Integrating Technology in a Field-Based Teacher Training Program: The PT3@ASU Project

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The Preparing Tomorrow's Teachers to Use Technology (PT3) initiative has funded various efforts to improve and enhance the technology preparation of preservice teachers. At Arizona State University, these efforts have focused on providing preservice teachers with opportunities to develop, implement, and evaluate their own instructional activities that utilize technology effectively and appropriately in authentic situations, to give them the myriad of tools necessary to integrate technology into teaching and learning activities. This paper focuses on the integration of these efforts into the field-based elementary education program, and discusses our formative evaluation of the field-based technology integration model, through the following questions: What are the preliminary successes of the model with regard to student perceptions, attitudes, and integration of technology into instructional activities? and What components of the model require additions or modifications?

The Preparing Tomorrow's Teachers to Use Technology (PT3) initiative has funded various efforts to improve and enhance the technology preparation of preservice teachers. Many of these efforts have focused on supporting education faculty, others have concentrated primarily on preservice teachers, and still others have developed repositories of resources for dissemination. However, these initiatives have not occurred in isolation. After publication of the Office of Technology Assessment (1995) national report, *Teachers and Technology: Making the Connection*, many colleges and universities began examining more effective means for technology preparation. This report examined schools' technological capabilities, barriers to student learning via technology, and teachers' current preparedness for technology integration. The report concluded that, "Despite technologies available in schools, a substantial number of teachers report little or no use of computers for instruction" (p. 1). The report also stated that teachers still struggle with integrating technology into the curriculum, and attributed much of this to inadequate training: "Most teachers have not had adequate training to prepare them to use technology effectively in teaching . . . On average, districts devote no more than 15 per-

cent of technology budgets to teacher training" (p. 8).

Much of the research related to technology integration in K–12 classrooms corroborates the results of the Office of Technology Assessment report. More recent research continues to show that teachers feel they are not provided adequate support to effectively use technology in their classrooms (Schrum, 1999; Strudler & Wetzel, 1999; Topp, Mortensen, & Grandgenett, 1995). This lack of support leads teachers to use technology for low-level, supplemental tasks such as drill and practice activities, word processing, educational games, and computer-based tutorials (Strudler & Wetzel, 1999; Willis, Thompson, & Sadera, 1999). As Abdal-Haqq (1995) stated, "[F]ew teachers routinely use computer-based technologies for instructional purposes" (p. 1).

Inadequate instruction and support for technology integration is not an issue only with K–12 teachers; research has demonstrated that technology preparation provided by teacher training institutions to preservice teachers with regard to technology has similar problems. In a review of the literature related to technology and teacher education, Willis and Mehlinger (1996) stated:

> Most preservice teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology. . . . [T]he virtually universal conclusion is that teacher education, particularly preservice, is not preparing educators to work in a technology-enriched classroom (p. 978).

In 1997, the National Council for Accreditation of Teacher Education (NCATE) commissioned a task force on technology in teacher education. Findings indicated that college faculty underestimated the importance of technology in K–12 education and treated integration as a "special addition" to teacher education. In addition, faculty viewed technology instruction as "other faculty's" responsibility and, consequently, were not modeling the use of technology in their teaching (NCATE, 1997).

In light of reports such as these, many educators have recommended restructuring technology preparation toward more integrative models (Larson & Clift, 1996; Northrup & Little, 1996; Rodriguez, 1996). Increasingly, preservice field experiences are recognized as opportunities for technology preparation (Brush et al., 2001; Hoelscher, 1997). In a survey of innovative teacher education programs, Strudler and Wetzel (1999) discussed how teacher education institutions such as Vanderbilt and the University of Virginia were focusing on collaboration among methods faculty and educational technology faculty in order to provide preservice teachers with experiences integrating technology into their teaching. These programs emphasized the need to provide preservice teachers with technology training in field-based teaching situations. This field-based model focuses on providing preservice teachers with authentic teaching experiences in real classrooms prior to student teaching.

Why a Field-Based Model?

At Arizona State University (ASU), most students enter the preservice teacher education program at the beginning of their junior year. Once they enter the program, they are immediately enrolled in a series of semester-long field-based teaching methods experiences at local "placement" schools. Each of these experiences requires students to successfully complete more traditional methods classes taught by methods faculty at the placement schools, and serve as interns for "placement teachers" (teachers working at the placement schools), assisting them with instructional activities and observing classroom practices.

Students are required to participate in a different methods experience (or block, as it is called at ASU), each semester. Each block focuses on different content and provides students with different experiences. For example, elementary education students complete the following sequence of field-based methods experiences: Block I—social studies and language arts, Block II—mathematics and science, and Block III—reading and multicultural education. Thus, students are involved in field-based teaching activities throughout the teacher education program. The field-based aspects of the program supplied a mechanism for providing teacher

education students with authentic opportunities to integrate technology into teaching and learning activities.

In contrast, prior to 1999 the integration of technology within the field-based teacher education program at ASU was not emphasized. Preservice teachers were required to participate in a campus-based educational technology class sometime during their junior or senior year, but there was no real coordination between what students were learning in this class and what they were doing in their methods experiences. Thus, teacher education students were learning discrete technology skills such as Web page design, PowerPoint®, and basic technology literacy without opportunities to apply technology in authentic teaching situations. The movement of methods courses to field-based settings, however, provided an opportunity to implement a plan to integrate technology skills and experiences with the field-based methods experiences. A collaborative effort between educational technology faculty and methods faculty in the elementary education program at ASU led to the development of new requirements for preservice teachers with regard to technology. These new requirements provided teacher education students in the elementary education program with opportunities to create technology-rich learning activities and implement those activities as part of their methods instruction.

