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Integrated Technologies, Innovative Learning: Insights from the PT3 Program (Vol. II)

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Integrated Technologies, Innovative Learning: Insights from the PT3 Program (Vol. II)

**Description**
This second volume of *Integrated Technologies, Innovative Learning* documents implemented and tested strategies from diverse members of the Preparing Tomorrow’s Teachers to use Technology (PT3) program. These stories of the struggles and successes of technological innovation and professional development from the PT3 program are rich resources for educators and policy makers. The stories range from the challenges of building institutional structures to the evolution of an individual teachers’ perspective of technology integration. Every aspect of the educational system is addressed in this far-reaching examination of how to facilitate the development of teachers who can best use technology to impact learning from kindergarten to college.

**Keywords**
education, technology, curricula

**Disciplines**
Curriculum and Instruction | Education

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Integrated Technologies, Innovative Learning

Volume II

Insights from the PT³ Program
Acknowledgments

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Preface

Hundreds of teacher education programs throughout the United States are currently working to determine how to best prepare teachers so they can effectively harness the potential of technology for learning. Hundreds of school districts and institutions of higher education throughout the nation are working to maximize the return on their investment in technology. The Over 400 consortia of the Preparing Tomorrow’s Teachers to use Technology (PT3) program have redesigned undergraduate and graduate curricula, addressed issues of digital equity, and established innovative ways of transforming teacher education through the power of technology. The two volumes of this book document significant insights of PT3 projects around the country. Volume I is available in paperback from ISTE and includes 20 chapters filled with a wealth of ideas and approaches for integrating technology in teacher preparation. The chapters in this second volume of the book further document implemented and tested strategies that represent geographically broad and economically diverse contexts. These stories of the struggles and successes of technological innovation and professional development from the PT3 program are rich resources for educators and policy makers. The stories range from the challenges of building institutional structures to the evolution of an individual teachers’ perspective of technology integration. Every aspect of the educational system is addressed in this broad ranging examination of how to facilitate the development of teachers who can best use technology to impact learning from Kindergarten to College.
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Content Matrices

The great diversity of ideas supported by PT3 funding allowed participating institutions to structure their grants to meet specific institutional needs. The project designs that emerged from this work included a different focus groups, a variety of implementation approaches, and range of community contexts. To assist your exploration of this wealth of innovations and insights, we have constructed a matrix of these dimensions for each of the two volumes. Immediately below you will find the contents matrix for the eleven projects contained in volume two. Underlying this matrix we have included a list of definitions describing the terms we are using.

### Volume II Table of Contents Matrix

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**Student/Peer Technology Mentors:** Students or faculty peers are used as technology assistants or mentors for technical or curricular support of faculty and K-12 teachers.

**Portfolios:** Pre-service teachers, teachers, or faculty use portfolios as a means of demonstrating competency in technological integration.

**Small Grants:** Money is given to faculty, teachers, or student teachers for equipment, software, etc. in a competitive or non-competitive process to support innovative ideas.

**Creation of Resources:** For example, databases of lesson plans, videotape, or other resources for teachers or faculty integrating technology into their instruction.

**Teams or Communities:** Pre-service teachers, K-12 teachers, and/or faculty combine in learning communities or work together in groups to develop curricula or to accomplish a particular technology integration goal.

**Assess Tech Competence:** K-12 teachers, preservice teachers, and/or faculty’s technology skills are assessed through performance assessments or other specific tool.

**Faculty Development:** Workshops, conferences, and other similar strategies are used to give professional development to faculty and K-12 teachers.

**Field Experience:** The project focuses upon integrating technology into student teachers’ field experience.

**Evaluation:** The chapter primarily focuses upon evaluation of PT3 projects.
ASU’S INTEGRATED FIELD-BASED TECHNOLOGY MODEL: A LEGACY OF COLLABORATIVE REGENERATION

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An integrated field-based model of educational technology and summer technology institutes enhance the technology integration skills of faculty and preservice teachers at ASU-Tempe. This requires a collaborative programmatic infrastructure that provides opportunities for education and technology faculty to develop shared goals and the technology and training necessary to reach those goals.

Arizona State University-Tempe is a metropolitan, Research 1 university with over 50,000 students. The College of Education graduates over 1,100 teacher candidates per year. In 2001 educational technology faculty received a PT3 grant to enhance the technology integration skills of faculty and preservice teachers. Two primary activities contributed to accomplishing this goal: 1) the development of an integrated field-based model of educational technology curriculum for elementary preservice teachers; and 2) summer technology institutes for faculty. These experiences were intended to provide faculty and preservice teachers access to, and training with, various types of technology tools in authentic settings.

In this chapter we will describe how the educational technology curricular changes funded by the grant required the development of a collaborative programmatic infrastructure to serve as the catalyst for the emergence of shared goals among educational technology and education faculty. This has resulted in broader than anticipated programmatic, curricular, and institutional changes. Finally we’ll describe the legacy of the PT3 initiative at ASU and share some of the challenges that continue to shape our efforts to improve the education of our preservice teachers.

Collaboration required:
Integrated educational technology curriculum necessitates re-evaluation of preservice program structure

In 2000 the PT3 Call for Proposals encouraged educational technology faculty members at ASU-Tempe to propose a new approach for teaching technology to preservice teachers by aligning technology and methods classes with authentic experiences in elementary school classrooms. When the grant began, the technology class was taught in the university computer labs. It was not coordinated in any way with other preservice courses, preservice
faculty did not know what technology was being taught or why, and the technology course offerings often conflicted with other preservice courses. Previous approaches ranged from trying to teach everything to everybody, to letting students self-select technology modules they needed or that piqued their curiosity. These approaches were unsuccessful and, as a result, had a negative impact on the reputation of the Educational Technology program.

The goal of PT3 project funded in 2000 was to enhance the technology integration skills of faculty and preservice teachers through two primary activities. First, we would develop field-based settings for the technology course and a curriculum that was integrated with the methods classes of a field-based elementary education program hosted by 15 community schools and which has 500 preservice teachers enrolled at any given time. Technology integration would be taught in elementary schools using the technology that was available in these settings, thereby providing authentic and rich experiences for our preservice students. Second, summer technology institutes would be offered for both education faculty and community school faculty hosting preservice teachers for their internships (Figure 1).

Figure 1: Technology Integration at ASU

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Collaboration Required: Create programmatic infrastructure across communities of practice (elementary & technology faculty)
1. Joint faculty retreats every semester
2. Technology team meetings include education faculty liaison
3. Collaborate to design professional development opportunities
4. Opportunities to develop joint presentations at professional meetings

PT3 Goal: Enhance the technology integration skills of faculty and preservice teachers

PT3 Activity: Integrated field-based model for technology course

Integrated field-based model curriculum adapted for stand-alone technology courses

2000 2001 2002

Preparing Tomorrow’s Teachers to Use Technology (PT3) Grant

Educator Learning Community (ELC) Grant

On-going Collaboration: Educator Learning Community (ELC) grant funded

ELC Goal: Accept web-based tool to develop program-wise growth and impact e-portfolios providing authentic assessments of the program’s impact on the learning of preservice teachers and the children they teach

ELC Activities:
1. Skills series of technology workshop for faculty
2. Summer technology institutes for faculty
3. Faculty mini-grants to use web-based tool in teaching

Add web-based tool to technology integration courses
A competency-oriented technology curriculum was piloted in the spring of 2001 at one elementary school. The curriculum was developed with a focus on competencies in the use of technology, and it was taught at the elementary school site. Formative feedback collected after the pilot semester revealed most students had the prerequisite competencies – word processing skills, the application of graphics, desktop publishing, and use of the Internet. However, we did not know whether the students were able to apply these skills in classrooms with children. The focus then shifted from teaching particular competencies and monitoring their application in methods courses, to curriculum integration and using technology with children in classrooms. This change in focus required a more collaborative style of interaction between the two faculties.

Educational technology faculty met in a retreat setting in the fall of 2001 with elementary education methods faculty to share syllabi and begin to align the technology course with the content of the methods courses. The two formal communities of practice – educational technology faculty and elementary education faculty – began to develop shared goals and the programmatic infrastructure necessary to achieve them.

The level of engagement changed among the faculty as the focus of the project broadened from “how do we teach technology competencies to preservice teachers” to one of “how do we best prepare today’s teachers to integrate technology in their classrooms with children.” With this shared goal came shared responsibility. Figuring out the application process for how to teach a particular skill or competency was limited to the parameters of that skill. Figuring out how to integrate and subsequently teach children required interactivity among methods course instructors and school personnel, as well as technology faculty and technology graduate student instructors. Elementary faculty began to view technology as an integrated part of the preservice curriculum. This was reflected in faculty panels and presentations at professional meetings (Brush et al., 2002). It was no longer a stand-alone course taught elsewhere by others but an integrated part of the field-based program.

**Collaborative programmatic structure developed:**
Catalyst for programmatic, curricular, and institutional change

Research in schools indicates that technology use is a function of both individual teacher characteristics and institutional characteristics (Cuban, Kirkpatrick, & Peck, 2001; O'Dwyer, Russell, & Bebell, 2003). Specifically, the school or institution must provide educators two types of opportunities: 1) opportunities to collaborate; and 2) opportunities to get training while having easy access to various types of technology. And, this must happen within a school or institutional culture that openly values the use of technology.

The PT3 grant, as originally conceived, focused on providing access to and training with technology through: 1) the development of an integrated field-based model of educational technology curriculum for elementary preservice teachers; and 2) summer technology institutes for faculty. In order to accomplish curricular integration and alignment it became necessary to examine the structure of the elementary education preparation program and begin to identify opportunities for elementary education faculty and educational technology faculty to work together as collaborators. The outcome was a programmatic infrastructure
that spans two communities of practice – elementary education faculty and educational technology faculty – and that provides opportunities to collaboratively develop shared goals and the technology tools and training necessary to reach those goals. This is the central, enduring contribution of the PT3 grant to our institution. This infrastructure embodies a collaborative style of interaction and has provided the catalyst for programmatic, curricular, and institutional change.

Programmatic Changes

In order to achieve the goal of enhanced technology integration skills for preservice teachers and faculty we needed to make a concerted effort to develop the programmatic infrastructure that would support a collaborative style of interaction across institutional divisions/departments (Brush et al., 2002; Glazewski et al., 2003). Collaboration was essential to the successful integration of educational technology experiences into the preexisting field-based methods courses in our elementary teacher education program. We deliberately constructed environments in which an interpersonal collaborative style of interaction was both modeled and made evident to faculty and preservice teachers. This collaborative style was defined by Friend and Cook (2000) as “a style for direct interaction between at least two coequal parties voluntarily engaged in shared decision making as they work toward a common goal.” (p. 6)

The collaborative programmatic infrastructure we developed includes four components: 1) faculty retreats each semester; 2) educational technology team meetings; 3) professional development opportunities; and 4) opportunities to develop joint presentations at professional conferences documenting the program. Retreats provide opportunities for the full faculty of the elementary education program and all faculty involved with the educational technology course to share syllabi and align course activities. In addition, weekly educational technology team meetings include an elementary education faculty liaison. The liaison actively contributes to educational technology curriculum design, implementation, scheduling, and dual faculty retreat development. She thus spans the two communities of practice acting as a “broker” (Cobb, McClain, de Silva Lamberg, & Christal, 2003; Wenger, 1998) addressing potentially divisive issues surrounding curriculum development, implementation, and evaluation.

Professional development opportunities for elementary education faculty funded by the PT3 grant included summer technology institutes. These became a collaborative effort as educational technology faculty actively sought input from methods faculty regarding content, and methods faculty had opportunities to demonstrate innovative ways they were using technology in their instruction.

Finally, PT3 provided funding for the joint development of papers and presentations at professional conferences documenting the impact of the various elements of the integrated field-based model of educational technology instruction. Interactions among faculty were always structured to establish parity among all participants in the program - faculty and graduate student instructors - by valuing the contributions of each individual and encouraging involvement through a process of shared decision-making.
Curricular Changes

On-going evaluation processes are now a permanent feature of the technology course offered to preservice teachers. Embedded measures of the impact of the curriculum on preservice teachers developed during the PT3 grant period are analyzed to adjust the curriculum with the goal of continuous improvement. These measures included preservice teacher surveys, technologically enhanced lesson plans, and course evaluations. The surveys provide feedback on confidence and attitudes toward technology and indicate that our preservice teachers continue to demonstrate positive attitudes toward technology and express their confidence about integrating technology into their teaching (Brush et al., 2003; Glazewski et al., 2003; Glazewski, Rutowski, Sutton, Ozogul, & Igoe, Submitted).

Lesson plan reflections indicate a vast majority of our preservice teachers are enthusiastic about the motivational aspect of providing opportunities for children to use technology (Glazewski et al., Submitted). They also describe technology as having an important role in students’ future lives. Finally, they see technology as providing a means for students to do things more efficiently – gather information from multiple sources, construct presentations, and capture data. Prior to entering the program they hadn’t thought about children using technology in the classroom (Glazewski et al., Submitted). The impact of designing and teaching a technology enhanced lesson during the integrated field-based educational technology course is captured in this preservice teacher’s lesson reflection: “….just being able to see the lessons and how much you can do with them and then trying it out with the kids and seeing how well that works. That really helps. It makes it seem like, ‘Okay, it’s possible!!’” This experience influenced the preservice teachers’ changing perception of the role of technology in classroom instruction or, as one student put it – “computers aren’t just for games anymore!” (Glazewski et al., Submitted)

The integrated field-based educational technology curriculum developed for the elementary preservice teacher program under PT3 now forms the basis of the curriculum for the stand-alone educational technology course offered to all preservice teachers in other programs in the college – secondary, special education, multicultural, and early childhood education (Figure 1). An important distinction does remain – preservice teachers in the stand-alone courses design but are not required to actually teach a technology-enhanced lesson with children. Preliminary research indicates that preservice teachers in the integrated field-based classes perceive software and hardware availability in schools to pose a barrier to integrating technology into their instruction to a greater degree than those preservice teachers in the stand-alone classes (Rutowski & Brush, 2003). The field-based classes make use of the technology available at the school sites but this varies from school to school, as does the stability of network connections. For example, some schools have smart boards and others do not. The same is true for wireless smart carts and digital cameras. Curricular changes and additional research are underway to address two key questions: how to model technology enhanced lessons to preservice teachers using existing school technology and at the same time expose them to state-of-the art technologies that may not be available at schools; and how to help them develop strategies and techniques to modify and adapt existing technologies in innovative ways.
Enhancing the technology integration skills of preservice teachers and education faculty continues to be an institutional goal. The PT3 grant allowed us to put into place a programmatic framework and curriculum that supports preservice teachers’ demonstration of the ability to develop and teach technology enhanced lessons that put technology in the hands of children (Brush et al., 2003), methods faculty have a much fuller picture of preservice teachers’ capacity to use technology (Brush et al., 2002), and most recently, methods faculty have begun to explore using new technologies to teach and manage their courses (Rutowski, Igoe, & Kopcha, 2004). However, it remains to be seen if our institutional culture has changed enough to support a collaborative style of interaction as personnel and faculty change over time.

Institutional Change

Access to technology varies within our college of education. Most classrooms have Internet access however there is only one fully mediated classroom with state-of-the-art technology. Typically instructors who want to use technology during instruction must reserve carts with specific hardware and check them out prior to class, push the often top-heavy carts through crowded corridors, in and out of elevators, and along busy sidewalks only to have to wait outside the classroom door for the room to become available. The hectic 5-10 minutes required to hook up cables, plug in power cords, and rearrange furniture while welcoming students then has to precede actual class time.

This scenario is not illustrative of an institutional culture that values the use of technology – one of the critical elements necessary for the use of technology by teachers (Cuban et al., 2001; O'Dwyer et al., 2003). However, the enhanced visibility of educational technology and elementary education faculty who participated in the PT3 grant and their membership on newly formed committees to develop university and college technology plans indicates that the culture of the institution may be changing.

Two components of the PT3 grant contributed to education faculty valuing and using technology in their teaching and gaining the credibility necessary to provoke institutional change: summer technology institutes; and support to present at local and national conferences. The summer institutes provided opportunities for both early adopter and novice education faculty to gain access and training in new technologies. The institutes also provided opportunities for building collaboration between education faculty and the educational technology faculty facilitating the institutes. Elementary education faculty began to use more technology in their methods courses for instructional delivery and management. They also began to develop computer and web-based assignments. Concurrently, educational technology faculty revised the educational technology course to complement and build on content in the methods courses (Brush et al., 2002; Glazewski et al., 2003).

The PT3 grant allowed us to develop and put into place the evaluation processes described earlier and these continue to inform curricular decisions in the technology course. It also provided travel monies for elementary education and educational technology faculty to present this research at national conferences. Conference presentations and the publications that followed helped establish the credibility of PT3 faculty in our college of education. This
visibility has been parlayed by faculty, all of whom are non-tenure track - clinical professors, lecturers, and faculty associates - into representation on a committee to develop a university technology plan and, most recently, participation in preliminary efforts to develop a technology plan for the college.

**PT3’s Legacy: On-Going Collaboration**

Researchers have documented successes of PT3 grants that act as catalysts for the development of collaborative communities of learners who explore technology innovation in teaching and who share their resources (Seels, Campbell, & Talsma, 2003). At our institution the PT3 grant served as a catalyst for the development of a learning community with a collaborative style of interaction that identifies shared goals and the technology tools necessary to accomplish those goals. Elementary education and educational technology faculty submitted a proposal to the college to continue our collaborative work across the college’s formal divisions during the final months of the PT3 grant. A two-year internal stimulus grant to establish the Educator Learning Community (ELC) to promote research in educator preparation was subsequently funded in the summer of 2003 (Figure 1).

One of the ELC goals is to develop program-wide growth and impact e-portfolios that provide authentic assessments of the program’s impact on the learning of preservice teachers and the children they teach using of a web-based tool (Figure 1). The need for an electronic portfolio was abundantly clear as we watched students integrate their work but found ourselves limited to paper documents traveling from one semester to the next. We also knew that we had no means for assessing the impact of our preservice teachers in the classrooms where they worked. In addition, our partner schools are highly motivated to develop multiple ways to assess the learning of their students in response to national and state accountability pressures. Sustained partnerships with our partner schools have contributed to the emergence of a cycle described by Margerum-Leyes and Marx (2002) in which knowledge about educational technology is both acquired in and brought to schools partnering with our teacher preparation program.

Three primary activities support the ELC goal (Figure 1). Capitalizing on the collaborative programmatic infrastructure developed during the PT3 grant period, we developed a series of skills workshops for education and community school faculty with the express intent of generating curiosity and interest in the web-based tool under consideration for use to create e-portfolios. Secondly, the PT3 summer technology institute model was adapted to take advantage of training in technology offered by Intel. We augmented Intel Teach to the Future training with program-specific training on using a web-based tool to manage courses and develop artifacts to be included in a program-wide growth and impact electronic portfolios of elementary preservice teachers. And, finally, mini-grant proposals developed by faculty participating in the summer 2004 institute have been funded to develop the design and elements of the electronic portfolio. Mini-grants have been shown by other PT3 investigators to be effective in stimulating technology innovation in teaching (Seels et al., 2003; Strudler, Archambault, Bendixen, Anderson, & Weiss, 2003). As a result of these activities, use of a web-based tool for instructional design and course management has been integrated into the
educational technology curriculum for all preservice teachers in the college, and the elementary education program is requiring program-wide e-portfolios of preservice teachers entering the professional program in the fall of 2004.

Our Challenge: Learning Community Maintenance and Regeneration

The impact of the PT3 initiative on preservice teacher preparation in our college of education has been threefold. First, we achieved the educational technology goal of our PT3 grant – enhancing the technology integration skills of faculty and preservice teachers. Second, we have benefited from the growing body of research generated by the PT3 initiative. Elements of that research have been adapted and incorporated into our program, informing and supporting our work with preservice teachers. And third, we developed a collaborative infrastructure that allowed us to establish a learning community that openly values technology tools as a means to accomplish shared goals. This has allowed us to transform the potentially static goal of enhancing technology integration skills into a dynamic process responsive to changing educational goals and the emergent technologies that can contribute to the realization of those goals.

