (1991) explains that pressure without support leads to resistance and alienation, while support without pressure can lead to drift or waste. In this PT[3] project there seems to have been a good balance between the pressure and support for the faculty to integrate technology in their curricula.

This study is important because the authors found that a majority of full-time faculty modeled important uses of technology in their classes and discussed factors thought to contribute to the change process and lead to faculty implementation of NETS•T. Adopting strategies used by exemplary colleges as a model appears to be a feasible framework for planning technology integration.

Two broad areas are suggested for further research: (1) Sustainability: Were the results of this project sustainable after the PT[3] project? Related questions include: Did the critical mass of use suggested in this study lead to subsequent major steps forward? For example, did faculty explore new, more powerful and compelling uses of technology in their

Figure 1. Percent of COE Full-time Faculty Implementing Two or More and Three or More Classroom Uses of Technology: Spring 2000 vs. Fall 2002.

subject areas? What factors allow the faculty in one completed PT³ project to continue to build and grow in its technology use and another to stagnate? Is there really sustainability without external resources? (2) Better Models: Are there better models of professional development such as providing faculty with mini-grants to work individually and/or in groups to develop a working knowledge of new technologies and implement new objectives, activities, and assignments in their courses? Is the workshop model better in some Colleges of Education, and a mini-grant approach in others? If so, what are those contextual factors that make a difference? Or is it not one or the other but both? Would a model that offered both mini-grants and workshops be most effective?

Acknowledgements

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