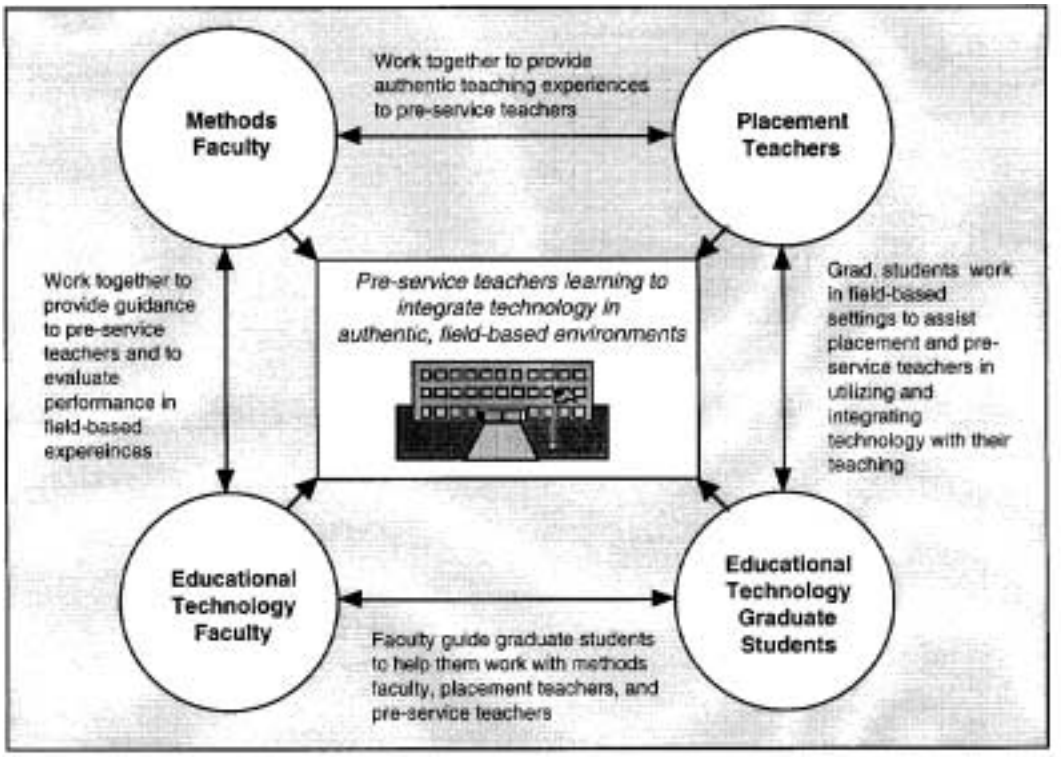
Goal and Components of the Field-Based Model

The overall goal or outcome for the technology experiences we provide our preservice teachers at ASU is for them to develop, implement, and evaluate their own instructional activities that utilize technology effectively and appropriately in authentic situations. We believe that this, in turn, will provide our teacher education students with the myriad of tools necessary to integrate technology into teaching and learning activities once they leave our program. There are two major components of the field-based technology integration model at ASU specifically designed to achieve this goal: (a) modeling effective technology integration, and (b) providing just-in-time support to preservice teachers, placement teachers, and methods faculty (see Figure 1). These components are described below.

Modeling effective technology integration. In order to provide authentic and appropriate technology experiences for preservice teachers, educational technology and methods faculty collaborated to develop a set of model lessons designed to demonstrate methods for effectively using technology in the classroom. Each model lesson focused on a specific content area (language arts, social studies, mathematics, or science), as well as a different form of technology. For example, in one of the language arts lessons, a work of children's literature that preservice teachers were using to practice specific oral reading strategies was used as the basis for a lesson that integrated reading, writing, digital imagery, and oral presentations. Graduate students from the educational technology and curriculum and instruction programs delivered the lesson to preservice teachers at one of their placement schools. Preservice teachers participated in the "modeling sessions" in a similar fashion to the way students in their classrooms would participate: using the technology integrated into the lesson to complete projects or other activities for which the lesson was designed. After completing the lesson, preservice teachers critiqued the effectiveness of the lesson, discussed issues associated with implementing the lesson in an authentic classroom, and described modifications that could be made to the lesson in order for it to be appropriate for other teaching and learning situations.

Preservice teachers participate in a minimum of two modeling sessions each semester. Once they have completed these activities, they are required to develop an instructional activity integrating technology and content. The content focus for the lesson varies depending on their progress through the program (e.g., Block I students are required to develop a language arts or social studies lesson, Block II students develop a math or science lesson). Once they have developed their activities, they implement the lessons with students in their placement schools. This provides preservice teachers with authentic

Figure 1 □ PT3@ASU technology integration model.



experiences using technology to facilitate instructional activities. After they have delivered their lessons, preservice teachers complete postlesson reflections in which they describe the procedures they followed in implementing the lessons, and discuss successful strategies employed during the delivery of the lessons, things they would do differently if they were to teach the lessons again, and the effectiveness of the technology used in the lessons.