The instantiation of the three institutional characteristics that contribute to technology use in educational settings - opportunities to collaborate; access to and training in various technologies; and an institutional culture that values technology (Cuban et al., 2001; O'Dwyer et al., 2003) – is an on-going process requiring constant vigilance. Our challenge is to maintain and adapt the collaborative infrastructure developed under the auspices of the PT3 initiative and sustained by the Educator Learning Community. Our hope is that a collaborative style of interaction, a programmatic infrastructure that provides opportunities to collaborate, and the evaluation processes we have established will continue to inform our work. In this way the promise technology holds for education will be realized because the technology tools chosen to address the challenges of a constantly changing educational landscape will support our ultimate goal – enhancing the learning of preservice teachers and the children with whom they work.
References


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A major component of Indiana State University's PT3 grant was the development of an electronic portfolio system. Our first attempt was problematic, however, we learned from our mistakes. This chapter discusses what we learned and how we devised a successful portfolio system and integrated technology into the teacher education program.

Indiana State University (ISU), the third largest producer of teachers in the state, was awarded a United States Department of Education’s Preparing Tomorrow’s Teachers to Use Technology (PT3) grant in 2001. While many successful initiatives arose out of ISU’s PT3 grant, one particularly noteworthy initiative, the development of an integrated electronic documentation system, had multiple setbacks and underwent significant revisions before the venture became a success. Our learning and eventual success despite initial failure are the foci of this chapter. More specifically, the purpose of this chapter is threefold: 1) to describe the original portfolio system and what we learned; 2) to outline the new portfolio system and delineate the underlying mechanisms leading to success; and 3) to provide recommendations for other institutions undertaking this type of initiative.

Setting the Stage

Over 20% of the entire student population at ISU are enrolled in a professional education program at ISU. Among the undergraduate teacher education programs, elementary education has approximately 900 students, early childhood and special education have nearly 200, and another 850 students are enrolled in the secondary education program, although secondary education students are considered majors in their respective content area. Currently, 21 departments across the university are connected to the teacher education program.

ISU is also involved in Professional Development School (PDS) partnerships with 20 schools in 5 districts. The PDS sites represent all levels of schooling and serve diverse geographical areas. These K-12 partners assist with the instruction, supervision, and mentoring of preservice teachers. This partnership allows the teacher preparation program to embed
practicum experiences within each of the methods courses, thus, preservice teachers are able to apply what they learn through coursework to authentic teaching situations.

**Rationale for PT3 at ISU**

ISU applied for a PT3 grant in order to increase faculty role modeling of technology, develop students’ skills and knowledge related to the integration of technology into the curriculum, and provide an avenue for electronic portfolio development. Prior to the PT3 grant, very few faculty members used technology for instruction on a daily basis and few took advantage of the technology resources, such as computer-enhanced classrooms and multimedia carts, which were available. This was consistent with research by the Milken Exchange on Education Technology (1999), who surveyed 400 teacher education institutions and found that most faculty do not model the use of technology in their teaching. Additionally, only a few faculty members had expertise in this area and were often asked to teach the “technology component” of a class, which reinforced that technology should be viewed as a stand-alone subject. This was contrary to research that has demonstrated that computers will have the greatest impact on student learning when they are integrated into the classroom and the work is tied to relevant standards (Barnett, 2003). Our students lacked role models who could demonstrate technology-based instruction, an essential need as identified in previous research (e.g., Carlson & Gooden, 1999; Jones, 2001; Kemp, 2000).

Prior to the grant, students developed paper-pencil based portfolios. With the emphasis on technology infusion, the decision to move to an electronic-based portfolio followed easily. The creation of an electronic portfolio which incorporates mapping of student work to the International Society for Technology in Education (ISTE), National Council for Accreditation of Teacher Education (NCATE), and Indiana Professional Standards Board (IPSB) content and developmental standards was one of the objectives of the ISU’s PT3 grant. The electronic portfolio would allow students to showcase their work with technology infused throughout and provide video clips of practicum experiences or student teaching that are demonstrations of meeting various standards. Additionally, artifacts that are created using technology or have technology relevant components can be easily included. As Chow and Rogers (1998) and ISTE (2003) have pointed out, the electronic portfolio can serve as a mechanism to document students’ progress in achieving relevant standards and their growth over time, faculty can continue to engage in authentic assessment of student outcomes, and faculty and administration can engage in evidence-based decision-making.

**First Attempt at an Electronic Portfolio System**

The PT3 implementation team, which included faculty from both elementary and secondary education, as well as technology staff members and an evaluator, decided to have students create their portfolios using FrontPage (see Figure 1). FrontPage was chosen because it was available to students through ISU’s Microsoft Campus Agreement. Within the portfolio students linked their artifacts to the designated standards. Elementary education decided to use Interstate New Teacher Assessment and Support Consortium (INTASC) standards, while secondary education used IPSB developmental standards, as the backbone for their respective portfolios. Additionally, the secondary education program required students to provide...
In fall 2001 the technology team, comprised of the director and assistant director of Information Technology Services for the College of Education, and graduate assistants began teaching faculty and students how to use FrontPage to create a portfolio. By fall 2002, the implementation team was beginning to uncover deep-seated problems with these two portfolio systems.

**Emerging Issues**

The following issues were uncovered during the implementation process of the initial electronic portfolio:

- **Two separate portfolio templates.** Students who were seeking dual licensure were left in a quandary—Which template do I use for my portfolio? Do I need to create two portfolios in order to meet the requirements for each licensure program?
- **Faculty buy-in of the electronic portfolio.** Faculty members often had the technology team teach the portfolio development workshop during a class when they needed to be away. Additionally, they instructed students to direct their questions to the technology team. Hence, students lacked appropriate faculty role models, and students aptly noted the lack of faculty involvement with the portfolio.
- **Technology as an add-on within the course.** Some faculty had a technology proficient instructor teach the “technology part” of the course. These faculty members did not see the value of integrating technology into their teaching, which according to Roberts (2001), is related to their motivation to do
so. Technology was relegated as a stand-alone piece and was not integrated into the course curriculum. Hence, students continued to lack role models who infused technology.

- **Connection to the management information system (MIS).** ISU was developing an MIS to track and aggregate student completion of relevant standards. This system was to document how students demonstrated competency on each standard through specific coursework. However, this system did not have work samples tied to the students’ records and it was not possible to do this using the FrontPage portfolio.

- **Scope and sequencing of technology standards throughout the curriculum.** The integration of technology through the curriculum was not developmental. For example, in a class near the beginning of preservice teachers’ coursework, students might be asked to create a WebQuest. However, some students may have never viewed or used a WebQuest. Additionally, many students lacked the technology skills to create one.

Based on the continuing emerging problems, the implementation team, along with the Dean’s office began exploring other options for an electronic portfolio system. The two FrontPage portfolio systems were not working and would not meet accreditation needs. With an upcoming NCATE visit and the timeframe of the PT3 grant, it was imperative to move quickly to resolve the portfolio dilemma.

### New Directions

**Creating a Roadmap for Adoption of Standards**

In April 2003, at the request of the PT3 implementation team, the university’s Teacher Education Committee (TEC) was asked to re-examine ISU’s adoption of the ISTE-National Educational Technology Standards (NETS). Previously TEC had adopted the ISTE-NETS, to guide the integration of technology into the teacher preparation programs; however, an action plan was never articulated. After reconsideration, TEC adopted the 2002 Technology Performance Profiles for Teachers Preparation. The 2002 profiles are significantly more comprehensive than what TEC had initially adopted and they suggest ways programs can incrementally examine how well candidates meet standards. Additionally, in order to implement the alignment of course learning outcomes with the standards, TEC adopted comprehensive matrices that align course learning outcomes with three of the four profiles (i.e., General Preparation Performance Profile, Professional Preparation Performance Profile, Student Teaching Performance Profile) defined in the standards.

In addition, the university adopted the IPSB content and developmental standards as the standards to be documented in the MIS system. This was facilitated with the strong backing of the administration, as well as key faculty. With the reevaluation of the portfolio’s direction it was also determined that these standards would be used to assess student performance in both the elementary and secondary levels.
Creating a Required Technology Course

In the discussion of how technology standards alignment takes place in the teacher education program it was deemed appropriate to have the General Preparation Performance Profile covered in a required technology course. This was done to facilitate a common understanding of technology. Beginning in fall 2003, all incoming freshmen and transfer students at ISU are required to demonstrate computer literacy either through an exam or enrollment in an approved general education course that specifically addresses computer literacy skills. In addition to developing foundational skills in this course, students demonstrate technology proficiency through course assignments.

This course is just a piece of the overall strategy of standards alignment by which all students are prepared with general knowledge of software applications as demonstrated by their successful completion of this requirement. However, this course does not adequately prepare future teachers to apply the pedagogical aspects of technology in the classroom. The pedagogical aspects are covered in the other profiles (i.e., Professional Preparation Performance Profile, Student Teaching Performance Profile), which are integrated into other courses and activities. This strategy reiterates the important role technology plays in standards-based teacher preparation programs. In order to document this integration of technology into the teacher education courses, faculty members designed facilitating activities.

Documenting Facilitating Activities

Selected faculty members in the summer of 2003 were asked to prepare facilitating activities for teacher education courses. Elements of the facilitating activities include course title, technology skill level (i.e., beginning, intermediate, advanced), ISTE-NETS addressed, overview and instructional context, curriculum with emphasis on technology, goals of the activity, advanced planning requirements, resources needed, suggested actions for completing the activity, samples of student’s work, and assessment rubric. To assist faculty members in creating the facilitating activities, two faculty members from other universities consulted with ISU faculty members on the development and appropriateness of the facilitating activities.

In some instances, the facilitating activities were merely formal documentation of experiences already incorporated in the course and the development of standards-based assessment rubrics, while in other instances the facilitating activities provided ideas of how faculty members can integrate technology into the course. For the latter, the courses did not previously incorporate technology.

Hence, course experiences already in place were re-designed such that technology enhanced the activities and standards-based assessment rubrics were created. The goal was not to add technology as stand-alone experiences or assignments, but rather emphasize that learning can and should be enhanced through the use of technology. The creation of the facilitating activities provided an excellent bridge to electronic documentation of standards through the use of LiveText™, a commercially available online documentation and portfolio program.
Implementing Electronic Documentation

In early summer 2003, the decision was made to adopt LiveText™ as the electronic documentation system for the teacher education program. Students purchased access to the system much as they would a textbook when they entered the teacher education program. Elementary education majors purchased access in their freshman year and secondary education majors purchased access to the system in their junior year. The program allowed a relatively easy way for faculty and students to align standards with coursework. Figure 2 shows how standards have been added to a basic lesson plan a student creates.

Figure 2. Standards Added to a Student’s Lesson Plan
Assessment

LiveTextTM allows faculty to create online assessment rubrics linked to the standards and students can submit their materials and receive feedback for the class through LiveTextTM. Hence, the assessment rubrics developed for the facilitating activities are being used in LiveTextTM to document the meeting of standards (See Figures 3 and 4).

Figure 3. Creation of an Assessment Rubric in LiveTextTM
Figure 4. Example of a Completed Assessment Rubric in LiveText™

This method of assessment keeps students’ artifact and the assessment outcomes in one location. This allows students to easily revisit previous work and note growth over time. Additionally, this allows the administration to aggregate data for program evaluation and to meet the growing need to provide student outcome data for accreditation purposes. Figure 5 provides a visual overview of how the various pieces align course learning outcomes with the standards and provides a mechanism for documentation of those standards.
LiveText\textsuperscript{TM} was planfully introduced into the curriculum. Extensive professional development, including workshops and one-on-one, on-time assistance was provided, and continues to be available, to both faculty and students. We began in fall 2003 with 24 classes and during spring 2004 the remaining elementary, early childhood, special education, and secondary education courses began using LiveText\textsuperscript{TM}. Some of the content area courses have begun using LiveText\textsuperscript{TM} with the remaining to begin implementation this year.

Near the end of the second semester of use, we conducted a short survey to ascertain students’ use and comfort with the new electronic documentation system. Faculty distributed the surveys in their classes and 248 students participated. Students reported using LiveText\textsuperscript{TM} in 0 to 4 classes ($M = 2.03$, $SD = .95$). Trainings were conducted in most of these classes, and 69% of the students reported that they understood what they needed to do.
at the conclusion of training. The majority of students conveyed that at least one of their instructors had posted lesson plan (79%), project (87%), or assessment (69%) templates. Furthermore, for students using the templates, most found these moderately to extremely easy to find or use. Additionally, the majority of students reported that they knew how to upload lesson plans (56%), projects (58%), or assessments (60%), and create lesson plans (55%), or project (52%) artifacts within LiveText™. Among those using these components, the majority reported feeling moderately to extremely comfortable uploading or creating artifacts. These data mirror the components that faculty reported using. When students had questions about LiveText™ they sought help from several sources. The three most popular sources were other students (76%), their current instructor (66%), and ISU technology staff (42%). Only a few (11%) used LiveText™ training materials, LiveText™ helpline (2%), or LiveText™ e-mail (5%).

Students were also asked to consider if as a professional, they would use LiveText™ and to provide a rationale for future use or non-use. Responses to the open-ended question fell into three themes, related to a cost-benefit analysis. At one end, students provided only positive comments and planned to continue to use the system as teachers. For example, they understood the power of the tool for providing templates, keeping a current portfolio, linking standards to lesson plans and other work, and sharing ideas for unit and lesson plans with others. In the middle were those who responded that they may use LiveText™, citing that they needed to become more comfortable with the system or would use it if their school did. At the other end, students provided only negative comments relative to barriers, such as cost, lack of comfort in using the system, or relevance. We are continuing to conduct trainings on the use of LiveText™ and discuss the use of the system, in order to address students’ perceived barriers to future use.

Important to note, unlike the first attempt at implementing a portfolio system, this time the entire teacher education program was on-board. The overall system to document standards for accreditation agencies and the ability for students to create a professional portfolio that aligned with standards finally had taken place. All of the parties involved with the creation received something of value.

**Recommendations**

We believe several key components have lead to our success with our second attempt at an electronic portfolio system. These include the following:

- **Faculty buy-in**
  This was accomplished in four ways including: 1) showing the relative ease of connecting assessment rubrics and students’ work; 2) simplifying the ability to collect artifacts for accreditation agencies; 3) providing a financial incentive for faculty to create and implement facilitating activities; and 4) providing a technical support structure that allows faculty to receive one-on-one on-time assistance so their questions can be answered when they occur.
• **Support from the administration.**
  During our second portfolio attempt, the dean’s office provided the necessary vehicle to eliminate the original portfolio project, as well as the leverage required to align the needs in a common direction. This allowed all stakeholders to realize that the issue was not whether an electronic portfolio was going to be used but rather what electronic portfolio product would best meet the needs of the programs.

• **Creation of a roadmap.**
  The electronic portfolio could not exist separate and apart from coursework. During the second portfolio process it was important to map all the standards across the courses (see Figure 5), so that it was clear which standards needed to be covered in a particular course. Then facilitating activities were created that aligned these standards to student activities. Finally, the portfolio became the vehicle to store student work artifacts, along with the faculty assessments of that work. This was vital to giving the portfolio meaning for both faculty and students.

• **Development of an extensive professional development program.**
  A number of workshops, one-on-one training sessions, and on-time assistance were all elements that helped faculty and students adopt the new system. Interviews with faculty showed this was key to making all the diverse elements of the project make sense and provided a big picture of how everything fit together.

These recommendations are a product of what we learned from our initial failure and subsequent success. These can be applied beyond developing a portfolio system to integrating technology more broadly into the curriculum. The old adage, “if at first you don’t succeed, try, try again” worked in this case. But an important element in this was learning from the mistakes of the first portfolio.
References


Quotes and an online survey captured the impact of week-long professional development sessions on faculty members’ personal and professional use of technology. Technology modeling, extensive hands-on activities, and opportunities to share and network provided faculty members from 19 state universities time to learn to integrate technology into their classrooms.

New standards, new assessments, new accountability procedures, and an influx of new technology in K-12 classrooms meant that teacher candidates' coursework and field-based experiences needed to provide them with opportunities to see technology integration modeled by their professors and with opportunities to teach with technology. These changes would be needed statewide and would require professional development for university faculty members. To foster these changes in 1997 the Louisiana State Systemic Initiatives Program created the Technology Consortium for Teacher Education (TCTE) under the leadership of Lajeane Thomas. (See http://cnets.iste.org/tcte/.) The consortium is composed of faculty members appointed by the deans of each of the state’s colleges of education. In 1999, the consortium was awarded a PT3 catalyst grant, The Technology in Higher Education | Quality Education for Students and Teachers (T.H.E.|QUEST). The grant’s goal was to provide technology planning assistance and professional development in technology integration for higher education faculty members. To facilitate faculty members’ access to the professional development sessions, one site was located in the northern part of the state at Louisiana Tech University and another site was located in the southern part of the state at the University of Louisiana – Lafayette.

To help us understand the challenges we would face and to determine successful methods for fostering acceptance of technology and curriculum redesign we examined the research on diffusion of innovations, computer self-efficacy, and adult learning. Diffusion of Innovations Theory provided insights into the conditions necessary for university faculty members to incorporate technology into their redesigned courses. Rogers (2003, p. 35) contends, “that the heart of the diffusion process consists of interpersonal network exchanges and social modeling by those individuals who have already adopted an innovation to those individuals who are influenced to follow their lead.” Hence, we provided faculty members with opportunities to develop interpersonal networks and opportunities to model for each other how they used technology in their teaching.

Faculty computer self-efficacy is crucial not only to the diffusion of technology in higher education but also to maximize the effects of technology adoption and integration within the
Compeau and Higgins (1995) found that individuals are more likely to increase their computer self-efficacy as a result of participating in training sessions in which they observe modeling of the use of technology, they are able to interact successfully with technology, and they are reassured that they are capable of mastering the skills. Training sessions designed in such a manner entail three of the four principal sources of information that define individuals’ self-efficacy for a given task: vicarious experiences such as technology modeling, enactive mastery experiences such as hands-on activities, and verbal persuasion including positive affirmations regarding ability (Bandura, 1997). As we developed and delivered the sessions we included technology modeling, extensive hands-on activities similar to what faculty members and their students would do in classrooms, and encouraging, positive affirmations regarding their attempts and successes.

Adult learning theory posits that adults are eager and ready to learn things that can benefit them in their present life situation, yet question if what they are learning is important. Adults are self-directed, responding to internal motivation more than external motivation with previous experiences guiding them as they learn new things (Knowles, Holton, & Swanson, 1998). We focused on designing the sessions to build on faculty members’ prior experiences and to match their immediate needs as we provided them with new opportunities for learning. We also recognized that adult learners want teachers who respect them, coach them, and support them as they learn.

**QUEST Professional Development Sessions**

Each session consisted of three two-day classes separated by two to three weeks over the course of the semester. For example, professors began classes on Monday and Tuesday, approximately three weeks later they attended classes on Wednesday and Thursday, and three weeks after that they attended classes on Friday and Saturday. The sessions were adapted from the Georgia Framework for Integrating Technology (InTech) in the Student-Centered Classroom (Kennesaw State University Educational Technology Center, 1999). InTech materials provided the framework for developing technology infused lessons for use in K-12 classrooms. Additional materials and activities were developed to model for professors how they could infuse technology in their courses. Cottrell (1999) contends that in order to see changes in teaching faculty development workshops must focus on how to use technology to improve teaching rather than focus strictly on learning to use the technology. Direct instruction was limited to explanations of how to use different pieces of software and hardware such as Inspiration, Microsoft Publisher, Microsoft PowerPoint, a projection system, a document camera, a digital camera, interactive whiteboard, personal digital assistant, CD writer, and a scanner. The faculty members had extended opportunities to work together as they experimented with the software and hardware to explore ways to use technology to enhance their teaching. Each participant received a binder of the materials, activities, instructions, and resources used during the sessions. We encouraged participants to share their thoughts about the lessons and frequently had participants brainstorm different ways to utilize what they had learned. For example after learning to use Microsoft Publisher one professor created flyers to promote a new class he was offering, printed them out, and left the session with several copies of the flyers and a roll of tape. A few weeks later another
professor reported that she taught her student teachers to create brochures about themselves to use as introductions for their cooperating teachers and the parents of their students.

We frequently asked professors to share their work with other participants. This not only helped to vary instruction, but also helped build participants’ self-efficacy by giving them experience using technology in front of their peers. Throughout the sessions, we visited informally with each of the professors to ask about their previous experiences with technology, what they wanted to learn about technology, and how they were presently using technology. These conversations and our daily debriefing sessions enabled us to personalize the lessons for each participant.