At the end of each semester, preservice teachers at each placement school collectively meet with faculty and graduate students to discuss their lessons. These "reflection and debriefing sessions" are designed to provide opportunities for preservice teachers to share their activities with their peers, receive feedback and suggestions for improving their teaching (and use of technology), and acquire additional ideas and resources for integrating technology into future activities.

Providing just-in-time support to preservice teachers, placement teachers, and methods faculty. It was apparent that preservice teachers would require additional support if they were going to develop technology-rich lessons and implement them with students. Most of the preservice teachers in the program had little or no teaching experience at all, let alone experience teaching with technology. Thus, it was necessary to include an ongoing, just-in-time support structure to the field-based model. Students in either the educational technology or curriculum and instruction graduate programs were recruited to provide this support. These students were selected based on their previous experience as teachers in K–12 classrooms, and their demonstrated knowledge of effective methods for integrating technology into the K–12 curriculum. The graduate students selected to participate in this program were provided with stipends and opportunities to receive graduate course credit.

The graduate students were assigned to placement schools on an ongoing basis in order to provide support and guidance to the preservice teachers placed at those schools. This support included assistance with both technical and pedagogical issues, help acquiring technological resources needed to implement lessons, and guidance regarding appropriate and inappropriate uses of technology in specific teaching situations. This support was generally provided at the placement schools, however graduate students tried to be as flexible as possible in providing assistance whenever and wherever needed.

In addition, although many of the methods faculty and field-based mentor teachers already possess exceptional skills in integrating technology with teaching, there was still a need to provide many of these individuals with additional training regarding effective uses of technology in various teaching domains, as well as available technology resources in those domains. Methods faculty and field-based mentors are not expected to possess comprehensive knowledge about the vast number of resources available or the resources that might be most appropriate for various teaching and learning activities. In response to this need, ongoing support was also provided in the field to these individuals by the educational technology faculty and educational technology graduate students.

Educational technology graduate students are continually placed in placement schools (typically one graduate student is assigned to a specific school) to assist both preservice teachers, methods faculty, and placement teachers. These students have expertise in both teaching and technology integration; thus, they are able to assist the placement teachers with activities they would like to attempt with their students, as well as activities the preservice teachers are planning. We believe that this support structure helps methods faculty and placement mentor teachers better model effective integration of technology into teaching and learning activities.

Initial Evaluation of Field-Based Model

The remainder of this paper focuses on our formative evaluation of the field-based technology integration model. We initially implemented the new technology requirements with preservice teachers in the elementary education program. This is the largest teacher training program at ASU, enrolling approximately 400 students per semester. We focused the evaluation on preservice teachers located at eight placement schools (four in Block I and four in Block II). In order to guide our evaluation, we focused on the following questions:

- What are the preliminary successes of the model with regard to student perceptions, attitudes, and integration of technology into instructional activities?
- What components of the model require additions or modifications?

METHOD

Participants

Participants in the study were 100 preservice teachers enrolled in the elementary education program. All but 5 of these students were completing either their junior or senior year at ASU; 94% were female, and 91% were between the ages of 20 and 25.

Participating students were enrolled in either Block I or Block II of their program. None of the students had begun their student teaching experiences; 47% of the participants planned to teach in the lower elementary (K–3) grades when they received their teaching credentials. When asked how often they use computers, 94% responded that they used them at least “several times a week.”

Design and Data Sources

A formative evaluation methodology was used that included both qualitative and quantitative data collection. This methodology was used in order to explain the successes and problems that occurred as we implemented and modified the interventions associated with the project, and to explore possible changes or modifications that could improve the effectiveness of the project activities (Guba & Lincoln, 1981). In addition, the

use of multiple data sources increases the reliability and validity of the interpretations (Mathison, 1988). Data sources used in this evaluation included technology attitudes and perceptions survey, preservice teacher lesson plans, postunit reflections, and preservice teacher interviews.

Technology attitudes and perceptions survey. The survey was developed as a means of measuring preservice teacher perceptions regarding technology integration, their general attitudes toward the technology integration activities, and the effectiveness of the activities with regard to helping preservice teachers overcome common barriers impeding the effective use of technology for teaching and learning activities. The 42-item survey consisted of three sections: (a) background information, (b) attitudes toward integration, and (c) environmental resource barriers. The overall Cronbach-alpha coefficient of the survey was relatively high ($\alpha = 0.81$), indicating that it was a fairly consistent measure.

The background information section contained 8 items designed to collect demographic information such as future teaching goals, age, gender, academic year, and frequency of computer use. The attitudes toward integration section included 18 Likert-type items measuring attitudes and beliefs related to technology integration and the effectiveness of the preparation received in the teacher education program. Example items in this section included "A variety of technologies are important to enhance student learning," and "I feel that my technology course has prepared me to integrate technology into my content area specialization." The final section, environmental resource barriers, contained 16 Likert-type items dealing with perceptions of potential technology integration barriers. Example items included, "There isn't enough time in class to implement technology-based lessons," and "It is easier to use technology with smaller class sizes." Participants rated the items in the last two sections of the survey on a four-point scale from *strongly agree* to *strongly disagree.*

Preservice teacher lesson plans. Preservice teachers were required to develop, either individually or in teams, an instructional activity that utilized technology, and implement that activity with students in their placement teachers' classrooms. A requirement for this activity was to develop a detailed lesson plan for these activities. These lesson plans were analyzed to determine the types of technology used in the lessons, and how technology was used by the preservice teachers and their students. The lesson plans ($n = 57$) were collected and analyzed for this evaluation.