During the sessions, we informally asked faculty members about how they were currently using technology in their university classrooms and if they would be willing to share what they were doing with the other faculty members. Many at first were reluctant to share as they did not think they were doing anything unusual or of interest to others. Once we convinced them that what they were doing in their classrooms would be of interest and of benefit to others in the session, they willingly modeled their lessons. One professor proudly shared his graduate students’ web pages showcasing their public school classrooms, which gave us intimate glimpses into the local public schools. A history professor’s graphic displays of nuclear proliferation since the bombing of Japan left us breathless. These professors modeled for their peers the power of technology to enhance teaching and improve student learning.

As they learned new software, explored new hardware, and experimented with new ways of teaching, the faculty members forged bonds with faculty members from their own campuses and from other institutions. The QUEST sessions provided them with time to explore new technologies in a relaxed, comfortable working environment and to collaborate with their peers as they developed ways to integrate technology into their own classrooms. A community of learners provides not only the resources and technical support required to use technology but also the confidence to teach with technology (Ginns, McRobbie, & Stein, 1999; Hruskocy, Cennamo, Ertmer, & Johnson, 2000). Knowing that some of the faculty members attending the sessions would be intimidated by the prospect of learning to use technology, we worked hard to provide them with a friendly, collaborative, non-threatening environment in order to facilitate learning and communication (Knowles, Holton, & Swanson, 1998; Linnell, 1994; Mandefort, 2001; McKenzie, 1991; Norton, & Gonzales, 1998).
Table 1. Overview of Results

<table>
<thead>
<tr>
<th>Changes in Teaching</th>
<th>No Changes in Teaching</th>
<th>Students’ Use of Technology</th>
<th>Barriers to Using Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>More interactive, constructivist classrooms</td>
<td>Reluctant to make changes</td>
<td>Required their students to use more technology in assignments and presentations</td>
<td>Lack of hardware and software</td>
</tr>
<tr>
<td>Modeling technology integration</td>
<td>Uncertain of their ability to use technology in their teaching</td>
<td>Assisted students as they developed their technology skills</td>
<td>Lack of time to learn and practice using technology</td>
</tr>
<tr>
<td>Writing grants to purchase software and hardware for their classrooms</td>
<td>Already using technology so they made no changes in their teaching</td>
<td>Recognized the importance of their students learning to use technology in their teaching</td>
<td>Lack of technical support</td>
</tr>
<tr>
<td>More learner-centered less teacher-centered</td>
<td>Students lack of access to technology</td>
<td>Accessing course materials online</td>
<td>Lack of administrative support</td>
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Faculty Interviews

In the spring of 2002, we randomly selected twelve faculty members who attended QUEST sessions at the north site to participate in structured interviews consisting of ten questions. The questions were designed to illicit information about the faculty members’ technology use, whether they made any changes in their teaching as a result of the professional development sessions, how they integrated technology in their teaching, whether they required their students to use technology, and whether they encountered any barriers when integrating technology in their teaching. The interviews were audio taped and transcribed by the researchers. Interview transcripts were analyzed using case analysis and cross-interview analysis (Patton, 1990).

Changes in Teaching

Faculty members discovered that to effectively incorporate technology their classrooms would need to be learner-centered rather than teacher-centered, “… I’ve turned so many of my lessons from direct instruction to indirect instruction and I’m serving more as a facilitator and a mentor than I am a direct instructor or tell all teacher.” Another said, “I have taught for so many years that it is really hard to try the new things. I would never have tried any of it if it had not been for my QUEST experience.” One faculty member referred to talking less as “probably the biggest change.” She then readily acknowledge how difficult this change was by saying, “ Not there yet, by the way.” The difficulty of learning not to talk and “letting students explore and come to their own conclusions,” was a concern for several professors who acknowledged that it will take time for them to become comfortable letting the students do most of the talking. And, it will take time to change their teaching, “I still lecture, but I supplement it with technology.”

The QUEST sessions demonstrated the importance of modeling technology integration as reflected in this comment, “… if I’m asking students to create lessons that have a technology component then I try very hard for my lessons to have a technology component as well.”
Some professors reported that the sessions had stimulated them to think about additional ways to use technology, had motivated them to use more technology, and had given them the skills and knowledge they needed to try new ways of teaching. As they developed computer self-efficacy, they were willing to incorporate technology into their teaching. As one said, “So you all really encouraged me to have more confidence in myself and go ahead and put that (technology) in my plans…” Another professor found the sessions motivated her to integrate technology in her teaching, “I got—more than any individual thing you gave us over there—is the stimulation to want to do more.”

The sessions provided extended opportunities to learn to use new software, to learn new ways to use familiar software, and to learn to use a variety of hardware. Faculty members appreciated having time and support as they learned and developed their skills “So, opportunities like T.H.E.|QUEST for us to go and receive training for us to integrate into the classroom are certainly wonderful. But it is also good for us to have time to become comfortable on a personal level …” Once faculty members returned to their campuses, they began writing grants and requesting funds from their departments in order to purchase additional software and hardware. One professor reported, “We’re setting up a model (technology) classroom.” Exposing the faculty members to different software and hardware, giving them extended time to work with the technology, and providing time to share their ideas for using technology with other professors encouraged them to think about ways to incorporate technology into their teaching. Enthusiastic about what they learned in the sessions they were eager to incorporate technology in their teaching and were determined to find the hardware and software to do so.

No Changes in Teaching

However, two faculty members were reluctant to make changes in their teaching and uncertain of their abilities to do so, hence, they reported using no technology or very limited amounts of technology in their teaching. One year after attending a training session a faculty member commented, “I think I will use it. But, I have not done so just yet.” Another faculty member said, “I think I can use Inspiration and now that I have it available to me, I think that I will use it. But I have not done so just yet.” Learning to use technology and being confident enough to use it in a classroom setting does not come easily to all faculty members.

Students’ Use of Technology

For new teachers to effectively utilize technology in their classrooms, traditional university teaching must be transformed to include opportunities for students to participate in the creation of curriculum-based technology projects (Pellegrino & Altman, 1997). In the interviews the professors reflected on their students’ technology use, “We’re using technology like crazy.” As professors’ technology skills increased, they required more technology skills from their students, “So now I require the generation (of a ripple effect) using Inspiration. I never did that before because I think that I was not familiar with it myself and I hadn’t used it that much,” and “in some of my classes they just can’t wait to get to the computer when we get in there.” As professors’ comfort level with technology increased they required their students to use more technology, “And I use Blackboard more. And also, as an
instructor I’ve use it more but I’ve had my students use it more because I’m doing things on Blackboard with them now that I wasn’t doing.” Another professor reported on her students’ enthusiasm for using technology in class, “And I’ll find that in the next class when I get there 3 or 4 minutes ahead of time they’ll be 6 or 8 students there ahead of me already on the computer before I even say what we are going to do that day.”

Faculty members reported providing assistance to students to insure that they could successfully complete assignments requiring technology. One stated, “…I do a mini reminder for those who feel uncomfortable using those technologies in particular with those email attachments. Then, I do some one-on-one work with them. I do not want them to leave my class without those technology skills.” Others made sure the students not only had the skills but also had the software to complete the assignments, “… I requested the demos from the company…”

Professors viewed technology integration and student technology use not as an add-on but as a clear necessity for the education and professional growth of teacher candidates. They recognized that by requiring teacher candidates to use technology they were also requiring them to change their teaching, “… if I left it to my teacher candidates… some would be just as they were taught— very traditional. I have helped them by requiring it—they don’t have a choice.” A math methods professor reported that integration of technology was a clear requirement in her classes. “They must show evidence of using technology with every math lesson that is either done in the professional development school or at the laboratory school.”

**Barriers to Using Technology**

When asked about barriers to using technology, faculty members commented on their personal teaching style, a lack of software and hardware, limited access to software and hardware, lack of technical support, no time to learn to use technology, and an absence of administrative support. One identified herself as a barrier to using technology, “My own perception of myself and my style and approach to teaching.” This professor also recognized budgetary constraints when it came to keeping technology current, “… there’s always something either to repair or update or some new software that comes along.” Several faculty members noted the lack of technical support available on their campuses. As one participant said, “This is the biggest, the one thing that I have a problem with is when I get ready to use it in the classroom it doesn’t work.” Professors were frustrated with the lack of technical support and with their own inability to troubleshoot and correct problems.

Faculty members reported their biggest barrier was the lack of time to learn to use the available technology and to explore ways to integrate technology in their teaching. One faculty member reported the main barrier to implementing technology was “that piece of time to sit down and play with it… that’s where the good stuff comes from— when you start playing with it.” Another faculty member commented, “Each time I start it’s a stop. I get too busy.”

Administrators who impede rather than support faculty members’ efforts to use technology in their teaching (Dusick, 1998; Thompson, Schmidt, & Hadjiyianni, 1995) were cited as
barriers by faculty members. One frustrated professor, after outlining plans for revamping her courses to integrate technology into her classroom, remarked: “Have I done that this semester? No. Why? Because I have administrators in my way— that are not supportive.” The basis for administrators’ lack of support for technology integration is not always easy to identify. One faculty member offered this explanation: “The administration at the highest levels— they don’t understand the need for this.”

**Online Survey**

In Spring 2004, 533 faculty members from across the state completed an online survey designed to assess the use of technology in their teaching. Of these respondents 89 indicated that they had attended QUEST sessions at either the north site or south site. The online survey included questions about the technology faculty members used in their teaching and open-ended response items about changes in their teaching and their use of online resources. Faculty members who attended QUEST sessions reported using a greater variety of technology in their classrooms than faculty members who did not attend QUEST sessions. Approximately 74% of QUEST participants, compared to 69% of the nonparticipants, reported using three or more different technologies in their teaching. When queried about their use of some of the basic components of BlackBoard course management system such as posting assignments, posting grades, making announcements, displaying course materials, sending email, providing resources for assignments, and accessing the digital drop box, approximately 81% of the QUEST participants compared to 74% of the nonparticipants reported using five or more of these basic components. The most striking difference between QUEST participants and nonparticipants was in the use of interactive components of Blackboard. Approximately 75% of QUEST participants and 48% of nonparticipants reported using interactive online teaching resources such as chat, discussion board, and interactive white board. The QUEST sessions included opportunities for faculty members to participate in chats, discussions, and lessons using the interactive white board. These activities had instructional components presented in lively, engaging formats. QUEST participants found these interactive components fun, interesting, and useful with three of four participants using some or all of these components in their teaching. The adoption rate for streaming video or personal web pages was low among participants and nonparticipants. This low adoption rate may reflect a lack of available technology. Approximately 18% of the QUEST participants reported using streaming video and personal web pages whereas 12% of nonparticipants reported using these technologies.

<table>
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<th>Table 2. Overview of Online Survey Results Regarding Technology Use</th>
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<tr>
<td><strong>Technology Use in the Classroom</strong></td>
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<tr>
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<tr>
<td>QUEST participants</td>
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<td>QUEST nonparticipants</td>
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Those faculty members who attended QUEST sessions reported using more technology in their teaching and using more components of BlackBoard course management software. An integral part of the sessions was extended opportunities to use technology in classroom
situations and to explore ways to use technology in their classrooms, which gave faculty members the confidence and the skills to incorporate technology in their teaching.

Changes in Teaching

When asked about changes in their teaching QUEST participants acknowledged that their teaching had become more interactive, constructivist, learner-centered, and project-based as they incorporated technology into their teaching. A mathematics professor wrote “… much less lecture. Since technology eliminates some of the tedious computations of the past, my questions are on a higher thinking level.” One professor commented “I’ve changed my approach to lecture/discussion days because of Discussion Board postings on assigned readings. I take my cue from students rather than deciding ahead of time what we’ll talk about.” One faculty member reported using WebQuests, Internet sites, and BlackBoard in his classes and noted, “I didn’t do any of this before T.H.E.|QUEST.” Other professors offered these comments about changes in their teaching “… I now use a more facilitated, less directed approach;” “I use more hands-on activities that involve students in how to use the technology for their own purposes;” and “I have purposefully swapped out non-tech based activities/resources for technology based ones.”

No Changes in Teaching

Of the eighty-nine QUEST participants who completed the online survey five participants indicated they were not using technology in their teaching. One simply stated, “No. Don’t use.” One QUEST participant reported no changes in his teaching because of a lack of release time to learn to use technology, “I don’t know how to do it well, and I have not been given the time to learn.” Some reported no changes in their teaching because prior to the professional development sessions they had been using technology in their teaching, “Little if any. I have been using PowerPoint and the Internet since the mid-90s” and “I haven’t really. I do the same things I would do with a chalkboard or handouts. I simply use technology instead.”

Students’ Use of Technology

Some QUEST participants require students to access course materials online, use technology in class presentations, use technology to complete class projects, and include technology in their lesson plans and unit plans. One recognized that requiring students to use technology was beneficial to their future endeavors, “Students gain experience and knowledge using technology that will be so much a part of their future work environments.” One faculty member noted that requiring students to use technology resulted in, “… more hands-on activities that involve students in how to use the technology for their own purposes.” Another faculty member reflected on using technology in teaching, “There is much more discovery-motivated learning.”

Not all faculty members required students to use technology to complete course requirements, as one psychology professor responded, “having computer skills is not necessary in the coursework I am teaching.” When asked about putting course materials
online several faculty members noted that putting course materials online meant that students did not have to come to class. But as one faculty member commented, “Some students use this as an excuse not to come to class. Though these are in all likelihood those who would find another excuse if the materials were not online.” Others cited students’ lack of access to technology as their reason for not requiring students to use technology, “… the computers the students have at home are so old the equipment cannot handle the technology used at the university.”

**Barriers to Using Technology**

QUEST participants reported that barriers to using technology included access and problems with the hardware. Equipment that works one day and not the next, classrooms that are not wired, presentation equipment that varies from one classroom to another, Internet links that do not always work, and sporadic Internet access were all reported as barriers to using technology in their teaching. Faculty members expressed frustration with hardware that did not work and at not being able to solve their technology problems, “Different computers show the information differently when it is printed off; ‘Glitches’ I don’t know how to fix.” Another barrier reported by faculty members was the amount of time that was needed to maintain BlackBoard and web sites, do online quizzes, answer email, and respond to discussion postings. However, one faculty member noted, “Creates a tremendous amount of work up front. Saves a lot of time in the long run.”

**Conclusions**

The QUEST sessions incorporated key components of the theories of diffusion of innovations, self-efficacy, and adult learning by providing faculty members opportunities to develop social networks, observe the modeling of technology integration, and experience successful interactions with technology while participating in hands-on activities. The sessions provided faculty members with time to learn to use technology and to practice using technology. Changes in faculty members’ teaching as a result of the QUEST sessions included more interactive constructivist teaching, modeling technology integration, writing grants to obtain more technology, and more learner-centered less teacher-centered classes. Those who made no changes in their teaching were reluctant to make changes in part because they were uncertain of their ability to incorporate technology in their teaching. Some commented that they made no changes after the session because they were already using technology in their teaching or because their students lacked access to technology. Most professors reported that after the sessions they required their students to use more technology to complete assignments as they recognized that it was important for their students to learn to use technology in their own teaching. Additionally, they required students to access course materials online and to utilize interactive features of Blackboard. When faculty members returned to their campuses they faced barriers that included lack of time to continue to develop their skills, lack of sufficient hardware and software, lack of technical support, and in some cases an absence of administrative support. While most of the faculty members who attended QUEST sessions reported changes in their teaching, not all faculty members did.
References


Building Teams and Tools for Teachers (BT3) is a 2001 Preparing Tomorrow’s Teachers to Use Technology Grant. BT3 actively promotes reform of university teacher preparation programs by focusing on preparing tomorrow’s teachers to use technology in the classroom. The program is guided by three primary objectives:

1) providing pre-service and inservice teachers as well as university faculty with learning opportunities that allow them to effectively incorporate technology in their teaching while successfully meeting Texas State Board for Educator Certification (SBEC) and Texas Essential Knowledge and Skills (TEKS) standards;

2) to promote collaboration between K-12 schools and university-based teacher preparation programs, and among teacher preparation programs and other academic disciplines;

3) incorporating this model of collaboration and the pedagogically sound integration of technology into teacher preparation curricula.

The BT3 consortium is made up of three Texas higher education institutions: St. Edward’s University, University of the Incarnate Word and Concordia University- Austin. Additionally, the partnership includes four school districts, 59 individual K-12 schools in the Austin, San Antonio, Dallas, and Houston areas, four independent school districts, and two not-for-profit institutions. Partnering institutions are represented on the BT3 advisory board, which meets monthly. The board is responsible for helping guide the program, making budget decisions, collaborating with others about technology integration and classroom
teaching, disseminating information about the project, and providing support services such as
grant writing, the delivery of instruction, and contributing resources to support program
efforts.

Originally, the BT3 project consisted of a 60-hour summer institute, within which pre-service
teachers, inservice teachers, and university faculty worked on teams to create technology
infused lessons to be taught in the classroom. BT3 has adopted the constructivist Active
Learning with Technology (ALT) curriculum of the Southwest Educational Development
Laboratory (SEDL). The ALT curriculum is unique in that it trains teachers in research-based
strategies that emphasize student-centered, real-life learning experiences for K-12 students
and ways in which technology can be used as a tool to support these practices. Participants,
K-12 teachers, pre-service teachers, and university faculty work through real-life,
technology-infused, problem-solving scenarios while learning valuable teaching strategies
that can be adapted to fit any classroom. While the curriculum is content driven, teachers end
up gaining knowledge in the use of and how to integrate various technology into their
teaching. During the summer training, pre-service (student) teachers are paired with K-12
inservice teachers who serve as their mentors in the upcoming fall or spring student teaching
experience

In recruiting inservice teachers to participate in the 60-hour summer institute, the demand for
technology integration training initially exceeded the program’s capabilities. Within the first
year alone, more than 150 K-12 teachers showed an interest in participating as mentors in the
program’s technology integration training opportunities. The following BT3 training
opportunities have been developed and offered:

1) educational technology workshops;
2) instructional technology workshops;
3) Active Learning with Technology training;
4) online technology integration course; and
5) the University Technology Grant Program.

*Educational technology workshops* provide pre-service, K-12 educators, and university
faculty members with a two- or four-hour training workshop focusing on a topic of their
interest. Through survey results, topics are derived, appropriate trainers are then hired and
instruction is delivered. Workshops are not technology specific; rather they are pedagogy
rich, content based, with supplementary technology resources infused. Educational
Technology Workshops topics include: KidPix Studio Software, Inspiration and PowerPoint,
Digital Still Camera/Photoshop, and eportfolio, among others. These Workshops are not
technology specific; rather they focus on how to implement best practices in teaching and
learning with technology resources infused.

*Instructional technology workshops* provide K-12 inservice teachers and higher education
faculty with intensive training on various technology applications and hardware mediums.
Topics range from operating systems to HTML.
Active Learning with Technology (ALT) workshops prepare K-12 inservice teachers to deliver training to other faculty and to integrate technology into curriculum while creating constructivist lessons. In contrast to the Educational Technology workshops, the Active Learning with Technology workshops (ALT) focus on best practices in teaching and learning. The ALT training uses the Active Learning with Technology Curriculum that was developed by the Southwest Educational Development Laboratory (SEDL). The SEDL curriculum emphasizes student-centered, real-life learning experiences for K-12 students and ways in which technology can be used to support these practices. ALT participants, who are all K-12 teachers, work through real-life, technology-infused, problem-solving scenarios while learning valuable teaching strategies that can be adapted to fit any classroom. This three-day workshop is offered when funding is available. Generally, participants receive a modest stipend. All attendees are prepared to serve as technology trainers so that they may share their new knowledge with others at their school.

Online technology integration courses offer pre-service and K-12 educators Continuing Education Units (CEUs), which can be used to maintain their teacher certification and to update their understanding of technology integration while creating curriculum materials. The online technology integration courses are self-paced and focus on a number of topics. These courses provide educators with a means of earning 40 or 80 CEUs for successfully completing a four or six week course. Topics include, but are not limited to:

- Using Computers as Instructional and Student Learning Tools
- Integrating Technology into the K-12 Classroom
- Web Page Development for Teachers
- Creating and Using Multimedia Presentations
- Troubleshooting the Technology

Additionally, BT3 partners have the option of participating in the St. Edward’s University Technology Grant Program (TGP). TGP provides K-12 institutions with access to the previously operated equipment on the St. Edward’s University campus. Trainers are available to travel to individual school sites to deliver technology integration training and to assist by installing and updating the equipment granted by the program. Through the St. Edward’s University Technology Grant Program, K-12 teachers, administrators, and technology coordinators can take part in the various BT3 technology integration training opportunities. Administrators can request that specific training topics be offered at their school site or at St. Edward’s University at no charge.

Over the past three years, BT3 has trained more than 500 teachers, who have reached more than 10,000 K-12 students. With the assistance of external sponsors and the dedication of the BT3 partners, the program has been sustained and will live on for years to come.

The Building Teams and Tools for Teaching (BT3) Program have been sponsored by the following organizations: The United States Department of Education, Advanced Micro Devices, Southwestern Bell Communications, State Farm, Telecommunications Infrastructure Fund Board, Engaging Latino Communities for Education, Brown Foundation
of Houston, Powell Foundation, International Business Machines, and Bank of America. Sponsors have provided financial support and equipment as well as instructional assistance.

The BT3 partners have assisted in program development, implementation and dissemination and in the development of new partnerships between BT3 and other community organizations. Each of the higher education institutions have mandated participation for its pre-service teachers and have tied participation to their teacher preparation curricula. Concordia University at Austin and the University of the Incarnate Word have created a required course that encompasses the BT3 curriculum and participation in the summer institute. St. Edward’s University has tied participation in BT3 to the student teaching experience. Students receive part of their student teaching grade based on their BT3 performance. St. Edward’s is currently in the process of creating a three credit hour college course similar to that already in place at Concordia and Incarnate Word.

In addition, three of the four participating school districts have agreed to provide stipends to each inservice teacher who participates in the 60-hour BT3 summer institute. Additionally, a university coordinator has been trained at each participating higher education institution and will continue to coordinate BT3 at their institution in the future. Finally, St. Edward’s University has fully institutionalized the position of BT3/Field Placement Director. This person will continue to provide the support needed to ensure that the program goes on indefinitely.

**Evaluation**

The BT3 project has been a success based on participation and sustainability alone. However, the project has gone well beyond these measures of success, employing a rigorous evaluation methodology, both formative and summative, to measure the participants’ learning outcomes. This methodology enables us to report on specific learning outcomes, as well as to document the many lessons we have learned throughout the process.

Participant learning outcomes for the project are defined by the ability of: inservice and pre-service teachers, and university faculty to expand their understanding the role of technology in education; and the ability of the student teachers to successfully apply the knowledge they gained in the classroom. The third year of the project has not yet ended. Therefore, the data reported here reflect the outcomes of the first and second years of the project (for a detailed description of the methodology and statistical analyses see, Zúñiga 2003).

Two techniques are being used to measure technological confidence and attitudes toward the educational uses of technology. First, the university faculty, inservice and pre-service teachers are asked to complete a self-assessment of their technology skills at the beginning of the summer workshops and again at the end of the follow-up sessions during the student teaching semester. A self-assessment was chosen, rather than an observation of actual technology skills for two reasons. First, the goal of the BT3 program was to help teachers use technology to support effective instructional strategies rather than to teach them to use technology. The SEDL Curriculum does not specifically “teach” technology skills. Instead, it introduces participants to the use of various low threshold technological applications through
active engagement in constructivist instructional exercises. The assumption is that participants will increase their technological skills in the process of becoming more engaged in using technology to improve instructional strategies and engage students. The outcomes measures for pre-service teachers discussed later in this article tend to bear out this assumption.

Second, some studies indicate that the participant’s confidence in using technology is as important, and perhaps more important, than their actual skill at using specific technologies. Hackbarth and his colleagues (2003) argue strategies and activities that minimize computer anxiety and increase computer playfulness increase the perceived ease of use of technology. They go on to say that perceived ease of use has been shown to play a critical role in determining a user’s decision to use technology. Therefore, the BT3 participant’s perception of their abilities is as important as their actual level of ability in encouraging more effective use of technology in the classroom.

One-hundred percent of the BT3 workshop participants responded to the skills self-assessment at the beginning of the year one workshops. The pre-service teachers indicated more experience with technology use than either university faculty or inservice teachers. Inservice teachers saw themselves as less experienced overall than either of the other two groups. All three groups said they had more experience with general computer skills such as “us[ing] the mouse” or “copy[ing] files from one directory/folder to another” than with the use of other technologies. One big difference between the pre-service teachers, university faculty and inservice teachers was the former group’s high level of experience with presentation and database skills. The pre-service teachers rated themselves as very experienced with these skills, while both the university faculty and inservice teachers rated themselves as only somewhat experienced. Pre-service teachers also had more experience with E-mail communication than the university faculty or the inservice teachers.

In the second year the overall technology skills of the pre-service and inservice teachers were slightly higher than in year one, but these differences were not statistically significant. However, 11 percent of the mentor teachers were repeating their BT3 experience. The overall skill level they reported was not only significantly higher than that of the incoming mentor teachers, but also exceeded that of the current crop of pre-service teachers. This indicates that the BT3 experience did, in fact, increase the technology comfort and sophistication level of the participating mentor teachers.

Interestingly, each group had significant increases in their level of technology skills. Self-ratings of technology proficiency for the pre-service, inservice and university faculty increased as a group in all eight technology-skill areas. Inservice teachers showed the most gains in perception of their overall technological sophistication increasing from a ranking of 3.5 on a 5 point scale at the beginning of the BT3 experience to 4.1 at the end.

BT3 participants were also asked about their experience using 13 technologies in instruction. Pre-service teachers were asked about their experience using these technologies in their university classes; while faculty and inservice teachers were asked about their use of these technologies in their own teaching. During the student teaching semester, pre-service
teachers are required to participate in two Saturday follow-up sessions. During each follow-up, pre-service teachers learn to videotape and edit video. The final BT3 project is for each pre-service teacher to videotape a technology infused lesson that they teach during student teaching. They are then required to edit their video, create an annotation and storyboard, finalize a unit of technology integrated lesson plans, and present their projects to program staff, university faculty, and other pre-service teachers. The final products are then evaluated by nationally renowned technology integration experts from around the country.

A majority of the pre-service teachers at the beginning of the BT3 experience said they have used computers for any purpose (58.1 percent); word processing (58.2 percent); World Wide Web browsers (55.8 percent); and E-mail (55.8 percent) to a great or very great extent in their college classes and 44 percent said they had used presentation programs. Very few said this about the other technologies such as spreadsheets, databases, concept mapping programs, drawing programs, digital cameras, digital video and scanners. After the end of their BT3 experience the perception of their computer use in instructional settings changed significantly. One hundred percent of the same group of pre-service teachers at the end of their student teaching semester said they used word processing and E-mail in their college classes and nearly 100 percent said they used computers in general. Moreover, almost 90 percent said they used World Wide Web browsers and two-thirds said they used presentation programs. In fact, the use of technologies in college classes increased across the board.

While just over 70 percent of inservice teachers said they used computers in their teaching at the beginning of the BT3 experience, more than 90 percent of the same group said this at the end of their BT3 experience. They also reported increases in the use of specific technologies in teaching such as word-processing, presentation programs, World Wide Web browsers, E-mail, Digital cameras and video, and scanners.

At the beginning of the BT3 process, the university faculty members were far more likely than inservice teachers to say they used technology in their teaching. At the beginning of the process, 90 percent of the university faculty said they used computers in their teaching; and 90 percent said they used word-processing and 100 percent said they used E-mail. The diversity of technological applications, rather than overall use, increased more for faculty between the beginning and the end of the process. University faculty members were more likely at the end of their BT3 experience to say they are using spreadsheets, databases, presentation programs, World Wide Web browsers, concept mapping programs (such as Inspiration), and digital video equipment for instructional purposes.

These comparisons are interesting but do not by themselves prove that the changes are related to participation in BT3. To better understand how BT3 is influencing these changes, all workshop participants also are asked to complete conceptual maps (see for example: Zelik, 2004) describing their perception of themselves as a teacher and their understanding of how technology can be used in instruction. Concept maps are completed at four points in time: at the beginning of the summer workshops, at the mid-point of the summer workshops, at the end of the summer workshops and at the end of the student teaching semester.
Themes from the first administration of the maps to the last showed interesting changes in the attitudes and perceptions of the participants. Themes from the first administration of the maps on their impressions of how technology can be used in teaching and learning can be placed into three main groupings.

• Lists of software or hardware applications such as word-processing, spreadsheets or PowerPoint (32 percent).
• Technology as a visual aid (20 percent) and/or technology as a way to engage students by combining entertainment with teaching (18 percent).
• Technology as an information resource (14 percent)

Participant responses to this question evolved over the course of the workshops and the student teaching semester. Not only did respondents list more uses of technology but the way they expressed them changed. While they did not cross-out their lists of software and hardware applications they added things, such as:

• “Technology should always be used to support and enhance rather than lead instruction,”
• “The ways technology can be used are only limited by what is available (14 percent).”
• They also were more likely to add comments about the use of technology to support diverse learning styles and about technology as a motivator and facilitator of discovery and motivator for active learning (38 percent).

These perceptual changes are important. One university faculty member, who began by being very suspect of the BT3 process, ended the process by saying on his final map that he now realized “…learning is more effective than teaching.” Other comments on the final maps that indicate increasing sophistication in their understanding of how technology can be used effectively in instruction include:

• “[technology] can enhance any lesson”
  Pre-service teacher
• “[I am] willing to try technology at a higher level of implementation”
• “technology should be used throughout the curriculum, not separated”
  Inservice teacher

Another measure of the outcomes of the project was the ability of the pre-service teachers to implement what they learned in the classroom. Each student teacher/mentor teacher pair was required to submit their BT3 unit plan, a 20-30 minute edited video demonstrating the teaching of their BT3 unit, and a critical self-reflection on the implementation of the unit. These packets were then reviewed by a group of national experts in teaching and learning with technology.

The reviewers represented directors of other PT3 projects, faculty in other teacher education programs, instructional developers and professional development staff from other universities and from the national R-TECs (Regional Technology in Education Consortia program). Seven reviewers participated in year one and 10 in years two and three. Reviewers were given a five-part rubric, developed for the BT3 program, that measures the pre-service
teacher’s mastery of unit plan development, technology infusion, use of constructivist learning strategies, classroom implementation, and assessment of student learning.

Thirty-nine pre-service packets were reviewed for 2002-03. The packets were rated using three categories “work in progress,” “approaching mastery,” or “mastery.” None of the pre-service teacher’s submissions were rated “work in progress.” One-third (33.3 percent) of the pre-service teachers were rated at the “Mastery” level and the remaining two-thirds (66.6 percent) were rated as “Approaching Mastery.”

In the second year of the project the “mastery” category was divided into “second level mastery” and “first level mastery” to allow for more discrimination among ratings. The scoring also was made more rigorous, increasing the likelihood that participants would fall into the “work in progress” category. Ten percent of the reviewed packets achieved a rating of “First Level Mastery” and 46 percent achieved a rating of “Second Level Mastery,” 24 percent were rated “Approaching Mastery,” and the remaining 20 percent “Work in Progress.” Interestingly when we look at the breakdowns by rubric area these same students rate higher on average in technology infusion than in overall proficiency. Twenty-six percent of these same students achieved ratings of “First Level Mastery and 40 percent achieved “Second Level Mastery” in the area of Technology Infusion.

Aside from the technical challenges of producing and editing the videos, the single greatest challenge was helping the pre-service teachers to understand how to present their work in a way that demonstrates the implementation of their lesson. In year one the quality of the video productions varied dramatically from videos that merely panned the classroom to sophisticated story boards presenting the pre-service teacher’s facilitation and the independent work of their students. One of the best videos produced was by a pre-service teacher in a middle school Art History class. This pre-service teacher organized her video so that it illustrated the instructions given to the students, the process they went through to research an artist and replicate a piece of his/her work, and her student’s PowerPoint presentations of their final product. To her credit, this pre-service teacher was offered a position after graduation at the school in which she was student teaching.

In the second year of the grant workshops more time was taken helping the pre-service teachers develop a storyboard for their videos. This change led to a significant improvement in video quality.

A related challenge was found in the poor quality of the critical annotations produced by the pre-service teachers. The pre-service teachers have had a great deal of difficulty understanding what is expected in a critical reflection of their own work, and frequently produced no more than a narrative description of what was contained in the video. This continues to be a challenge, however, in years two and three discussions of our expectations for the annotations during the student teacher seminars and BT3 workshops in years two and three of the grant has led to a marked improvement.

One of the somewhat unexpected, but very gratifying outcomes of this project was the building of relationships between the pre-service and inservice teachers. When asked "what
was the most important thing they got out of the workshops," one of the most common responses was how pleased they were to get to know each other before the start of school. In fact, numerous anecdotes surfaced about growing collegial relationships (spring student teachers working in their mentors classrooms voluntarily during the fall; mentor and student teachers running after school enrichment programs together) and full-blown friendships (mentor teachers asking their student teachers to their homes for dinner) developing between the pre-service and inservice teachers.

For all of the project’s success, there are a number of things a teacher preparation program should consider before adopting a model like BT3. Like all pilot programs, we faced challenges and learned many important lessons along the way.

To begin with, forming a steering committee that is dedicated to the process and willing to invest time in the project is an essential ingredient to success. The BT3 steering committee meets monthly. This regular activity actualizes ownership and investment in the program by all partners. Moreover, steering committee members not only attend meetings, but spend numerous hours participating in training sessions and workshops.

The Advisory Board is comprised of education deans, IT directors and coordinators, assistant superintendents, superintendents, principals, university faculty members, university administrators, an external evaluator, Southwest Educational Development Laboratory leadership, and other members of partnering institutions. Board members take an active role in recruiting and hiring program staff, and holding forums in partner schools and at the universities with the aim of introducing the Consortium’s model and summer workshops to potential participants. Moreover, board members assist in making budgetary and programmatic decisions and attend national conferences to disseminate information about the program. They visit individual school sites to recruit partners to participate in the program. Additionally, the advisory board has helped in the development of a proposal for making the program a credit-bearing course in the curriculum of the School of Education at each higher education institution. The advisory board helps identify potential external funding sources, assists in the development of program materials, helps in the creation of the program website, and develops curriculum for the summer workshops. Without their dedication, the project would not have achieved the level of success that it has.

Adequate staffing is also essential to success. A full-time director (12 months) is essential to recruiting partner schools and inservice teachers, communicating regularly with these constituents, coordinating student-teacher and mentor teacher placements, delivering technology training, facilitating faculty supervision, assessment and evaluation components, and generating sustained and continuing financial support for the program through external funding.

Implementation of this model also requires sufficient infrastructure resources to provide adequate technology facilities for delivering training and individual follow-up activities, availability and staffing of this facility, clerical support for the Program Director, office space, and operating budget. BT3 was fortunate to have partner schools that were willing to volunteer workshop space and computer laboratories. However, not all spaces worked
equally well and long-term success of the project would be difficult without the additional funding that was secured to open a teacher education computer laboratory at St. Edward’s University.

Full support from the dean of the school of education and/or another appropriate academic administrator; support and involvement of a faculty curriculum committee for ongoing course design; support and cooperation from university teaching supervisors; and comparable administrative support from the partnering institutions (IHE, LEA, evaluators, corporate funders) are all essential to a successful program.

In the case of BT3, the dean of the St. Edward’s University School of Education was one of the original grant writers. Therefore, there was early buy-in to the project. Due to his efforts the university as a whole was informed about the project and lent its support. Involving faculty and administrators in decision making was vital to our success. Early in the project, when university faculty, staff and students challenged some aspects of the program, the dean’s leadership was critical in moving the project forward. For example, during the first year of the project, the dean of the School of Education at St. Edward’s University made participation in BT3 a requirement for all pre-service teachers. Initial reaction from university faculty and students was negative. His leadership in pushing this forward and standing his ground led to ultimate acceptance of the program and its subsequent institutionalization.

Institutionalization needs to be particular to each institution. The team building and technology component (BT3 summer workshop) is essential, but how that component is structured, observed, and incorporated into a credit-bearing certification preparation program is unique to each institution. For example, one of our IHE partners used a single school site for training and field-placements; another IHE uses several schools/several districts, including private schools, for training and placements; another IHE conducts a residential summer program on their campus, with participant student/mentor teacher teams drawn from private schools statewide. The mission and history of the IHE weighs heavily in how the program will be uniquely institutionalized.

Although different programs may implement the model differently, the success of the BT3 model depends upon individualized learning and team building among the student-teacher/mentor teacher teams. Smaller programs with intense in-field internship supervision may be best suited to this methodology. No short-cut and quick-and-easy programs need apply!
References


### BT3 – Building Teams and Tools for Teaching

**Student Teacher Unit Plan**

**Project Evaluation Rubric**

**2004-05**

<table>
<thead>
<tr>
<th>Work in Progress</th>
<th>Approaching Mastery</th>
<th>Mastery</th>
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#### A. Unit Plan

1. Plan doesn’t address all relevant TEKS by providing TEKS numbers and phrases and the way in which the unit addresses each TEKS is not clearly articulated.

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<tbody>
<tr>
<td>1. Plan addresses all relevant TEKS by providing TEKS numbers and phrases and clearly explaining how each TEKS is addressed in the unit.</td>
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2. Plan doesn’t address all relevant TEK Tech Apps/ISTE standards by providing numbers and phrases and the way in which the unit addresses each TEK Tech Apps/ISTE standard is not clearly articulated.

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<tr>
<td>2. Plan addresses all relevant TEK Tech Apps/ISTE standards by providing numbers and phrases and clearly explaining how each TEK Tech Apps/ISTE standard is addressed in the unit.</td>
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3. The Plan fails to use at least 3 different technology applications in a way that supports the unit’s learning goals.

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<th>Work in Progress</th>
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<tr>
<td>The Plan calls for at least 3 technology applications, but the technologies are not always used in a way that clearly supports the unit’s learning goals.</td>
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3. The Plan uses at least 3 technology applications in a way that clearly supports the learning goals of the unit.

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<th>Mastery</th>
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<tr>
<td>3. The Plan uses at least 3 technology applications in a way that clearly supports the learning goals of the unit.</td>
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4. Goals, strategies, preparation plan, materials used, assessment plans are incomplete, missing or not aligned with one another and do not consistently support the unit’s learning goals.

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<th>Work in Progress</th>
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<tr>
<td>One or more sections (goals, strategies, preparation plan, materials used, assessment plan) of the plan are incomplete or weak and/or there is a gap in the plan.</td>
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4. Goals, strategies, preparation plan, materials used, assessment plan are all clearly articulated and are consistent with and support the learning goals of the unit.

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<td>4. Goals, strategies, preparation plan, materials used, assessment plan are all clearly articulated and are consistent with and support the learning goals of the unit.</td>
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<td>Work in Progress</td>
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**B. Technology Infusion**

5. The technological applications don’t fit well within the lesson and appear to be an add-on rather than an integral part of the lesson. The use of technology does not support the learning strategies or overall goals.

Students move through the lesson easily but the technological applications aren’t always an integral part of the lesson. Some of the technology seems to be more of an add-on than integral to the lesson.

5. Students move seamlessly through the lesson using different technological applications. The technology is a seamless part of the lesson/unit.

6. The learning goals of the lesson/unit could easily be met without using these particular technological applications at all.

6. The technology supports the learning goals of the lesson/unit, but there are better technological applications for the task(s) that the student teacher/mentor teacher should reasonably be expected to be aware of and use.

6. The technology is used in a way that clearly supports the learning goals of the lesson/unit.

7. Neither the student teacher nor the mentor teacher is comfortable with the use of the technology and they can’t answer student questions or help the students to find the answers. The teachers and students don’t know what to do when technological problems arise and haven’t thought about having backup strategies.

7. The student teacher and mentor teacher are comfortable with most of the applications and can help students answer questions that arise or direct them to someplace where the answer can be found, but tend to get flustered when problems arise and don’t have clearly articulated back up strategies in place.