Postunit reflections. After the preservice teachers delivered their activities, they were required to participate in a final group debriefing session. During the debriefing, they described the activities they had designed and delivered, explained the instructional strategies they had used to integrate technology successfully into their lessons, and reflected on portions of the activities that had not been effective, including things they would do differently the next time they delivered the activities to students. In preparation for this debriefing, preservice teachers were asked to complete postunit reflections in which they described (in written form) the instructional strategies they believed were most effective, the impact that technology had on their lessons, and how they would change or alter their lessons if they were to deliver them in the future. Completed reflections ($n = 57$) were collected and analyzed for common themes among the participants.

Preservice teacher interviews. Six preservice teachers (two participating in Block I and four participating in Block II) were randomly selected from the overall population to participate in semistructured interviews. Each 30-min interview was audiotaped and immediately transcribed. Interview questions related to current uses of technology, beliefs regarding the role of technology in education (e.g., How important is technology in K–12 environments today?), perceptions of the effectiveness of preservice teacher preparation for technology integration (e.g., How well do you think the college is preparing preservice teachers to integrate technology?), and ideas for effective technology integration preparation (e.g., What should teachers be able to do with technology?).

Procedures

Survey data were collected from the participants in November 2001 during their final reflection-debriefing sessions. Participants were given approximately 15 min to complete the survey. At the conclusion of the debriefing sessions, students provided researchers with copies of lesson materials for the activities they designed and copies of their postunit reflections.

Over the next two weeks, participants selected for interviews were contacted and interview times were scheduled. Each interview was conducted in a small conference room on the university campus. One of two researchers conducted each of the interviews using the semi-structured interview protocol described above. Each interview session lasted approximately 30 min. All interviews were audiotaped and transcribed for data analysis. All interviews were completed by the end of December 2001.

RESULTS

Participant Surveys

A summary of participant responses (N = 100) to the attitudes toward integration section of the survey is provided in Table 1. In terms of positive responses, 86% (n = 86) of participants agreed with the statement, "I am confident about integrating technology into a language arts, social studies, math, science or other content area lesson," 92% (n = 92) agreed with the statement, "Given a learning goal, I am able to develop ideas for integrating technology," and 92% agreed with the statement, "A variety of technologies are important to enhance student learning." In terms of negative responses, 53% (n = 53) participants disagreed with the statement, "I feel that my technology course has prepared me to integrate technology," 57% (n = 57) disagreed with the statement, "I do not need more training on how to integrate technology," and 36% (n = 36) disagreed with the statement, "I do not need assistance to deliver a technology-integrated lesson."

A summary of participant responses (N = 100) to the environmental resource barriers section of the survey is provided in Table 2. Statements that had the highest levels of agreement among participants included: "It is easier to use technology with smaller class sizes" (95% agreement, n = 95), "In order for technology integration to be successful, teachers should have more access to computer labs" (93% agreement, n = 93), and "There isn't enough time in class to implement technology-based lessons" (85% agreement, n = 85). Statements with the highest levels of disagreement among participants included: "A successful lesson that integrates technology can be accomplished with one computer in the classroom" (46% disagreement, n = 46), "More teachers would integrate technology if they had more training on how to use technology" (61% disagreement, n = 61), and "A teacher must have advanced technology skills to effectively use technology in a lesson" (50% disagreement, n = 50).

Lesson Plans

Analysis of the 57 individual and team lesson plan documents revealed that they used a variety of technology, ranging from overhead projectors to televisions to digital video technologies, such as camcorders and digital technologies. In terms of hardware, a majority of participants (80%, n = 46) used some form of computer technology in their lessons. Other hardware devices most often used in lessons included printers (used by 22% of participants, n = 13) and video-image capture technologies such as digital cameras, scanners, and video cameras (used by 24% of participants, n = 14).

Word processing software, such as ClarisWorks® or Microsoft Word®, was integrated into lesson activities by 29% (n = 17) of the participants. Some form of Internet browser (Netscape® or Internet Explorer®) was used in 20% (n = 11) of the lessons, and PowerPoint® was used in 13% (n = 7) of the lessons.

Finally, many of the lessons focused the use of technology on preparation and teacher presentation of concepts. One third (n = 19) of the lessons did not include any use of technology by students; that is, the technologies incorporated in the lesson were used exclusively by

the teacher to present information or collect resources prior to the implementation of the lesson. Two fifths (42%, n = 24) of the lessons integrated technology exclusively for student use, and the remaining lessons involved a combination of teacher-student use of technology.

Postunit Reflections

After implementing their technology-integrated lessons, participants were required to complete a postunit reflection activity. A total of 57 postunit reflections were analyzed. The reflections consisted of participants' written responses to the following questions:

- Describe the parts of the lesson that you felt were successful. What are some of the strategies that you used that you would use again in other lessons?
- Describe the parts of the lesson that you felt were not successful. If you were to deliver this lesson again, what revisions would you make to the content or strategies used in the lesson?
- Do you think the technology incorporated into your lesson worked effectively? Would you use the technology again? Why or why not?

Perceived successful lesson strategies. Participant

Table 1 ☐ Participant responses to attitudes towards integration portion of the survey (in rank order).