7. The student teacher and mentor teacher are both comfortable using the technologies. They have provided resources for the students to use to find answers to common problems and can help students find answers to other questions when they can’t answer them themselves. Both students and the teachers are able to adapt when technological problems arise. The teachers have clearly articulated back up strategies in case of technology failures.
### C. Use of Constructivist Learning Strategies

<table>
<thead>
<tr>
<th>Work in Progress</th>
<th>Approaching Mastery</th>
<th>Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

8. The teacher (mentor or student teacher) tells the students what to do and they follow step-by-step instructions.  
Students are actively engaged in the lesson and are learning by doing. However, the instructions setting up the problem are either not clear, incomplete, or are so detailed that there is little room for creativity or independent problem solving.  
8. Students are actively engaged in the lesson and are learning by doing. Instructions are clear and set up the problem. Students are given room for creativity.

9. If the students have a problem or don’t understand something the teacher simply gives them the answers.  
When students run in to problems the teacher gives them some time to help each other explore solutions. When they don’t find solutions quickly the teacher intervenes and gives them the answers.  
9. Students are given the freedom to make mistakes and help each other learn how to solve problems. The teacher acts like a coach/facilitator in helping them develop strategies for finding solutions.

10. The students are not expected to produce an identifiable product.  
10. The students produce a product but it is something that does not have much meaning for them.  
10. The students are required to produce an authentic product as an outcome of the lesson (one that is relevant to the lesson and holds significant meaning for them).
## D. Classroom Implementation

<table>
<thead>
<tr>
<th>Work in Progress</th>
<th>Approaching Mastery</th>
<th>Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

### 11. The lesson that is taught does not closely resemble the items/strategies described in the lesson/unit plan. The actual lesson does not reflect the stated intention of the unit plan.

- **Work in Progress**: The lesson that is taught does not closely resemble the items/strategies described in the lesson/unit plan. The actual lesson does not reflect the stated intention of the unit plan.
- **Approaching Mastery**: The lesson that is taught includes most, but not all of the items/strategies described in the lesson/unit plan. The actual lesson moves away from the intention of the stated intention of the unit plan.
- **Mastery**: All items/strategies mentioned in the lesson/unit plan are present and actually taught. The actual lesson clearly reflects the stated intentions of the unit plan.

### 12. None of the relevant TEKS described in the unit/lesson plan are apparent and/or addressed. The lesson that is being taught does not reflect the unit/lesson plan and what was said about how the TEKS would be addressed.

- **Work in Progress**: None of the relevant TEKS described in the unit/lesson plan are apparent and/or addressed. The lesson that is being taught does not reflect the unit/lesson plan and what was said about how the TEKS would be addressed.
- **Approaching Mastery**: Most, but not all of the Relevant TEKS described in the unit/lesson plan are apparent and/or addressed. The lesson that is being taught strays in some important ways from the way the unit/lesson plan said the TEKS would be addressed.
- **Mastery**: All of the relevant TEKS described in the unit/lesson plan are apparent and/or addressed. The lesson clearly reflects the way in which the unit/lesson plan said the TEKS would be addressed.

### 13. None of the relevant TEK Tech Apps/ISTE standards described in the unit/lesson plan are apparent and/or addressed. The lesson that is being taught does not reflect the unit/lesson plan and what was said about how the ISTE standards would be addressed.

- **Work in Progress**: None of the relevant TEK Tech Apps/ISTE standards described in the unit/lesson plan are apparent and/or addressed. The lesson that is being taught does not reflect the unit/lesson plan and what was said about how the ISTE standards would be addressed.
- **Approaching Mastery**: Most, but not all of the relevant TEK Tech Apps/ISTE standards described in the unit/lesson plan are apparent and/or addressed. The lesson that is being taught strays in some important ways from the way the unit/lesson plan said the ISTE standards would be addressed.
- **Mastery**: All of the relevant TEK Tech Apps/ISTE standards described in the unit/lesson plan are apparent and/or addressed in the lesson as it is being taught. The lesson clearly reflects the way in which the unit/lesson plan said the ISTE standards would be addressed.

### 14. The mentor and student teacher are not sensitive to student responses to the lesson and are not aware of the needs of the students.

- **Work in Progress**: The mentor and student teacher are not sensitive to student responses to the lesson. They observe needs for change in the lesson but have difficulty changing their direction when needed to help students meet the original learning goals.
- **Approaching Mastery**: The mentor and student teacher are sensitive to student responses to the lesson. They observe needs for change in the lesson but have difficulty changing their direction when needed to help students meet the original learning goals.
- **Mastery**: The mentor and student teacher are sensitive to student responses to the lesson and are able to evaluate and assess student needs and, if necessary, to adapt the lesson on the spot to student needs in ways that are true to their original learning goals.
<table>
<thead>
<tr>
<th>Work in Progress</th>
<th>Approaching Mastery</th>
<th>Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**E. Assessment of Student Learning**

15. Assessment of student learning is not well integrated into the lesson and is at best an add-on to the lesson. No thought is given to how the assessment supports learning.

Assessment of student learning is well integrated into the lesson, but it is not integrated well into the process of learning itself.

15. Assessment of student learning is well integrated into the lesson. As much as is appropriate for the age group, students are engaged in self-assessment and/or peer-assessment and assessment of learning is made a part of the learning process.

16. Students receive feedback after the lesson is over. Feedback does not come in time for students to reflect on their own learning.

Students receive feedback quickly (during the lesson or right as it ends) but students are not encouraged to evaluate their own learning or given feedback that helps them to reflect on their own learning.

16. Students receive instant/or nearly instant feedback on their performance. Feedback is timely and encourages and helps students reflect on their own learning.

17. The way in which learning is measured does not relate to the learning goals of the unit and to what and how the students are expected to learn.

Measures of learning are generally appropriate to the type of learning desired, but could be more clearly articulated with the learning goals and what and how the students are expected to learn.

Measures of learning are appropriate to the type of learning desired. For example, the success of a project-based assignment includes measures of process as well as content and finished product.

18. Only a single measure of student learning is used.

More than one measure of student learning is used, but they do not touch on multiple ways of demonstrating knowledge.

Multiple measures of student learning are used that reinforce each other and give students different ways of demonstrating knowledge (for example, student self-assessment as part of the lesson is combined with a test of content knowledge and a rubric for evaluating the presentation of the project.)
BT3 – Building Teams and Tools for Teaching  
Student Teacher Unit Plan  
*Project Evaluation Rubric*  
2004-05

Intern Teacher ID No. _______________
Reviewer ID No. ________________

<table>
<thead>
<tr>
<th>Scoring Sheet</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Unit Plan</td>
<td></td>
</tr>
<tr>
<td>B. Technology Infusion</td>
<td></td>
</tr>
<tr>
<td>C. Use of Constructivist Learning Strategies</td>
<td></td>
</tr>
<tr>
<td>D. Classroom Implementation</td>
<td></td>
</tr>
<tr>
<td>E. Assessment of Student Learning</td>
<td></td>
</tr>
<tr>
<td><strong>Overall Score</strong></td>
<td>📊</td>
</tr>
<tr>
<td>First Level Mastery</td>
<td>97 - 108</td>
</tr>
<tr>
<td>Second Level Mastery</td>
<td>86 - 96</td>
</tr>
<tr>
<td>Approaching Mastery</td>
<td>75 – 85</td>
</tr>
<tr>
<td>Work in Progress</td>
<td>74 or below</td>
</tr>
</tbody>
</table>

Comments:
The Stanford project focused upon five key objectives: 1) Implement new approaches to teacher education aimed at the development of powerful teaching through the use of technology; 2) Provide teacher candidates with the ability to develop and teach units that integrate technology into the teaching of core content; 3) Develop and test technology-based curriculum materials and units for use in other teacher education programs and schools; 4) Provide candidates with the scaffolding and ability to use appropriate computer-based technology to facilitate the learning process; and 5) Develop learning communities between Stanford and partners.

The Stanford Technology in Teacher Education Project sponsored by PT3 helped the Stanford Teacher Education Program (STEP) redesign its technology-related curriculum and respond to the advanced technology standards required for an effective and innovative teacher education program. In designing and implementing the project, we adopted an approach that was integrative, performance based, and product driven. Project evaluation documented that STEP teacher candidates learned to use computer-based technology in the classroom appropriately and showed competence in using computer-based technology infused throughout their university- and school-based curricula. From email communication to technological resources that facilitate teaching and learning, from developing skills in basic applications to critically examining a variety of educational technologies, STEP teacher candidates actively and frequently engaged in using technology at the university as well as in their field placements. The project had a deep and broad impact on teaching and learning in STEP. In this chapter, we describe aspects of the uses of technology by teacher candidates, faculty and staff, cooperating teachers in placement schools, and high school students. We highlight how the use of technology benefited teacher candidates and schools – and most importantly, students in those schools.

Context: The Stanford Teacher Education Program (STEP)

STEP is 12-month course of postbaccalaureate study for prospective secondary teachers. The program combines a full year of student teaching with graduate coursework leading to a Master of Arts in Education and a preliminary California Professional Single Subject Teaching Credential. STEP’s small size (between 60-75 candidates), access to top faculty,
university supervisors, and cooperating teachers, as well as its purposeful design offer highly focused instruction interwoven with hands-on teaching experience, sustained mentoring, and personalized advisement. Constant communication among members of a relatively small team of instructors and staff brings strength and coherence to the curriculum.

At the university, candidates have access to well-resourced computer labs that have multimedia capabilities, are rich in hardware and have a wide selection of software and educational applications. In field placements, candidate access to technology varies. However, STEP teacher candidates have access to laptops, probeware, digital cameras, projectors, and other equipment they can check out from the university and bring with them to their schools. In addition to exploring the multi-faceted challenge of identifying how technology supports teaching and learning through coursework and field placements, STEP teacher candidates participate in skill-based workshops offered throughout the year, one-on-one coaching sessions, and individual, small group and project-based assignments.

Many on-line course resources are used by faculty and students (e.g., Blackboard, Coursework). Over half of the courses require group projects and thus the use of collaborative tools. STEP teacher candidates develop a deep grounding in content pedagogy, understanding of learners, and the learning process in their Curriculum and Instruction (C&I) courses. During their C&I courses, each preservice teacher prepares a curriculum unit. Appropriate uses of technology are included as one of the evaluation criteria for the unit. In designing their unit candidates need to:

1) explore and examine software and web resources to evaluate their effectiveness and alignment with content- and teaching-standards;
2) analyze best practices and research findings on the use of technology;
3) design lessons that demonstrate effective use of technology; and
4) reflect on their practice by examining student work and the feedback they received from students to guide their subsequent instruction.

To assess the use of the unit and to revise it as needed, candidates videotape selected lessons to analyze, review and reflect upon with their supervisors and colleagues. It is during fall quarter that candidates become acquainted with specific technology resources in their respective C&I courses and then experiment with these resources in their field placements.

For example, during the years of the project, in the Science C&I led by Dr. Schultz, candidates explored the uses of “probeware” in their university course and also with students in their field placements. In English C&I, candidates made a Quicktime movie for an assignment that asked them to demonstrate their assessment of a student’s reading strategies. In Foreign Language C&I, candidates began to build their curriculum unit which relied heavily on multimedia resources. In Mathematics C&I, candidates analyzed and critiqued a comprehensive review of various applications that enhance the teaching and learning of mathematics at the secondary level (e.g., graphing calculators, Geometry Sketchpad). In Social Studies C&I, sessions were devoted to the analysis of primary and secondary sources with particular attention to such documents available on-line.
The course entitled “The Centrality of Literacies in Teaching and Learning” is taught during summer quarter. Among the main purposes of this course is to introduce teacher candidates to the challenge of teaching diverse student populations and expanding their repertoire to include multiple representations of content material. At the time of the project, integral to this course was a literacy case study where the candidates were asked to prepare a multi-media presentation of an adolescent as a literate individual. Alphabetic literacy was to be used minimally. Instead, art, music, sound, photography, video clips, charts, and graphs were to be presented to illustrate the adolescents whom candidates observed and tutored during the summer school session. As part of this course and to learn how to fulfill the course assignment, candidates participated in the following skill-based tutorials: scanning and editing graphics and photographs; designing web pages; preparing presentations that incorporate graphics, text and video (Powerpoint), and uses of internet resources.

The four-quarter long Secondary Teaching Seminar (the Practicum) is the overall glue for the program. This sequence allows teacher candidates to complete their teaching assignment in a local high school or middle school and to make deliberate connections between the clinical experiences in these classrooms and their university courses. This year-long sequence also allows the teacher candidates to practice and to deepen their methodological and technological skills.

Over the years of the project, teacher candidates and university supervisors became increasingly comfortable with videotaping classrooms and candidates’ teaching. These videotapes became valuable data for specific feedback and grounded analysis of candidates’ performances in the classroom. University supervisors participated in a number of professional development sessions designed to teach them how to use the video camera effectively and how to use the tool for purposes of feedback and support of candidates’ learning.

Clinical placements in local middle school and high school classrooms allow teacher candidates to observe others and to experiment with the use of tools that facilitate their teaching practice. Increasingly, schools become more and more technologically well-resourced and cooperating teachers and their colleagues acquire stronger and stronger knowledge about uses of technology and are then able to use that knowledge in their classrooms. Thus, teacher candidates are better able to observe others and use the technological tools that enhance teaching and learning across subjects in their clinical placements. Candidates are urged to develop an inventory of technology resources at their school site. Since they are required to be in their field placements for at least 20 hours per week, they have opportunities to explore the resources at the school, interact with the staff in charge of media labs, and communicate with librarians and administrators regarding these resources. Using the frameworks presented to them in their courses, they can consider if and how content being taught best uses technological resources to support, manage, and enhance learning. They can also practice and demonstrate the ability to create and maintain an effective learning environment using computer-based technology. Furthermore, they communicate with their students and their parents using printed media and build web-sites for easy access to information about the courses they teach.
At the time of this project\(^1\), the graduation portfolio represented the culmination of the candidate’s work during the program. This portfolio was a digitized collection of materials and artifacts reflecting the candidates’ theoretical and practical knowledge, pedagogical stance, teaching skills, and educational philosophy. It included multiple sources of evidence collected over time, organized, and refined to illustrate their professional growth and best work. As such, it was the integration of candidates’ clinical work and coursework, providing a sense of learning that “adds up” across the program as a whole. For instance, key assignments from courses such as the literacy case, the curriculum unit, and the teaching event were designed to meet final portfolio requirements. In the process, the portfolio integrated evidence about teaching with evidence of student learning, thus reinforcing a teaching stance concerned with ongoing diagnosis of and responsiveness towards student needs, rather than teaching as mere implementation of routines. Candidates produced their portfolios and presented it at their individual portfolio exhibition.

Production of the digital portfolio, a graduating requirement, was scaffolded throughout the practicum. Margaret Krebs, PT3 Director and Katie Miller, Technology Coordinator for STEP, conducted workshops and were responsive to the candidates on an “as needs” basis. During the workshops they reviewed the technology resources, tutored candidates individually and in small groups on specific technology tools, problem solved equipment and hardware failures. Both Ms Krebs and Ms Miller acted as important facilitators because they had the technical expertise and a deep understanding of the STEP curriculum and the graduation requirements. They were able to provide assistance and feedback both at the technical and at the substantive levels.

Candidates prepared two versions of their digitized portfolio: 1) a display version that presents best work and omits any items that may raise issues of confidentiality. (This version was used as an employment portfolio as well.); 2) a more complete version for credentialing purposes including quarterly assessments by supervisors and cooperating teachers, reflections of supervisor’s observations, drafts of assignments demonstrating professional growth as well as finished products of the candidates’ best work.

The portfolio provided a performance-based way for candidates to integrate the skills they had practiced throughout the year. In addition, candidates grappled with copyright, privacy and security issues around their own work as well as that of their students and cooperating teachers. To scaffold and support this work, STEP teacher candidates who needed extra support participated in a “Digital Portfolio Club” during the spring quarter. The meetings of the “club” were organized and facilitated by the STEP Technology Coordinator and candidates’ participation was voluntary: some attended every meeting, others only selected ones. For each of the weekly meetings conducted in the computer lab, Ms. Miller prepared and published an agenda but also left ample time to address specific questions and to try out specific applications as needed.

### Evidence of candidate learning and performance

The following table is a summary of the indicators of candidate technology use and the places where candidates were required to develop technology skills.
<table>
<thead>
<tr>
<th>Indicators of Technology Use</th>
<th>Course of Study</th>
<th>Demonstrated Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses computer applications to manage records</td>
<td>Practicum</td>
<td>Throughout program</td>
</tr>
<tr>
<td>Uses computers to communicate through printed media</td>
<td>Practicum, Classroom Management</td>
<td>Parent Involvement Plan</td>
</tr>
<tr>
<td>Interacts with others using email</td>
<td>Program requirement</td>
<td>e.g. STEP distribution lists</td>
</tr>
<tr>
<td>Is familiar with a variety of computer-based collaborative tools</td>
<td>Program requirement</td>
<td>Communications with colleagues and faculty</td>
</tr>
<tr>
<td>Examines a variety of current educational digital media and uses established selection criteria to evaluate materials</td>
<td>C&amp;I Practicum</td>
<td>e.g. Software Evaluation Assignment</td>
</tr>
<tr>
<td>Chooses software for its relevance, effectiveness, alignment with content standards, and value added to student learning</td>
<td>C&amp;I Practicum</td>
<td>Curriculum Unit Software Evaluation Assignment</td>
</tr>
<tr>
<td>Demonstrates competence in the use of electronic research tools</td>
<td>Program requirement</td>
<td>Course syllabi and assignments</td>
</tr>
<tr>
<td>Demonstrates the ability to assess the authenticity, reliability, and bias of the data gathered</td>
<td>Program requirement</td>
<td>Course syllabi and assignments</td>
</tr>
<tr>
<td>Identifies student learning styles and determines appropriate technological resources to improve learning</td>
<td>Centrality of Literacies, C&amp;I</td>
<td>Literacies case study Curriculum Unit</td>
</tr>
<tr>
<td>Considers the content to be taught and selects the best technological resources to support, manage and enhance learning</td>
<td>C&amp;I</td>
<td>Literacies case study Curriculum Unit</td>
</tr>
<tr>
<td>Demonstrates an ability to create and maintain effective learning environments using computer technology</td>
<td>C&amp;I Classroom Management</td>
<td>Curriculum Unit Classroom management plan</td>
</tr>
<tr>
<td>Demonstrates knowledge of copyright issues</td>
<td>General university policy</td>
<td>Digital portfolio</td>
</tr>
<tr>
<td>Demonstrates knowledge of privacy, security, and safety issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uses a computer application to manipulate and analyze data (e.g. create, use, and report from a database; and create charts and reports from a spreadsheet).</td>
<td>Practicum, Field placement</td>
<td>Digital portfolio</td>
</tr>
<tr>
<td>Communicates through a variety of electronic media</td>
<td>Program requirement</td>
<td>Parent Communication Plan</td>
</tr>
<tr>
<td>Interacts and collaborates with others using computer-based collaborative tools (e.g. threaded discussion groups)</td>
<td>Program requirement</td>
<td>e.g., STEP distribution lists</td>
</tr>
<tr>
<td>Contributes to site-based planning or local decision making regarding the use of technology and acquisition of technological resources</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Indicators of Technology Use

| Demonstrates competence in evaluating the authenticity, reliability; bias of the data gathered; determines outcomes and evaluates the success or effectiveness of the process used. | STEP curriculum | Course syllabi and assignments |
| Optimizes lessons based upon the technological resources available in the classroom, school library media centers, computer labs, district and county facilities, and other locations. | C&I Practicum Field placement | e.g. Quarterly Assessment: Standard 6: Professional Educator |
| Designs, adapts, and uses lessons which address the students' needs to develop information literacy and problem solving skills as tools for lifelong learning | Literacies C&I Practicum Classroom Management Field placement | Literacies Assignment Curriculum Unit Quarterly Assessment |
| Creates or makes use of learning environments inside the classroom, as well as in library media centers or computer labs, that promote effective use of technology aligned with the curriculum | Practicum Classroom Management Field placement | Literacies Assignment Curriculum Unit Quarterly Assessment |
| Uses technology in lessons to increase each student's ability to plan, locate, evaluate, select, and use information to solve problems and draw conclusions. | C&I Practicum Field Placement | Curriculum Unit Quarterly Assessment Digital Portfolio |
| Uses technology as a tool for assessing student learning and for providing feedback to students and parents | Literacies C&I Practicum | Literacies Assignment Curriculum Unit Digital portfolio |
| Monitors & reflects upon the results of using technology & adapts accordingly | C&I Practicum | Digital portfolio |
| Collaborates with other teachers, mentors, librarians, resource specialists, and other experts to support technology-enhanced curriculum | Field Placement | Quarterly Assessment |
| Contributes to site-based planning or local decision making regarding the use of technology and acquisition of technological resources | | |

Over the course of the three-year project, during the first week of orientation to the program, STEP teacher candidates completed a survey regarding their computer literacy skills and technological proficiency. Data from this survey allowed us to plan for the personalized and individualized help needed by the different candidates. Furthermore, it allowed us to construct heterogeneous working groups of candidates who could serve as technology resources for one another. This overall norm of mutual help and collegial support was and continues to be strongly emphasized and supported in all aspects of the STEP curriculum. This sharing of expertise among candidates was also evident during the “digital portfolio club” meetings.

At the end of the academic year, post-surveys were administered to candidates asking them to rate their proficiency on selected indicators. Table 2 shows the percentage of candidates who rated themselves as either “proficient” or “expert” in terms of their ability to use aspects
of technology for instruction. Overall, data indicate that for each of the indicators, a significantly higher percentage of STEP students rated themselves as “proficient” or “expert” after their experiences in the program. For example, by the end of their program, almost 80% of candidates who completed the program in 2003 rated themselves as proficient or expert in their ability to use multimedia tools to provide multiple representations of content material, an increase of almost 60% when compared to their self-ratings at the beginning of the program. Similar increases are evident across all years of the project, on all dimensions. Moreover, candidates believed their experiences in STEP helped prepare them to design lessons that used technology effectively. Each year, there was a significant increase from the beginning to the end of the program in the number of candidates who rated themselves as “proficient” or “expert” when they were asked to describe their ability to “design lessons that encourage students to use a variety of information resources and technology tools to build their own understanding of content”. For example, almost 70% of candidates from STEP in 2003 rated themselves as “proficient” or “expert” on this dimension, compared to only 16% at the beginning of the program.

### Table 2. Candidates’ self-rated ability to use technology for instruction

<table>
<thead>
<tr>
<th>Instructional Uses of Technology</th>
<th>Beg ’01</th>
<th>End ’01</th>
<th>Beg ’02</th>
<th>End ’02</th>
<th>Beg ’03</th>
<th>End ’03</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Uses technology to provide students with problem-based activities</td>
<td>4%</td>
<td>54%</td>
<td>8%</td>
<td>57%</td>
<td>14%</td>
<td>59%</td>
</tr>
<tr>
<td>B. Designs lessons so that students have equitable access to available technology to successfully complete the assignment</td>
<td>10%</td>
<td>60%</td>
<td>8%</td>
<td>57%</td>
<td>7%</td>
<td>67%</td>
</tr>
<tr>
<td>C. Uses technology to communicate in ways previously not possible (i.e., exchanging email with parents, posting student work on the school web site)</td>
<td>25%</td>
<td>70%</td>
<td>28%</td>
<td>71%</td>
<td>16%</td>
<td>67%</td>
</tr>
<tr>
<td>D. Uses multimedia tools to provide multiple representations of content material</td>
<td>8%</td>
<td>81%</td>
<td>15%</td>
<td>85%</td>
<td>21%</td>
<td>79%</td>
</tr>
<tr>
<td>E. Uses specific criteria to select software that matches grade level, content, and instructional outcomes</td>
<td>10%</td>
<td>44%</td>
<td>6%</td>
<td>37%</td>
<td>16%</td>
<td>44%</td>
</tr>
<tr>
<td>F. Uses technology to provide students with real-world problems, including an audience or resources outside the classroom</td>
<td>10%</td>
<td>49%</td>
<td>8%</td>
<td>46%</td>
<td>20%</td>
<td>52%</td>
</tr>
<tr>
<td>G. Designs lessons that encourage students to use a variety or information resources and technology tools to build their own understanding of content</td>
<td>10%</td>
<td>68%</td>
<td>10%</td>
<td>69%</td>
<td>16%</td>
<td>69%</td>
</tr>
<tr>
<td>H. Encourages students to use technology to develop and solve authentic problems, often including contact with outside experts and audience</td>
<td>10%</td>
<td>49%</td>
<td>8%</td>
<td>38%</td>
<td>17%</td>
<td>49%</td>
</tr>
</tbody>
</table>

In addition to the surveys, data were collected through interviews with Candidates in year three. Referring to requirements of their university coursework (e.g., the curriculum unit, the literacy case described earlier), the candidates perceived that the application of technology within the context of their assignments was a meaningful way to learn how to integrate technology into instruction. Moreover, this modeling of technology-embedded assignments was an effective way for STEP to encourage candidates to learn how to create a curriculum for their students that also embeds technology. The findings showed that candidates were leaving the program well prepared to integrate technology into their teaching.
Evidence of changes in faculty’s practice and perceptions

Faculty members teaching in STEP were interviewed as to their use of technology in their courses. Consistent with research at the K-12 level, data suggest that organizing the C&I courses to include technology had been easier for some STEP faculty members than for others. For example, one faculty member was rather skeptical and said, “I am not sure there are the same kind of materials at the secondary level that are better than what teachers can do without technology.” In contrast, another faculty member felt strongly that all teachers in his content area should be well-versed in the use of the internet to find resource material and he consistently modeled technology use in his instruction. He stated, “Technology is absolutely essential to the content of their instruction. . . . How can you have legitimacy in teacher training in my subject area if you are not fluent yourself?” Still another faculty member stated that being asked to integrate technology into her course “changed [her] thinking . . . and opened [her] eyes to something different.” These quotes reflect the variability in faculty’s willingness and commitment to address and model use of technology for prospective teachers.

Securing a PT3 grant brought important human and financial resources to STEP and allowed for initiating, planning and implementing training of faculty and staff. Margaret Krebs, PT3 Director, devoted much time, energy and effort to understand the program well: the needs of teacher candidates and faculty, the STEP context and its curriculum as well as the guiding national and state technology standards. She encouraged and mentored faculty members in using technology. She requested proposals and funded small, technology-related projects connected to the work with teacher candidates. She helped faculty develop action plans, provided workshops, visited classes, and made available subject-specific resources and software applications. She reached out and made connections among STEP faculty and other faculty in the Stanford School of Education involved in other programs such as the Learning, Design and Technology (LDT) master’s level program. For example, graduate students from this program made presentations to STEP candidates and provided assistance and feedback on the technology component of the curriculum units developed by the candidates. Ms Krebs also connected STEP faculty and staff with PT3 participants from other universities. She emphasized the importance of this work in the context of STEP meeting specific national and state technology standards for the credentialing of teachers.

These efforts produced important results for faculty and candidates as reported earlier (see Table 2 above). However, interviews also suggested that the barriers to using technology by STEP faculty were similar to barriers facing teachers at the K-12 level. For example, one faculty member commented about the difficulty her students had in gaining access to reliable computers. She stated, “I find it amazing that even at Stanford, computers were failing. I know some of [the students] probably caused the problems because they were novice users, but I had a lot of experienced students and they had problems with the hardware.” Moreover, during the early phases of our project before the full launch of our activities, faculty reported that they, too, had trouble accessing rooms with technology in which to teach, as this quote illustrates: “Most of the classrooms I taught in didn’t have access to technology. . . at that point, didn’t have smart panels, so actually doing any of these things wasn’t easy. There were very few classrooms. . . that had the technology in the rooms.” Clearly, without sufficient
access to technology for both students and teachers, even well-trained, highly motivated faculty will not be able to integrate technology effectively into instruction.

Although the PT3 project offered resources and training opportunities for faculty, some faculty reported scheduling and time constraints as challenges to taking advantage of these opportunities. As one faculty member stated in an interview, “It takes a long time to learn this stuff.” Another agreed: “I went to one of the summer workshops, but . . . it was right before we had this intensive class. I couldn’t afford the time. timing was bad.” The project also provided valuable ongoing support for faculty. One faculty member stated that her ability to integrate technology into her course “wouldn’t have happened to the extent it did” without PT3 support which she called, “a godsend” because PT3 staff “kept things moving.” Other faculty members, though appreciative of the efforts of the PT3 staff, felt that even more subject-specific support would have made a difference, as this quote illustrates: “[One PT3 staff member] was interested in finding technology for teaching [my subject area], but she didn’t find a lot. If there are things out there that would be great for teaching [my subject area] that I don’t know about, it would have been great to have more support finding them.”

Constraints on time and work capacity were also concerns of faculty members in teaching teacher candidates how to use technology. One faculty member explained, “We have such limited time in teacher education. You constantly have to make choices. What is the most important thing to prepare people to go out and teach? . . . When you ask students to do something and you know that they will encounter frustration, I weigh that. They are already over stressed, so think really carefully about the value.” Another faculty member agreed, stating, “To use any of those [technologies] meaningfully is a huge investment of time.” Despite this, however, the faculty member recognized the necessity for these types of assignments, stating: “On the other hand, if they don’t make the investment of time there is never going to be a chance for them to do it in the classroom. So, I can see the wisdom in [the technology requirements].”

**A case study from the Science C&I**

We describe in more detail the experience of the Science C&I because Dr. Susan E. Schultz, one of the authors of this chapter, served as the instructor for the three-quarter sequence during the period of the project. This case study illustrates how a specific application was infused in the course and how candidates documented the impact of its use on their teaching and their students’ learning.

After considering a number of computer-based tools, Dr. Schultz selected Probeware by Venier as an appropriate technology resource for use in her science methods courses. Probeware used with laptops enabled teachers and students to investigate a variety of topics that were not easily understood through direct observation. For example, it enabled students to replicate data that were unachievable by conventional laboratory techniques, such as detecting motion or monitoring heart rate, thus bringing real-world problems into the classroom. Teacher candidates learned how to use the new technology to augment the teaching of science and developed lessons in collaboration with their cooperating teachers at the school sites. The teacher candidate/cooperating teacher team applied the technology in
their science classrooms and with their students. Students engaged in meaningful work and learned first-hand how to collect and analyze data and how to use technology to compare and interpret their data. The “real world” nature of this work served as a powerful way to engage students in a truly authentic gathering of data over a period of time. Ultimately, teacher candidates investigated, evaluated and produced curricula and teaching models that utilized a collaborative system combining the resources and goals of teacher education programs and local high schools.

Schultz conducted a study to examine how the 19 teacher candidates in her class used computer-based technology to enhance their teaching and the influence of this technology on high school/middle school science students’ learning. The two guiding questions for the study were: (1) How did the candidate design a lesson integrating this technology and evaluate the effectiveness of the lesson to support powerful teaching? and (2) How did technology support student learning in the content area?

Sources of data for the study included candidates’ lesson plans, reflection papers, samples of student work, videotapes of the lessons, and interviews. Data analysis focused on the effectiveness of using Probeware to create learning opportunities and the impact of technology on student learning.

In her evaluation of this intervention, Schultz (2003) found that STEP teacher candidates successfully designed and implemented lessons using Probeware to teach specific content to students. Types of probes used in the teacher candidates’ lessons included motion detectors and photo sensors in Physics; temperature, conductivity, and pH probes in Chemistry classes; and EKG probes in Biology/Physiology classes.

Not surprisingly, in their interviews teacher candidates identified scarcity of time, collecting and organizing equipment, piloting the lessons, and preparing students to use the technology tools as some of the biggest challenges. An additional challenge was the necessity to teach students supplemental information to understand what the probe was measuring and how the collected data related to the lesson. A typical example was captured in a candidate’s quote, “In terms of the technology, the most difficult part was for me to take freshmen and sophomores with little experience and understanding about cardiac health and fitness and make the EKG a useful tool for students because it’s a very complicated measure, in terms of where you put the leads and how you read it, and what it really means.”

When responding to prompts about how the use of technology enabled them to teach, demonstrate, or illustrate a specific concept, teacher candidates’ most frequent responses focused on the use of instrumentation by field scientists, the ability to detect and collect a measurement not normally captured by traditional labs, display of a graphical representation of data, and the ability to store data collected from field sites to be analyzed later. The following response by a candidate focused on the ability to detect and collect a measurement, “The main part of the technology we used was photo-gates into the computer to capture velocities of actual matchbox cars. And you couldn’t have done it with a stopwatch because they were just traveling too quickly and it wouldn’t have been accurate enough. So, it was really essential for them to get the points of the motion in the X-Y direction.”
Candidates were uniform in their evaluations that the use of technology helped students understand the relevance of the content being learned and how it could apply to everyday situations. A typical candidate’s response was as follows, “With the technology, it is a really powerful demonstration that these physics equations actually work in real life to predict real-life outcomes. I think that’s really powerful for them and it wouldn’t have happened without accurate timing.” Candidates’ perceptions were supported by communications with the cooperating teachers who felt that the high school students now had a better grasp of the content than students in previous years. After observing the use and the impact of probeware on student learning, five cooperating teachers asked to learn more about this new technology. Margaret Krebs and Susan Schultz organized a series of workshops for these teachers and additional ones from their departments focused on probeware. The workshops, supported by staff from Jasper Ridge, a biological preserve located on the Stanford campus, brought together STEP faculty, cooperating teachers, biologists and additional teacher candidates. After their initial skepticism towards technology in the classroom, these teachers became ambassadors and later mentors to other science teachers in the departments. Ultimately, more high school students gained access to investigating scientific concepts through the use of probeware.

In response to further interview questions, most of the candidates (80%) also reported higher levels of engagement with all portions of the lesson and a “feeling” of increased student motivation. This is captured by the following quote, “In terms of students having a higher level of motivation, I don’t have a measure of it, but I had a sense of it and you could sense the environment in the classroom, which was, I think the students were pretty excited to do this lab, there’s a lot of activity…The students were really involved in it.”

Assessing student learning revealed the largest variation in candidates’ responses. About two thirds of the candidates felt that they did not adequately capture what students knew and were able to do using their selected assessment tools. As one of them said, “I don’t think I did a very good job of assessing their learning, because I didn’t know what the hell I was doing yet. So, I don’t know if I have a really good feel of how much they really understood it. They did well on completing the lab packet. And they did pretty well on a traditional quiz on it. I’m not sure how effective it was unfortunately, because I didn’t – I didn’t do a very good job of assessing their knowledge.”

Other candidates (37%) talked about formal and informal methods of assessing what students knew and were able to do. One candidate said, “The technology portion of the lab was very effective. The graphs that students produced were accurate and if correctly analyzed could teach them all they needed to know about phase change. Interacting with students and asking them to explain the unusual shape of the graph I could informally assess their understanding of the lab. Most students could identify the point where the last of the ice melted as the point where the slope changed the first time and that the water started to boil when the curve reached its final plateau.”
Sustainability

Like with all externally funded projects, sustaining activities at the original level of implementation is difficult to achieve. However, the Stanford School of Education has shown its commitment to continuing to integrate technology in the teacher preparation program by creating a staff position to support faculty and candidates in their uses of technology. The program continues to pay significant attention to the infusion of technology in both the university- and school-based curriculum. Uses of technology have become routine parts of the way the program functions and the way it prepares candidates. We are also continuing to raise funds for more projects that focus on technology.

The original grant allowed the STEP faculty, students and its partners the opportunity to dialogue, experiment and reflect upon effective methods of integrating technology into a teacher education curriculum. As the STEP faculty and staff began to explore what effective integration of technology in teaching looks like, it became more and more apparent that the next step in deepening this connection rested in partnering with discipline-based colleagues in other schools and institutions that could offer resources and training in content-specific applications of knowledge and technological tools. The significance of these efforts is the removing of walls that sometimes separate certain fields of study and practice, and the opening up new avenues for partnership and cross-disciplinary models for teacher education and preparation.

Notes

1 The content of the STEP graduation portfolio has changed recently due to state-mandated changes in the requirements for credentialing. For a current format of the required graduation portfolio, the Performance Assessment for California Teachers, see www.pacttpa.org.

References

USING TECHNOLOGY IN MEANINGFUL WAYS WITH FIRST YEAR TEACHERS: TRIUMPHS AND TRIBULATIONS ENCOUNTERED WITH PT3 INITIATIVES

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This chapter highlights the successful strategies used to inspire and prepare beginning teachers to become effective users of technology. The triumphs and tribulations encountered during this two-year PT3 project are recounted, focusing on specific technology tools that hold promise for eliciting and encouraging meaningful reflective practice with this special population.

The PT3-funded Collaborative Advancement in Distributed Resource Education (CADRE) project is a joint initiative on behalf of the University of Arizona's teacher preparation program and three local school districts to develop technology-proficient educators who are prepared to meet the needs of 21st century learners. One of the three goals for this grant was to provide first year teachers, working in schools serving low-income or minority communities, sustained face-to-face and networked mentoring that results in continued technology integration. This chapter focuses on the innovative ways this project has transformed this aspect of teacher education, highlighting the successful strategies used to inspire and prepare beginning teachers to become effective users of technology. The chapter is presented as a journey with two different groups of first year teachers, taking a closer look at the triumphs and tribulations encountered in the efforts to present meaningful technology experiences for use with this special population.

The focus of this particular PT3 project with beginning teachers placed an emphasis on specific technology tools designed to elicit and encourage meaningful reflective practice. During the first year of teaching, novices must be surrounded with a professional culture that supports teacher learning (Feiman-Nemser, 2003). In this critical stage of development, beginning teachers are developing practical knowledge (Cochran-Smith & Lytle, 1999) dependent on the unique context of a particular classroom (Munby, Russell & Martin, 2001). How teachers acquire such knowledge and the situations in which they learn become a fundamental part of the learning process (Putnam & Borko, 2000; Schon, 1991). It was therefore considered essential to unpack these teacher reflections through specific technology tools that compliment and in some ways are derived from the teaching practice. During the first year of work with these beginning teachers, three technology tools were utilized to elicit and encourage reflection on teaching as it naturally occurs in practice. Portfolio development, online discussion, and videotaping teaching were chosen for use with this initial group. During the second year of the PT3 project, a new group of first year teachers were introduced again to online discussions, with an additional mentor teacher support component. Paired
Insights and understandings from the PT3 efforts and initiatives across the two academic years will now be presented, with special attention to the lessons learned in the form of trials and tribulations encountered along the way.

**A Good Start: Three Promising Technology Tools**

During the initial year in which beginning teachers were introduced into the PT3 grant, our plans were three-fold: 1) To give instruction and support on creation of an electronic portfolio to encourage the first year teachers' reflections on their experiences and knowledge; 2) To introduce a web-board for online discussion communication with other first year teachers across the city and provide a forum for group reflection on the work of teaching; and 3) To digitally videotape first year teachers so that they might be able to use this technology as a reflective tool and integrate results into their electronic portfolio. These three technology tools were chosen for their promise to elicit and encourage reflective practice among the beginning teachers. The electronic portfolios were chosen so that these teachers might create a purposeful collection exhibiting their efforts, progress, and achievements (Canada, 2002; Lankes, 1998). Online learning had emerged to allow convenient asynchronous communication and reflection among learners (Harasim, 1991) overcoming obstacles of distance and time (Zhao, Englert, Chen, Jones & Ferdig, 2000). This opportunity to dialogue with colleagues or cohorts is an important aspect of teacher inquiry and reflective practice (Rust, 1999; Wilson & Berne, 1999). Videotaping teaching episodes to encourage reflection is not a new practice in preservice teacher education (Wedman, Espinosa, & Laffey, 1999; Lambdin, Duffy, & Moore, 1997). In these cases, video has been utilized to enhance self-evaluation, affording the luxury of being able to engage in reflection once a lesson has transpired (Sherin, 2000).

Ten first year teachers, teaching a range of grades between kindergarten and twelfth grade and representing four school districts in the city, participated in the initial project. Participation was gained by sending an email to all graduates of the teacher preparation program, asking volunteers to respond if they were interested in participating and had obtained a beginning teacher contract within the city for the upcoming school year. The beginning teacher participants met with the research team eight times, spread evenly throughout the 2002-2003 academic year. These meetings served as instructional time for creation of the portfolio, and as a common time to discuss the project in general and touch base on other aspects of the technology experiences. The first year teachers were individually videotaped in their classroom three times during the year, in the months of September, December, and April. In the month following each videotaping, individual open-ended interviews (Seidman, 1991) were conducted to assess which technologies were beneficial to the beginning teacher and how the technologies might be improved for better use. These open-ended interviews, which took approximately 15-20 minutes to complete at the individual teacher’s school site, were taped and transcribed for later review (Bogdan & Biklen, 1992). A Likert-scale survey was administered to the first year teachers at the initial meeting in August and the final meeting in April. Finally, the beginning teachers were required to participate in an online discussion board created for the group a minimum of three times during the school year. The discussion board was introduced in October and
suggested participation months were November, February, and May. Requirements for the first year teacher participation in this study were staggered so as to not overwhelm them at any particular point in the school year. Data collected from interviews, surveys, videotapes, and online discussion transcripts were analyzed to determine the effectiveness of the three technology tools for eliciting and encouraging beginning teacher reflection leading to improvement of their teaching practice. Results of this initial project are now presented in the form of triumphs and tribulations.