Item Description	*Participant Response (N=100)* *X**	*SD*
A lack of knowledge about technology will impede a teacher's ability to integrate technology.	1.57	0.69
A variety of technologies is important to enhance student learning.	1.66	0.62
Technical problems often occur regardless of the extent of teacher planning when integrating technology.	1.69	0.69
Content instruction should take priority over technology skills.	1.77	0.62
Technologies used in a lesson should be selected based on the learning goals of the lesson.	1.78	0.69
I can deliver a technology-integrated lesson with technical support preparing and delivering the lesson.	1.79	0.62
I could integrate technology into a lesson with more technology skills training.	1.81	0.72
I am confident about integrating technology into a language arts, social studies, math, science, or other content area lesson.	1.84	0.73
Given a learning goal, I am able to develop ideas for integrating technology.	1.86	0.57
A lack of knowledge about how to integrate technology into content areas is a barrier.	1.90	0.80
For effective technology integration in a lesson, a teacher needs to adapt his or her teaching strategies to become more student-centered.	1.99	0.63
It is important to select technology to use in a lesson prior to planning for the content of the class.	2.22	0.96
I do not need assistance to deliver a technology-integrated lesson.	2.26	0.77
I feel that my technology course has prepared me to integrate technology into my content area specialization.	2.61	0.80
I do not need more training on how to integrate technology.	2.65	0.94
Technical problems can be avoided with proper teacher planning.	2.72	0.81
Teaching students to use technology is not my job.	3.18	0.85
It is unreasonable to expect teachers today to integrate technology into instructional activities.	3.21	0.79

* Note: 1 = *strongly agree;* 4 = *strongly disagree*

reflections (N = 57) regarding the successful strategies utilized in delivering their lessons tended to focus on preplanning strategies, encouraging student involvement, modeling classroom activities, and establishing collaborative groups. Eleven of the participants (19%) discussed the effectiveness of preplanning and motivating students early in the lesson as effective strategies. For example, one participant stated, "It . . . worked well to have students prepared for what they were going to do. I quickly explained what we would do, and its application to the lesson." Another participant said, "My anticipatory set for this lesson was extremely successful because the students were drawn in." Similarly, one participant stated, "I believe that my grabber, animal charades, was a successful strategy. The kids loved it."

Nine of the participants (16%) specifically discussed the effectiveness of modeling the activities students were expected to complete prior to beginning the lesson. As one participant stated, "Modeling what children were supposed to do proved very beneficial and helped them understand the goal of the assignment." Another participant was even more specific, stating "I feel modeling to the class the process of writing a script and having students demonstrate it was successful. This helped students get an idea of what was expected of them.

Table 2 ☐ Participant responses to environmental resource barriers portion of the survey (in rank order).

Item Description	*Participant Response (N = 100)* *X**	*SD*
It is easier to use technology with smaller class sizes.	1.55	0.63
In order for technology integration to be successful, teachers should have more access to computer labs.	1.68	0.60
There is not enough technology support in schools today.	1.88	0.81
There isn't enough time in class to implement technology-based lessons.	1.91	0.68
Technology-integrated curriculum projects require more preparation time than projects not incorporating technology.	1.93	0.82
Schools do not provide enough support to teachers for technology integration.	1.98	0.68
Students with novice technology skills can learn effectively in a technology-integrated lesson.	1.98	0.60
A teacher with novice technology skills can deliver an effective lesson integrating technology.	2.07	0.74
It is more difficult to deliver a technology-integrated lesson in a classroom with 1–4 computers than in a computer lab.	2.12	0.73
Lower-elementary students (K–2) cannot effectively use technology as a learning tool.	2.20	0.83
Most schools do not have enough computers to effectively integrate technology.	2.21	0.76
An unsuccessful technology-integrated lesson is usually the result of a lack of teacher's technology skills.	2.38	0.83
A teacher must have advanced technology skills to effectively use technology in a lesson.	2.48	0.73
A successful lesson that integrates technology can be accomplished with one computer in a classroom.	2.48	0.91
More teachers would integrate technology if they had more training on how to use technology.	2.66	0.78
Lack of software availability in schools is a barrier to effective integration of technology.	2.93	0.83

* Note: 1 = *Strongly Agree;* 4 = *Strongly Disagree*

It also served as a good reminder to students of what needed to be done when they forgot or felt confused."

Finally, nine participants (16%) discussed the success of collaborative grouping when implementing their lessons. One participant said, "The most successful part of the lesson was students helping each other." Similarly, another participant stated, "I would definitely use group work again. [The students] were able to help one another and learn to successfully interact as a group." One participant stated that she was pleasantly surprised by the effectiveness of collaboration: "I felt that it was helpful to have the students sit in partners rather than alone. The students helped each other when they were having trouble. . . . To my surprise, the students did not fight over who got to use the [computer] first."

Perceived areas for improvement. When asked to describe difficulties they had implementing their lessons, and revisions they would make the next time they delivered a technology-enhanced lesson, participants focused on preplanning and preparation, the need for collaborative groups, and improving their estimates of the amount of time needed to complete technology-enhanced activities. Interestingly, many of the comments regarding improvements needed for implementing the lessons were similar to comments made by other participants when asked to describe the successful strategies they employed when implementing their lessons.