Triumphs from the initial project

Videotape encourages meaningful reflection

Overall, results indicate that the first year teachers in this study found value in each of the technology tools with videotaping encouraging the most meaningful reflection on their teaching practice. Despite slight variations among individuals, the averages for the group of beginning teachers remained constant when asked which tools encouraged the most meaningful reflection on their teaching. Results are synthesized in Figure 1.

Figure 1. Group Averages for Encouraging Reflection

The beginning teachers in general expressed that videotaping their teaching helped them to see mannerisms and unintentional tendencies that they normally would not otherwise be aware of, such as repeatedly using certain expressions. This was the most meaningful tool to them throughout the study as it provided an opportunity for instant reflection on their
teaching practice. Portfolio development began the study ranked significantly lower than videotaping teaching. However, in contrast to videotaping, these numbers increased in value over time. The increase suggests that this tool gained popularity during the study as teachers began to realize how it might encourage reflection over time. The beginning teachers reported that developing a portfolio helped them to organize their teaching materials and present the best of their teaching practices. Online discussions began with a lower average than the other two technology tools and continued to be the considered least effective at encouraging reflection throughout the study. Although this tool will be discussed further in the tribulations that follow, the beginning teachers did appreciate the online discussion as a way to share their teaching experiences and frustrations with each other.

Each of these technology tools was recognized by the beginning teachers in this study for professional development purposes

Throughout the study, the first year teachers responded positively when asked if using computer technologies was essential to their professional development, consistent with findings from Hawkes & Rosmiszowski (2001). Since the tools were valued for gaining self-awareness and for professional development, these beginning teachers might be inclined to use these technologies in the future (Norton & Sprague, 1997). Thus, the three tools might be introduced into teacher induction practices and continuing professional development programs as an avenue for reflection on teaching and a structure for novices to think and talk about their work.

**Tribulations from the initial project**

The online discussion tool gained inconsistent participation impeding efforts to create a sustainable and more meaningful reflective conversation

Results indicated that online discussions were the least likely tool for these beginning teachers to use for reflective purposes when given the opportunity to do so in the future. These results are consistent with those of Harrington and Hathaway (1994) who suggest that not all participants recognize the value of such conferencing activities. Although the beginning teachers found value in providing and receiving nonevaluative and nonthreatening emotional support during their first year of teaching (Chubbuck, Clift, Allard, & Quinlan, 2001; Edens, 2000), their lack of consistent participation made this technology less effective. The beginning teachers also were often frustrated that they were only talking to other first year teachers with the same amount of expertise.

The middle months of the study, November through January, gained the most participation from this group of beginning teachers. By March, it appeared that the beginning teachers were only getting on the discussion board if they wanted to initiate a topic, and very rarely were responding to others. Responses in the final interviews yielded two suggestions that were considered to be viable ways to adapt the online discussion to better meet the needs of beginning teachers. First, it was suggested that the study should have required participation more often. Although the minimum number of entries required was set as to not overburden the first year teachers, it is highly probable that this may have contributed to limited
participation. However, 8 of the 10 participants made more than three entries throughout the year, and the highest number of entries for a single beginning teacher was eighteen. The second suggestion was to include mentor teachers for collaboration on the discussion board to provide for a richer discussion (Aune, 2002). Although suggested by only two of the ten beginning teachers, it seemed to be a promising addition to this technology tool in future projects.

Access problems in the schools prevented equal opportunities for beginning teachers to use the technology

Issues arose during the academic year regarding opportunities to use the technologies needed, specifically the online discussion board. Some of the school districts in the area employ such a high level of security screening that some web sites have been blocked or are not available to the teachers in their schools. Most of the beginning teachers in this initial group then had to rely on their personal home computer for access to the designated site. In most cases this was sufficient, yet one particular beginning teacher had problems with her own system as well. Although the percentage of those affected was not significant in this particular study, it is worthy to mention as it cannot be presumed that all beginning teachers will have access to all of the technology tools they might need or be asked to use.

A uniform lack of integration when using the three technology tools

The three tools emerged as separate in that two of them were considered more personal, and the third more of a group reflective tool. The beginning teachers in this study indicated a preference for videotaping and portfolio development, both of which are concrete displays of teaching practice providing an opportunity for personal reflection. These teachers chose to keep the videotapes of their teaching to themselves, and not a single participant chose to include these displays of practice in their teaching portfolio despite being given examples of how to do so. Similarly, videotaping teaching was never discussed during the online discussions. There was only one instance in which the beginning teachers demonstrated integration of the three technology tools. At one time during the online discussion, the conversation turned to writing a philosophy of education, which many teachers were including in their portfolio. Despite this small overlap, the beginning teachers tended to consider the technology tools to be separate tools and rarely explored options to integrate the three.

A New Start:
Breathing Life into Online Discussion and the Introduction of Other Technologies

Using lessons learned from the tribulations encountered with the initial group, new technology experiences were created for use with a second group of beginning teachers in the subsequent year. First, the disappointing reception received from the earlier initiative for online discussion created a motivation to improve the tool so that it might be more effective. Utilizing the suggestions from the beginning teachers in the initial group, mentor teachers were added to the electronic discussion to provide additional insights and perspectives about the practice of teaching. Adding mentor teachers was hoped to enhance the potential for
reflective discourse in the context of a community (Nicholson & Bond, 2003; Harrington & Quinn-Leering, 1996). The other suggestion from the initial group was to increase the amount of participation required in the online discussion throughout the academic year. It seemed reasonable that doing so would indeed increase participation, and would also place a larger emphasis on the tool's importance. Thus, the new online discussion component required the beginning teachers to participate a minimum of 20 times during the year, or approximately every other week between August and May. Mentor teachers were employed to be regular contributors to the board and respond to anyone who may have made a posting during that time. The mentors were asked to participate 40 times during the school year, approximately once a week during the academic year. Consistent with the beginning teacher assessment at the end of the initial study, the online discussion would be considered to be a group reflective technology tool.

Two new technology tools were introduced in the second year project to offer technology experiences between pairs and on an individual basis. The decision to change tools from the initial year was made primarily to assess the use of two new tools, considering that videotaping and portfolio development had already established themselves as viable tools for use with beginning teachers. The first new tool was paired mentoring through email correspondence. Mentor teachers have often been employed to work with beginning teachers as a way of establishing relationships based on dialogue and reflection (Stanulis, 1995), giving beginning teachers access to the mentor's teaching knowledge and critical examination of issues (Fairbanks, Freedman & Kahn, 2000). Research indicates that correspondence via email offers one way to gain these additional perspectives and support for solving problems (Davis & Resta, 2002). Each of the beginning teachers was paired with a mentor teacher outside of the school in which they taught. Paired conversations between the beginning teachers and their assigned mentors were to be completed a minimum of 20 times throughout the school year. The mentor teachers were asked to serve as a guide and advisor as they assisted the beginning teacher to reflect in this setting, and the mentors were responsible for keeping records of all email correspondence. The other new technology introduced was an alternate way for the beginning teachers to engage in individual reflection. A Palm Pilot device was provided for each of the beginning teachers to use for recording their individual reflections, with a minimum of 20 required throughout the school year. The beginning teachers were asked to compile these reflections and provide this data after the first and second semesters of school.

Twenty beginning teachers participated in the second year PT3 project. They taught in all grades ranging from kindergarten to seventh grade. Participation for this second group was gained through email as in the first initiative, but only graduates who had participated in earlier PT3 activities as an undergraduate received the call to volunteer. Thirteen of the twenty beginning teachers were employed for their first year of teaching in the city where they completed their initial teaching certification, representing six different districts across the city. The seven remaining beginning teachers accepted jobs outside of the city, but were able to participate as they remained in the same state and all requirements for this study were electronic. The beginning teachers were paired with mentors according to grade level at an introductory meeting in August before the study began. Mentor teacher participation was gained primarily from a pool of practicing teachers who were also graduate students seeking
their advanced degree in teacher education. Additional volunteers from the mentor teachers' schools were then included to meet the number of beginning teachers in the project. Ten of the twenty pairs of beginning and mentor teachers taught at the same grade level. In eight pairings, there was a difference of one grade between their assignments. In only two cases was the gap larger between grade levels, yet in both cases there was only a difference of two years. The mentor teachers' collective experiences included teaching in all grades from kindergarten to twelfth grade and special education, with a range of 3-25 years of classroom teaching experience.

In addition to data collected from the online discussion transcripts, paired emails, and individual reflections from the beginning teachers, survey and interviews were conducted via email with the beginning teachers (Bogdan & Biklen, 1992). A six-point Likert scale survey was conducted in August, December, and April. An open-ended response interview (Seidman, 1991) was also distributed electronically three times during the school year, in the months of September, January and May. As in the previous initiative, requirements for the beginning teacher were staggered so as to not overwhelm them during any particular week. On one week, they were asked to email their mentor. The following week, they were asked to visit the discussion board and make an individual reflection. This cycle continued from the first week in August to the final week in May, for a total of 40 weeks during the entire academic school year. The data was analyzed to determine the impact of each of these technology tools for improvement of the beginning teachers' practice, along with which tools encouraged the most meaningful reflection. Suggestions made by this second group were also compiled for consideration when working with future groups of beginning teachers. Results of the second project are now presented in the form of triumphs and tribulations.

Triumphs from the second project

The combination of the three separate technology tools provided something for everyone

When asked which of the three technology tools encouraged the most meaningful reflection on their teaching practice by the end of the study, the twenty beginning teachers responded fairly evenly across the three tools. Approximately one-third of the group preferred paired emails with mentors for reflection, another third liked the online discussion, and the final six beginning teachers felt the individual reflections completed on the Palm encouraged the most meaningful reflection. The beginning teachers who valued the paired email with a mentor appreciated having a relationship with an experienced teacher who could help them through rough times and provide immediate feedback and responses to questions. These beginning teachers described how the paired reflections tended to be more personal as their mentors got to know them and what they needed as time went on. Those that preferred the group online discussion for reflection felt that the arrangement allowed for a wide variety of experience, perspectives, and suggestions. The beginning teachers described how it was nice to know that they were not alone in what they were experiencing, and were able to gain moral support, advice, and feedback to questions. Some first year teachers thought the online discussion was particularly beneficial when they had exhausted all possible resources at their school. Finally, the beginning teachers who were partial to individual reflections with the Palm expressed that these reflections were more personal to their class and school and allowed them to
critically think about and analyze their practices. These teachers felt the individual reflections provided a way to look back on the school year and decide what they might do the same or differently next year. The beginning teachers also described how these reflections were the easiest to access and use wherever they desired.

*Overall, the beginning teachers agreed that the three technology tools had a positive impact on their teaching practice, with paired mentor emails having the most impact*

On the final survey for the project, all the beginning teachers agreed with little or no variation that the paired email with mentor, the group online discussion, and personal reflections on the Palm all had a positive impact on their teaching practice. When asked about each tool separately in the final interview, results varied slightly. Eighteen of the twenty teachers (90%) felt that the paired email with a mentor had a positive impact on their teaching practice. These beginning teachers were happy to have an experienced teacher to give them advice and ideas from outside of their school. They expressed the benefit of having someone to talk to who was both non-judgmental and non-biased when providing information or opinions. Fifteen of the twenty beginning teachers (75%) thought the personal reflections on their Palm had an impact on their teaching. These reflections allowed them the time to sit back and reflect, ultimately allowing them to learn from their experiences and honestly assess their strengths and weaknesses without having someone else read those individual reflections. Although all beginning teachers agreed that the group online discussion had a positive impact on the final survey, there was a less enthusiastic response in the interview as 13 of 20 teachers (65%) felt this tool had a positive impact on their practice. Those that agreed described how the online discussion was a great resource for advice and ideas. These beginning teachers were able to find possible solutions to their questions from the wealth of perspectives provided by the large number of people participating.

*The improved online discussion showed promise in the second initiative*

Survey results throughout the study with the second group of beginning teachers indicate that although online discussions were not favored as much as the paired email with mentors, they were also not the least likely to encourage reflection. In fact, survey averages remained in the same range throughout the study, indicating that the beginning teachers in general agreed this tool encouraged meaningful reflection on their teaching. Results for all three technology tools from the second group can be found in Figure 2.
Having mentor teachers involved in the second year was a beneficial addition to the project

Not only were the mentor teachers available to share their expertise and insights with the beginning teachers, but they also were effectively modeling the use of technology in the process. The mentor teachers were engaged in email communication and also participated in the online discussions, which often encouraged the beginning teachers to continue as well. Thus, this tool became more of a way to share inquiry into practice within a professional culture (Hargreaves & Fullan, 2000). As indicated in the three previous triumphs, paired email with mentors was the highest ranked tool for both encouraging reflection and having a positive impact on teaching practice. Also, repeating an online discussion with only first year teachers might have had limited success as it did in the previous year. Thus, involving mentor teachers in the project was a highly positive outcome of the project.

Tribulations from the second project

The first year teachers often failed to fully utilize the expertise of their mentors

Despite the fact that having mentor teachers involved greatly benefited the project in many ways, as stated in the final triumph above, the beginning teachers varied on whether they fully took advantage of this resource. Closer examination of the email correspondence between the mentors and beginning teachers indicated that some pairs held their relationship at a highly superficial level and simply used the opportunity to touch base from time to time. In these cases, questions were rarely asked and the level of reflection, if at all present, was minimal. Thus, it seemed that the beginning teachers considered their mentor to be an email
friend, rather than a source of information and support. On the other hand, many of the mentor and beginning teacher pairs utilized this aspect of the project to its fullest potential. Some beginning teachers asked profound questions and advice from their mentor on deep and philosophical issues related to teaching. The mentors then stepped up to the occasion and were very honest in their assessments and suggestions. A few mentors offered to meet in person to talk or send materials to compliment what the beginning teacher would be teaching. Thus, the relationship didn't work at the optimal level in all mentor and beginning teacher pairings; but when it did work, it worked very effectively.

Beginning teacher participation and interest varied with the three technology tools

Although the requirements for participation in all three technology tools were clearly stated, not all beginning teachers fulfilled their obligations as suggested. The beginning teachers in this group tended to meet the expectations for the paired email with their mentor more so than with the other two tools. This was due in part to the fact that all emails between the pair were counted towards the total, whether or not they were initiated by the beginning teacher. Sixteen beginning teachers (80%) met or exceeded the expectations set forth for paired emails at the onset of the study. Thus, only four beginning teachers (20%) and their mentor failed to meet the expectations for the paired email. These pairs completed between 10-19 emails, in and some cases were just short of the 20 required. Individual reflections completed on the Palm were the second most likely requirement to be met, with fifteen beginning teachers (75%), meeting or exceeded the minimum number required. The remaining five beginning teachers (25%) all failed to meet the obligation during one or more semester, two of which had technical difficulties with equipment that caused this problem. Finally, online discussion participation was the least likely obligation for the beginning teachers to fulfill, with only eleven of twenty participants (55%) meeting or exceeding the minimum expectations. Thus, nine beginning teachers (45%) failed to complete the required number of entries to the online discussion, and five of those participants made less than half of the entries suggested.

An analysis of whether each individual beginning teacher met the requirements in all areas revealed that fulfilling obligations with all three technology tools was rare. Only 6 of the 20 beginning teachers (30%) met the full requirements in individual reflections, paired email, and online discussions. There were a total of ten beginning teacher participants (50%) who met requirements in two of the three technology areas. The area most likely to not be met among these ten beginning teachers was the online discussion. Most problematic, however, was the fact that 4 of the 20 beginning teachers (20%) failed to meet requirements with two of the three technology tools. All four of these participants did not make the minimum number of online discussion entries, and lacked participation in another area as well. Two of these beginning teachers were a concern throughout the academic year. Several attempts were made to hold these individuals accountable, usually creating an increase in activity that would decline yet again at a later time. As with all groups, however, it is presumed that some beginning teachers may be more excited and willing to use the technologies than others.
Incompatible systems and access issues continued to be problematic

Similar to the initial project, some beginning teachers had technology problems due to access and incompatibility issues. Again, the district systems did not always allow access to the online discussion board and in many cases would not allow synchronization of the Palm Pilot with the school computers. This was particularly problematic for one beginning teacher who did not have a computer at home and had to visit a friend's home whenever she wanted to access the discussion board. Also several times during the onset of the project, beginning and mentor teachers alike would forget their password for the online discussion or need the direct link to gain access. These problems, for the most part, were ironed out early. Other problems were specific to the individual teacher as in the case of one email pair that weren't getting each other's messages due to blocked private email services. Finally, although more an issue of preference and ability and less of access problems, some of the beginning teachers gave up on their Palm device the first time they had any problems. They simply chose not to use the device rather than seek help or assistance for its proper utilization.

A completely electronic project requires teachers to be competent collectors of data

The entire second year of this project was managed electronically, with only one introductory meeting. Beginning teachers were asked to keep up with the schedule of reflections every other week and send them at each semester's end. The mentor teachers were asked to do the same with the email correspondence. Data received as a result was not always accurate, and often missing information. For the most part, the beginning teachers completed their reflections and sent them in as scheduled. The only problems noted were the few cases in which they failed to do all ten reflections during a semester, or neglected to date their entries. Email correspondence from the mentor teacher was more difficult to make sense of as often the documents included emails that were repeated, without dates, or in non-sequential order. In several cases, it became obvious that certain emails were missing, especially when a person was answering a question that was not documented as being asked. Others included only the emails from the mentor to the beginning teacher as they kept a copy of what they wrote but failed to include the emails from the beginning teacher to them. Finally, two mentor teachers chose to print out copies of the email correspondence rather than save them in electronic format. It became very clear that an increased emphasis needs to be placed on the collection of data in a project such as this. Especially when working with technology, it becomes important to make sure that all involved have the skills and expertise necessary to not only complete their obligations, but also manage the data in such a way that it is presentable and accurate at a later time.

Implications for Future Projects: Where do we go from here?

After taking a retrospective look at the entire PT3 project with beginning teachers over the course of two years, it becomes necessary to assess the overall triumphs and tribulations and continue the discussion of how we can strive to use technology in meaningful ways with first year teachers in future projects and programs. In sum, all of the five technology tools employed across the two years hold promise for use in eliciting and encouraging reflective
practice with beginning teachers. In the first project, videotaping and portfolio development established themselves as viable tools for use with this population. The beginning teachers tended to value these more private and personal reflections on their teaching practice. Another individual reflective tool introduced in the second year, personal reflection with the Palm pilot, was not favored as highly yet many beginning teachers found a great value in having these private reflections on their strengths and weaknesses throughout their initial year of teaching. Thus, these three technology tools each offered a chance for the beginning teacher to reflect individually and thus had a positive impact on their teaching practice. All three might be considered in future projects as tools to encourage this type of individual reflection that is undoubtedly necessary for beginning teachers' development, while at the same time utilizing key technologies in the process.

In the second project, paired email with mentors was considered to be a very effective tool, and encouraged beginning teacher reflection with another who could offer experience and expertise on related teaching issues. This type of communication was highly valued by the beginning teachers for both reflective purposes and impact on their teaching practice. Also, employing mentors to be participants in the online discussion improved the conversation and promoted a forum for a community of learning experiences. Involving mentors in the second year had such a profound impact that in some ways they represent what may have been missing in the initial project. Additional investigations of how mentors can be utilized as partners with the beginning teachers, while at the same time serving as models for effective uses of technology, are needed to further explore these issues.