Planning and preparation was a major theme throughout the debriefings. Ten participants (17%) stated that they felt additional planning was needed to implement lessons incorporating technology. One participant stated, "I would . . . make sure I knew what level of understanding [the students possessed] prior to instruction. I would explain the activity better before beginning it. I would make sure that I knew *exactly* what I was doing on the computer and how to explain it." Other participants described specific preparations they would make before delivering their lessons again:

> If I were to deliver this lesson again, I would have precut male and female figures. . . . Making the [figures] was just supposed to be a quick and fun activity that reinforced one of the sets of myths and facts that we learned. It turned out that this activity took the longest out of the entire lesson.

Seven participants (12%) also discussed the effectiveness of incorporating collaborative activities when using technology in the classroom. One participant stated, "I think it would be neat to let the students work in groups, and let them find information themselves on the Internet." Another participant said, "The difficult part of the lesson was teaching the technology portion of the lesson to a large group. In the future, I would [use] smaller groups . . . to allow for more individualized instruction."

Finally, time was a recurring theme throughout the debriefings. Eleven participants (19%) specifically stated that they did not allocate enough time for the activities, or that they underestimated the amount of time certain portions of their lessons would take to complete. When asked what revisions she would make to her lesson, one participant said, "I would make it a two-day lesson instead of the hour I was given." Similarly, another participant stated: "Next time, I would give myself a lot more days and time to instruct and implement my lesson." Participants were also surprised at the time needed for students to complete activities on the computer. As one participant stated, "The technology part was difficult, since they were so young. They were not very familiar with computers." Another said, "The main problem was the amount of time it took. I did not take into account how long it would take the students to type."

Effectiveness of technology. When asked to discuss the effectiveness of technology, many participants responded enthusiastically that the technology had a positive impact on their instruction and the attitudes of their students. Thirty-six (63%) of the participants made positive statements regarding the effectiveness of the technology incorporated into their lessons. One participant said, "The technology I incorporated into my lesson was crucial for the overall effectiveness of the lesson. The [use of technology] made a huge difference on the excitement the kids had for the assignment. I would definitely use it again." Another participant stated, "[The

technology] kept the students engaged and interested in the subject. The students felt a huge sense of accomplishment once they completed the assignment on the computer." Finally, the lessons preservice teachers were required to develop and implement encouraged many of them to learn more about technology integration: "Seeing how students loved to be involved with this lesson has encouraged me to want to learn more about using computers in the classroom."

However, several participants did state that there were some difficulties integrating technology, particularly with younger students (n = 11, 19%). When asked to discuss the effectiveness of technology for instruction, one participant said: "I would use technology again especially in the upper grades. With kindergarteners there is not too much they can do with computers." Other participants stated that "The technology part was difficult, since they were so young," and, "I feel that technology is more useful with older children."

Finally, seven participants (12%) expressed their frustrations with the lack of support for technology integration provided by their placement teachers. When asked if they would incorporate technology differently, one participant stated:

> I think instead of having them do word processing, I would have them do PowerPoint presentations. . . . I think this would be more [effective]. However, . . . you have to work with your [placement] teacher, and if they want you to do something a certain way, that is how you do it.

Another participant described his frustration attempting to implement a lesson incorporating the use of the Internet in his placement teacher's classroom:

> I . . . planned a lesson that integrated language arts, social studies, and technology. I thought the lesson plan was creative and purposeful. In addition, I thought the students would particularly enjoy it because the activity revolved around each individual student. . . . When I presented my lesson plan to the teacher, she informed me that even though she was certified for the Internet, she did not want to integrate it into the curriculum. She explained that even though firewalls were in place, she was not ready or prepared to deal with the implications of the Internet. Therefore, my lesson plan was unacceptable. . . . I was really disappointed that my [placement] teacher did not want to use the Internet.

Participant Interviews

During interviews, preservice teachers stated that even after they had completed the required technology-integrated lesson activities, they did not feel that the experiences provided in the teacher education program adequately prepared them to utilize technology in future teaching and learning activities. For example, when asked whether the teacher education program had prepared them to integrate technology, one preservice teacher responded: "I don't think they're doing a good job . . . I didn't learn anything in this course. . . . All [I had] to do is put together a lesson plan." A second interviewee stated: "I'm computer illiterate. I don't know how to use programs with kids and I don't know where to learn it." Another interviewee concurred, commenting: "I haven't learned anything. I still don't know how to do anything."

Preservice teachers interviewed stated that more focus needed to be given to providing training on specific technology skills, as opposed to broader pedagogical issues. When asked how the technology component of the teacher education program could be improved, an interviewee stated: "Teach us more technology skills. If I don't know the skill, how can I teach the concept using the technology?" Another interviewee stated, "We have excessive training in courses and not enough in the technical areas."

Interviewees also tended to have negative views regarding the use of technology in educational settings. Several of the preservice teachers stated that technology served as "an easy way out" for conducting research or completing writing activities. In terms of using computers and the Internet for research, one interviewee stated:

> You can use the computer to do research. But you can do it with other resources, [like] encyclopedias. I think kids—they don't know how to go to the library anymore and look things up with a card catalog . . . the card catalog was always so important. They always taught us that. Now they don't.

A second student stated:

> You can stay home and look up information on the Internet, rather than going and checking out books at the library. Now you can just stay home and look up research on the Internet. They don't even know if that's credible anyway. Which is what is the downfall about the Internet. . . . I don't know, I think that's a lazy way to be.

Preservice teachers had similar views regarding writing activities. One interviewee stated:

> [A] lot of teachers say, "This has to be typed." If you're taught how to have good handwriting and enforce good handwriting, you wouldn't need it to be typed to be able to read it, so I think it's just a way of getting out of doing sloppy work. I don't think you need a computer. I think you can write a report just as easily.

Many of the preservice teachers interviewed stated that technology was more appropriate for upper-elementary students than for lower-elementary students. For example, one preservice teacher stated:

> I'm only in a first grade class so I think in order to bring understanding to technology is difficult in a first grade classroom. They don't even have their writing skills and their reading skills. You need to have those first before you start throwing them on computers.

Another preservice teacher stated, "I'm in a kindergarten classroom and there are five computers—not for educational purposes but just to play games and stuff and I think . . . [reading and writing] should be [the focus]. Because they need to learn how to write." She concluded by stating, "With younger kids, there are so many other skills you need to attack before you even start integrating technology."

Interviewees were fairly critical of the use of technology by methods faculty and the placement teachers. Many interviewees found that their placement teachers either used computers for rewards after classwork had been completed, or for drill and practice of basic skills. Few interviewees stated that they observed their placement teachers using technology with students in the classroom. As one interviewee stated: "I work with first graders and they're not even allowed to go [use the computers]." A second interviewee stated bluntly, "My students don't use computers ever."

Finally, comments from preservice teachers during their interviews indicated that they had difficulty determining how technology could be used effectively in the classroom. Many of the interviewees saw few benefits of technology in their teaching. One preservice teacher stated: "Computers are not interesting. And I don't think anything a teacher can do on a computer to model something is going to be interesting." Another preservice teacher commented: "I've learned so much stuff with technology, but I don't think it will help me with teaching in elementary school." One interviewee summed up beliefs regarding technology by stating: "I don't really know what technology does to help students."

DISCUSSION

The purpose of this paper was to provide a detailed overview of the field-based methods used by faculty at ASU to integrate technology into the preservice teacher education program. In addition, we presented formative evaluation data designed to assist with addressing two major evaluation questions: (a) What are the preliminary successes of the field-based program with regard to student perceptions, attitudes, and ability to integrate technology, and (b) What components of the model require modifications or additions? These questions are discussed below.

Preliminary Successes of Program Components

Modeling. The data collected indicated several components of the field-based model that may have had a positive impact on preservice teachers' knowledge of technology integration. The modeling activities we implemented may have had benefits beyond simply providing the preservice teachers with authentic examples of effective technology-integrative lessons. When asked to indicate successful strategies used when delivering their lessons, numerous preser-

vice teachers specifically discussed their use of modeling the lesson activities with their students. Comments from the debriefing sessions such as, "I think I did a pretty good job of modeling the lesson" may indicate that preservice teachers adopted the strategy demonstrated during the field-based technology activities with their own students. However, further data collection is needed in order to determine if the modeling activities built into the technology workshops had an impact on student use of this strategy, or if the students acquired the technique from other components of the teacher education program. This additional analysis could prove beneficial, since the use of modeling to demonstrate technology integration activities is considered to be a highly effective strategy not only for preservice teachers, but for students in K–12 classrooms as well (Faison, 1996; Kovalchick, 1997; Nicaise & Barnes, 1996).

Collaborative activities. Many of the lessons implemented by preservice teachers incorporated collaborative groups as a classroom management strategy. Once again, this could be attributed to the effectiveness of the modeling activities we provided to the preservice teachers throughout the semester. Integrating collaborative and cooperative learning strategies with technology-integrated instructional activities has been shown to have a positive impact on student performance and attitudes (Brush, 1997; Lou, Abrami, & d'Apollonia, 2001). Thus, we continually stressed the effectiveness of designing cooperative and collaborative activities, particularly when using limited resources (such as computers) in a classroom situation. We included collaborative activities in each of the lessons we modeled for the preservice teachers. Participation in collaborative group activities during the modeling sessions may have provided preservice teachers with additional methods for implementing collaborative structures in their own lessons. As with preservice teacher use of modeling techniques, however, further data needs to be collected in order to determine the extent to which other components of ASU's teacher education program positively affected their use of cooperative and collaborative learning strategies with their technology lessons.

Confidence and enthusiasm. One of the most encouraging findings from the data was the confidence and enthusiasm demonstrated by the preservice teachers, particularly with regard to designing and implementing technology-integrative lessons. A vast majority of participants responded positively to survey items dealing with developing content-area lessons that integrate technology (e.g., "I am confident about integrating technology into a math, science, language arts, social studies, or other content area lesson"), and with generating ideas for integrating technology into the curriculum (e.g., "Given a learning goal, I am able to develop ideas for integrating technology"). In addition, when asked to discuss the effectiveness of the technology incorporated into their lessons, numerous preservice teachers responded positively, with statements such as "the children *loved* the technology portion of the lesson," "The technology really enhanced what I did," and "I would definitely use technology again in future lessons." Although these results cannot be directly attributed to preservice teacher participation in this program, research has demonstrated that providing teachers with a supportive, positive environment while they are initially attempting to implement curricular innovations such as technology in classroom contexts has a positive impact on their willingness to utilize technology in future activities (Beyerbach, Walsh, & Vannatta, 2001; Ely, 1999). Based on these data, participants of this program may be increasingly willing and able to integrate technology in future classroom situations.

Potential Modifications and Additions

Additional focus on early elementary models. In both interview and debriefing-reflection data, several preservice teachers suggested that technology was inappropriate for early elementary students. Preservice teachers were continually providing statements such as: "I would definitely use technology with older children," and "I feel that it is difficult to integrate technology into the lower grades." While we thought that the modeling activities we designed were adaptable for a wide range of grade levels, these data sug-

gest that we did not provide effective models for use with students in early elementary grades (K–3). The limited time we had available with the preservice teachers somewhat hindered our efforts to provide a wide range of models. However, one solution we will be implementing in the future is the use of video cases of teachers effectively integrating technology (Savenye, Brush, Middleton, Blocher, & others, 2002). Many teacher education programs are using video cases to supplement preservice teachers' field experiences (e.g., Barab, MaKinster, Moore, & Cunningham, 2001; Morey, Bezuk, & Chiero, 1997). Based on the results of this evaluation, we have specifically developed several cases focusing on K–3 teachers utilizing technology to facilitate instruction. We plan to incorporate these cases into subsequent modeling sessions.

Additional support for placement teachers and methods faculty. Another area of concern expressed by some preservice teachers was the lack of modeling and technology support provided by some placement teachers and methods faculty. As one preservice teacher stated, "[S]tudents [in my placement teacher's classroom] don't use computers ever." Although we provided modeling and support to preservice teachers both during the formal modeling sessions and informally throughout the semester, the use of technology for teaching and learning activities needs to be modeled by methods faculty and classroom teachers as well (Carlson & Gooden, 1999; Duhaney, 2001). To this end, we have begun to implement a series of "technology institutes" specifically designed to provide methods faculty and placement teachers with additional skills and experiences regarding the use of technology in classroom situations, and strategies for integrating technology into the core content areas (Brush et al., 2001). In addition to this more formal training, we have increased our efforts to provide just-in-time support to methods faculty who wish to incorporate technology into their class activities, and have invited teachers at our placement schools to attend modeling sessions with our preservice teachers.

Changing perceptions of preservice teachers. A final area for improvement relates to the perceptions of preservice teachers in the field-based program regarding both the appropriate uses of technology in schools and the effectiveness of the experiences in which they participated as part of the new program. It is interesting that while 86% of the preservice teachers felt confident in their abilities to integrate technology into their lessons, many did not view their experiences in the educational technology workshops as contributing to those abilities. More than 50% of preservice teachers responded negatively to survey items related to their formal technology instruction (e.g., "I feel that my technology courses have prepared me to integrate technology into my content area") as well as their level of training related to technology integration (e.g., "I do not need more training on how to integrate technology"). Further research should investigate preservice teacher understanding of technology integration (types of technologies, high-level use, low-level use, etc.) and the curricular experiences they feel contributed to building their confidence about integrating technology into their instruction.

Preservice teacher comments about the effectiveness of the technology incorporated into their lessons focused on how they perceived technology as a motivating factor, for example, "[T]he children loved the technology portion of the lesson," "[The technology] kept the students engaged and interested in the subject," and "Seeing how students loved to be involved with this lesson . . . ." Preservice teachers did not cite technology as contributing to increased student understanding of the concepts taught, nor did they speak of technology as enhancing their instruction in ways that would have been impossible without it. Research with inservice teachers has demonstrated that teacher training and access to technology does not necessarily result in increased technology integration in classroom instruction (Cuban, Kirkpatrick, & Peck, 2001; Windschitl & Sahl, 2002) but is mediated by teacher beliefs about the value of technology and the culture of the school. The value preservice teachers placed on the technology-rich modeling activities they experienced in their educational technology workshops may have been mediated by their prior experiences and the beliefs they had formed about learning and teaching.

Interview data from the preservice teachers working in early elementary classrooms indicated that they tended to distinguish between instruction in reading and writing, and access to computers. Content instruction was described as a precursor to access to technology. Technology was described in terms of motivating games that did not have an educational value. "I'm in a kindergarten classroom and there are five computers—not for educational purposes but just to play games and stuff." In addition, two interviewees stated that technology could detract from content area instruction. There was a concern that the use of a word processor could inhibit children from developing good handwriting, that children were not taught traditional research methods using card catalogues and encyclopedias, and that the Internet contained unreliable information. These statements may indicate that we need to enhance discussions dealing with technology's ability to facilitate more rigorous research activities in classrooms. However, this involves providing guidance to preservice teachers in developing more expansive research activities with their students.

One of the challenges for this program is to engage our preservice teachers in conversations about their beliefs regarding the role technology should play in teaching and learning, while at the same time training them to use specific technologies. This is a difficult task, but if it can be accomplished, we have the potential to address two of the issues voiced by the preservice teachers in this study—"I don't really know what technology does to help students," and, "I still don't know how to *do* anything."

Conclusions

Providing preservice teachers with meaningful and effective experiences related to technology integration is a daunting task. In this paper, we have described one model for providing these experiences, and preliminary data that both supports the effectiveness of our model and indicates components that need improvement. Although we are in the first year of fully implementing this new approach, we believe that preservice teachers in our program are already receiving experiences with increased relevance and applicability to their future professional placements. It is hoped that through continued evaluations and modifications to this model, we can further enhance the experiences we provide our teacher education students. □

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