Across the two academic years, the online discussion evolved into a tool that is becoming increasingly effective. The second year participants suggested that the online discussion site be made easier to navigate and perhaps organized more effectively, which will be considered in future projects. However, tremendous progress was made across the two years and suggestions for how to offer such online discussions in the future can be made accordingly. Table 1 synthesizes the results by project. It should be noted that the mentor teacher entries to the online discussion in the second project have been removed in this analysis.
Table 1. Online Discussion Comparison by Project

<table>
<thead>
<tr>
<th></th>
<th>Initial Project</th>
<th>Second Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of First Year Teachers</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Total First Year Teacher Entries</td>
<td>66</td>
<td>343</td>
</tr>
<tr>
<td>Average Entries per Participant</td>
<td>6.6</td>
<td>17.15</td>
</tr>
<tr>
<td>Range of Entries per Participant</td>
<td>2-18</td>
<td>6-25</td>
</tr>
<tr>
<td>Required Number of Entries</td>
<td>minimum of 3</td>
<td>minimum of 20</td>
</tr>
<tr>
<td>Percentage Meeting Minimum</td>
<td>90%</td>
<td>55%</td>
</tr>
<tr>
<td>Percentage Over Minimum</td>
<td>80%</td>
<td>25%</td>
</tr>
<tr>
<td>Entry Range per Month</td>
<td>0-17</td>
<td>12-52</td>
</tr>
<tr>
<td>Highest Participation Month</td>
<td>January</td>
<td>December</td>
</tr>
<tr>
<td>Lowest Participation Month</td>
<td>April</td>
<td>January</td>
</tr>
</tbody>
</table>

As shown in Table 1, increasing the number of entries required per first year teacher raised the average entries in the second project significantly. However, 90% of the beginning teachers in the initial project met or exceeded the minimum number of entries required, compared to only 55% in the second group. Thus, it can be suggested that simply asking for three entries throughout the study is too few, while twenty may be too many. This number must be reconsidered in future projects, perhaps settling on some amount in between the two, such as 12-15 entries per participant. In both groups, the highest participation months were those in which each individual project required them to participate. Despite the fact that January received the highest number of entries in the first project and the fewest in the second, the second project was able to maintain its momentum throughout the school year. This would mostly effectively be achieved in future projects by staggering the requirements to ensure participation throughout the academic year. However, it may be ascertained at a later time that beginning teachers find value in this tool more at certain times of the year. It seems reasonable that they might be apt, for example, to need more assistance at the beginning of the year. A more flexible participation schedule might allow for gaining further insights into this possibility.

After experimenting with five different technology tools that each had a positive impact on the beginning teachers involved, it becomes apparent that teachers should be given a choice of possibilities rather than mandating that certain tools be used. It may be feasible to expose beginning teachers to a variety of individual reflective tools (such as the choice between videotaping teaching, portfolio development, and reflection using the Palm), a paired tool such as email with a mentor, and a group tool such as the online discussion for them to choose from. Ultimately, if they are given the technology resources and expertise, then they may opt to use them more or less depending on their needs. On the other hand there remains a lurking possibility that, if given the choice, busy first year teachers might choose to not use...
any of the technologies. This is where incentives for participation are key in orchestrating a beginning teachers' involvement in learning to use these technologies. Through PT3 funding, each of the beginning teachers was given a monetary sum for participation and was also provided with a Palm pilot device and accessories for their work in the project. These incentives, along with a genuine interest in technology on the part of most participants, brought them to the table and allowed for exposure to each of the technology tools. It is hoped that this introduction enabled them to become familiar with the features and advantages of each of the technology tools so that they might continue to use such tools in the future.

However, simply exposing beginning teachers to technology tools for a limited amount of time does not necessarily guarantee that these teachers will continue to use these tools throughout their career. To truly transform teacher education, beginning teachers must be provided on-going and sustained support designed to further inspire and prepare them to become effective users of technology. Introducing beginning teachers to specific technology tools to use for reflective purposes during their first year of teaching is a promising start. Future work is needed to continue to give teachers rich technology experiences that allow them to realize the full potential these tools have to offer their continuing professional development.
References


It is a constant challenge for teachers to keep up with the ever-changing technological advances in the world today. Current teachers often struggle with how to use technology to enhance their students' learning experiences. Teacher education programs have a responsibility to offer both pre-service and in-service teachers strategies and methods for effectively using technology in their teaching practices. In this chapter, we describe how teacher education programs collaboratively take an innovative approach to preparing teachers to integrate technology in instruction. This chapter discusses issues facing teachers in the area of technology integration as well as offers a system that resolves the issues and provides support to pre-service and in-service teachers and teacher educators.

**Issues**

Teachers are often required to work in isolation. As a result, there are four interrelated issues that arise. First, while teachers may spend time outside of their teaching experiences planning and collaborating with other teachers, when the time comes to conduct the lesson or the learning experiences, the teacher is often left to do the teaching alone. This means that teachers many times do not have the support or the assistance that they need in order to effectively use technology. Second, while many teachers have successful technology integration experiences, the successes occur away from other teachers and therefore, they do not have the opportunity to share their experiences. Third, the knowledge of how to effectively integrate technology into teaching practices is rooted in experience and is learned through the result of actions. This type of learning is difficult to elaborate and communicate to others. Finally, many school districts have only a few teachers who hold most of the technology integration knowledge. When these teachers leave the district, the knowledge that they have leaves as well.

These issues can all be addressed by designing methods to assist teachers in sharing their successes and failures with their colleagues; providing opportunities for teachers to learn from each other by sharing in the experiences of practicing teachers; recording and storing the experiences of teachers in order that the knowledge they hold is not lost; and increasing
the size of the community of teachers integrating technology into their teaching practices. These principles can be met through the use of a system designed upon the principles of case-based reasoning.

**Case-based Reasoning**

Case-based Reasoning (CBR) is based on the idea that learning attained from a past situation can be adapted to fit a new situation. This is the natural response of humans faced with a problem. We tend to assess the situation, search our memory for past experiences similar to the current situation, seek out the experiences of peers and colleagues, and adapt and apply those lessons learned to the new situation. The CBR process can be broken down into the following steps (Allen, 1994):

1) Presentation of the problem. The current situation is presented as a case to be solved. There are situational details that form the query for the search of the case base.
2) Retrieval of similar situations in the form of stories or cases. A search of the case base results in a retrieval of cases matching some or most of the situational features of the present problem.
3) Adaptation of the retrieved cases to fit the current situation. Possible solutions are adapted to fit the current situation.
4) Validation of the new solution. When the new solution is tested, the resulting success or failure will be added to the case base within the new story or case.
5) Update of the case base. The new case is stored as a new solution and is added to the case base for future use.

CBR has emerged as a promising method to build knowledge-based systems because of its simplicity (Watson, 1997, Watson, 1999). The concept of CBR follows the process that humans use to solve problems. A CBR system based on the nearest neighbor algorithm captures the knowledge gained through experiences and indexes those experiences according to pre-defined structural features. This allows previous knowledge to be retrieved and adapted to fit current situations and to solve problems. In contrast, rule-based systems require the extraction of “rules” in a knowledge domain in order to solve a problem. Any need to change the rules in a system can be time-consuming and costly. CBR systems, however, can be built without the difficult process of extracting the rules, and therefore can be much easier to adapt and build.

In addition to the simplicity of the system, another advantage of CBR includes the ability for the system to support problem solving in ill-structured domains, where rule-based systems are bound to fail. CBR systems also offer users concrete examples in the form of cases, which can assist the user in problem solving. Novice users can benefit from perusing the experiences of experts solving similar problems. Asking novices to study and apply the lessons learned from expert teachers allows the novices to be peripheral participants in the community of practice and giving them the opportunity to learn the language and practices of the teaching community.
The KITE Project

The Knowledge Innovation for Technology in Education (KITE) project is a collaboration of eight teacher education programs. The team is comprised of the University of Missouri-Columbia as the lead institution and seven other universities. The KITE project has developed a system utilizing CBR in order to teach pre-service and in-service teachers how to effectively integrate technology into their teaching practices.

The goal of the project was to build a CBR knowledge repository containing technology integration experiences, thereby enabling learning through sharing, communal understanding through storytelling, continuous exchange and creation of new knowledge, and collective problem solving (O’Dell & Grayson, 1998).

Figure 1. The three levels of the KITE knowledge repository

The KITE Knowledge Repository

The KITE knowledge repository has a three-tiered structure as shown in Figure 1. The first tier is a goal-based scenarios (GBS) learning environment. GBS is a learning strategy utilizing the concept that learning is most effective when the learner is placed in realistic situations, with clear contextual elements and the learner understands the reasons for the learning activities. A system using GBS can benefit from a case library by using the cases to set the scenario for the user. KITE has used GBS in developing the Technology Integration Learning Environment (TILE). The scenarios scaffold the learning by presenting a realistic situation for the learner to solve.
The second tier is the case base. With more than 1000 cases ranging across grade levels and subjects, the KITE case library allows users to seek out cases that are similar to their situation. The cases in a CBR system have three functions (Kolodner, 1993):

1) They provide contextual information to help with understanding or assessing a new situation.
2) They contain suggestions for solutions to problems.
3) They provide an opportunity for evaluation of suggested solutions.

KITE cases are captured through the use of “knowledge scouts”. Each of the seven partner institutions employed knowledge scouts, who were responsible for gathering technology integration experiences from teachers in their areas. They contacted local schools, met with practicing teachers and interviewed the teachers, asking them to share their technology integration experiences. The teachers shared their experiences and the transcribed interview was then indexed according to the KITE indexing structure. The cases were then proofread and a rubric was applied assure that the case information met the standards set by the case development team for case completeness. The case was then added to the knowledge repository.

The KITE CBR search engine is the final tier of the KITE system. The cases in a case library can be used for a variety of purposes, but without a search mechanism the cases would be worthless. The search engine is designed to function similar to the human thought process in that people tend to recall similar situations when encountering a new situation. The focus of the CBR search is to retrieve cases that have semantically similar meanings. This allows the user to present a problem case and find similar cases containing possible solutions to the problem case. A CBR search facilitates the CBR process for reasoning and learning.
As shown in Figure 2, there are four major components in the KITE CBR engine - 1) case library, 2) feature vector space, 3) user interface, and 4) search engine. First, all stories collected by the knowledge scouts in the case library are indexed into case feature vectors which the similarity between two cases can be calculated quantitatively. Second, a user querying the case library will use the interface shown in Figure 3 to identify the aspects of the technology integration problem (context or situation) that are most relevant to their needs. Then, the user interface turns the problem into a query case that is converted into a query feature vector. Third, the query vector is matched against all case vectors in the high dimensional vector space using the nearest neighbor algorithm that finds the case vectors with shortest distances to the query vector. Fourth, the search engine returns all found cases ranked in distance. The shorter distance means a closer match. The user then chooses a matched case number to open the solution case.
Using KITE for Technology Integration Education

Currently, the project consortium has used KITE in several ways for technology integration education. In this section, we will describe how the cases in the KITE knowledge repository can be used as instructional resources to support technology integration education.

As an EPSS

An electronic performance support system (EPSS) is a system designed to provide knowledge-on-demand to users. An EPSS can electronically “provide whatever is necessary to generate performance and support at the moment of need [so it can be] universally and consistently available on demand any time, any place, and regardless of situation, without unnecessary intermediaries involved in the process” (Gery, 1991, p. 34). KITE is a web-based system, available online at any time or place in order to provide teachers with access to the technology integration experiences of more than 1000 of their peers. This allows teachers to search for similar technology integration experiences and plan their lessons and learning activities based on the lessons learned of other teachers in similar situations.
As an Instructional Resource

KITE has worked to develop several resources for teacher educators. The Technology Integration Learning Environment (TILE) is a tool designed to provide teacher educators with the support for using KITE cases and CBR in teacher education courses. TILE and other KITE activities have been used in several teacher education programs. Within the modules in TILE, learners are presented with instructional scenarios and asked to find and study KITE cases. They are then asked to propose new solutions for the scenario and to discuss their solutions with others. This practice allows the learners to compare and contrast the technology integration cases, looking for possible solutions to the current scenario.

Figure 4. Sample of a TILE scenario

As an example, Figure 4 shows a scenario that is based on a KITE case. Learners reading the scenario will evaluate the cases, compare similarities and differences with other cases, and prepare a new solution that combines the three cases evaluated. Here are several additional methods that the KITE consortium programs have used KITE as an instructional resource in their methods courses:

- Students conduct multiple case studies given a instructional problem.
- Students synthesize best practices and lessons learned from found cases given an instructional context.
- Students contrast realities from found cases with theories in the textbook.
- Students demonstrate how various technology use standards (e.g., ISTE) can be manifest from cases.
- Students develop lesson plans based on the same thread of stories.
As the Medium of an Online Learning Community

The technology integration cases in KITE are the foundation for building an online learning community. This community can facilitate the development of professional excellence and knowledge sharing. The online community of practice provides novice teachers the opportunity to share in the experiences of practiced teachers and expert teachers are forum for sharing the knowledge they hold. With the addition of online tools such as discussion boards, chat tools and other communication mediums, an online community can share and reflect on their experiences, sparking innovations and developing strategies for technology integration practices. By comparing and contrasting cases in the knowledge repository, members of the community are able to gain multiple perspectives on technology integration practices. They can take this knowledge gained to improve their own practices, based on the strengths and weaknesses that they discover.

Lessons Learned

Through the process of designing and developing the KITE knowledge repository, there arose a number of issues pertaining to the CBR system and the user interface. Development of the search engine, including case representation and case quality, and the design of the user interface were the most challenging issues.

Case Representation

The core of the KITE knowledge repository is the CBR based search engine. In order to accurately represent the knowledge held in the repository, case representation is of utmost importance. Since the CBR search engine is designed to look for cases based on the similarities to the context of the input situation, a critical task in the development stage was identifying the 1) domain features that would represent the domain of technology integration 2) the feature weights that would determine the importance placed on individual features in the context, 3) the options given for each index that would give value to search features and 4) the option distances that would determine how a case is similar to other cases.

The domain features selected to represent the domain of technology integration in KITE cases included the grade level, subject area, teacher’s years of experience, goal of the technology integration activity and outcome of the activity. These features represent or index each story as a case. For example, a teacher looking for information about teaching 12th grade American history using the Internet and publishing software could input those features into a CBR search interface and would find cases similar to the context requested.

The weight of the features allowed importance to be placed on features that were more important to the KITE knowledge repository users. Teachers participating in a formal evaluation of KITE indicated that the most important features of a KITE case were the subject and grade level. If a teacher is searching for information about integrating the use of a digital camera in a 4th grade science activity, they would prefer to find cases related to science and lower grade levels rather than focusing on the technology used.
The options given for each index can be numerical, where the years of teaching experience can be selected from 1-35; or they can be non-numerical, with a finite list of text values. School location, for instance, would have the options for rural, urban, suburban, etc. These set the values used for determining the distance in the algorithm. The key to the CBR search is the similarities between cases. In order to calculate the similarity between two cases, the weighted average of all option distances is taken. A shorter distance between the two cases indicates more similarity.

The implications for the careful consideration of all these parameters can be seen not only in how cases are represented in KITE, but also in how the knowledge scouts conducting interviews gathered the information needed. Changes to the parameters after interviews have been conducted and stories gathered causes great difficulty in attempts to refine the cases and the search engine. The development of a structured indexing scheme allows the knowledge scouts to gather the important information needed for a complete and worthwhile case.

In developing the KITE index structure, a technology integration expert was consulted to propose the initial indexing scheme, followed by review from two teachers experienced in technology integration. The entire team then discussed resulting disagreements and adjusted the scheme as needed. A similar process was used in developing the weighting matrixes for the feature options.

After 300 KITE cases had been placed in the knowledge repository, extensive testing was done to determine search accuracy. If the search results did not match with the evaluation participant’s expectations, the case values were examined to determine changes that should be made in the weighting. In addition to search accuracy, it was important to be sure that the results from the CBR search were high quality cases with important information provided.

**Case Quality**

The process for collecting KITE cases involved a knowledge scout who conducted an interview with a practicing teacher, then transcribed the interview and submitted the interview to the case development team. The case development team then indexed the case according to the structure developed and input the case into the knowledge repository. The quality of the case therefore relies on the ability of the knowledge scouts to gather accurate and complete information and the ability of the indexers to appropriately index the case.

A number of measures were taken throughout the project to assure that the knowledge scouts collected quality stories. During the first year of the project, a needs assessment was conducted and the results were used to train the knowledge scouts. Support mechanisms were put in place. A job aid was developed which included an interview protocol. A web-based tutorial was developed in order to help new knowledge scouts learn the process. The tutorial included interview tips shared by experts, information on the types of questions to be asked in the interview and techniques for interviewing, good examples of indexed stories to provide a benchmark for scouts, and a set of trial stories for knowledge scouts to practice indexing. We found that knowledge scouts who participated in indexing other knowledge scout interviews were able to be more successful in conducting interviews. They were more aware
of the information needed to complete the case and more familiar with strategies that they could use in interviewing.

In addition to the support tools developed, a rubric was created to judge case quality. The rubric counted the number of predetermined required index terms required in order to contain sufficient details to adequately portray the technology integration experience. When the rubric was first developed, a “spot-check” was done on cases already in the knowledge repository using a randomly selected 20% of cases available. We found that a surprising 49% of cases did not pass the rubric. Following this check, we took steps to remedy this by meeting with all the knowledge scouts and conducting a more intensive training session. Successful scouts were asked to share their experiences and the case development team determined to provide the scouts with more immediate feedback on the cases that they submitted. An updated job aid was also provided.

The rubric was not only used to check cases once they were in the repository, but the knowledge scouts were also asked to apply it to each case prior to submission. The passing rate for cases following these measures has increased to 84%.

**Interface design**

Historically, CBR research has focused on the computer science or artificial intelligence perspective with little attention given to the design of a user interface. In addition, most of the users of the KITE system were not familiar with the concept of CBR or even capable of using CBR to conduct searches. To remedy this situation, we adopted the rapid application development approach (Robinson, 1995) to the design and development of the system. The search engine has been through at least five iterations of “molding” and “tweaking” to reach its current format today. Feedback was collected from panel reviews and formal usability testing with pre- and in-service teachers. Errors and omissions were detected and fixes were made as needed throughout the development process. This process has lead to the development of a more user-friendly system, which can be used for learning and sharing of knowledge by users inexperienced with the principles of CBR.

**Conclusion**

The sharing of experiences for learning and innovation has been a part of the human culture across the ages. Stories are the most natural method for sharing experiences as the human brain is designed to better understand complex issues when the information is set into context. The KITE knowledge repository is a useful tool for capturing, storing and sharing the experiences of teachers in many different locations. The CBR system allows members of a community, spread across time and place, to learn from each other and improve their teaching practices. Cases that are stored in the knowledge repository can reach a wider group of people and can be kept in the “memory” of the system, preserving the experiences of its members.

The lessons learned through the use of CBR for education and knowledge sharing, as seen in the KITE project, can be applicable to any number of domains. The KITE system has been
designed to be adapted in order to fit a variety of different needs. Future plans for systems at the University of Missouri include a field experience system for pre-service teachers to share the knowledge that they have gained in clinical experiences in local schools and an entrepreneurial experience system for people starting small businesses. By utilizing the concept of CBR, knowledge gained by one person can be explicated and stored in the memory of the system. This knowledge can be easily accessed and adapted to fit the needs of many users, expanding the possibilities for learning and self-improvement.
References

This chapter discusses the efforts of the Nebraska Catalyst Project and its collaborative evaluation process for monitoring progress of the integration of educational technology use into pre-service teacher education in the state. Nebraska is a very independent operational environment for educational institutions, which includes 535 K12 school districts, and 17 institutions of higher education accrediting Nebraska teachers. Such institutional independence meant that the higher education institutions and K12 school districts, although individually quite excellent, had limited experience in working together on educational technology related goals. The Nebraska Catalyst Project was a bold step toward shared institutional strategic planning, decision-making, and faculty training related to educational technology. The evaluation mechanism used by the project was an important component of this successful project, and used four key strategies to help successfully monitor progress. These strategies included 1) developing a well-organized reporting system, 2) encouraging joint work on institutional assessments, 3) establishing an online format for evaluation information, and 4) systematically returning feedback to the individual institutions. This article describes the evaluation component of the Nebraska Catalyst Project and how it operated in the context of these four evaluation strategies, and within the very independent educational environment existing within the state.

Midwestern Independence and the Nebraska Catalyst Project

Textbooks on Nebraska history typically record a rugged beginning to the state and often showcase the courage and independence of the many pioneer families who settled as Nebraskans. Fighting the harsh elements of unpredictable weather and expansive prairie, these families learned to be very independent by successfully building their own houses, raising their own food, and generally protecting their hard-won homestead. Although always pleased to work with other families and build communities when possible, these families developed a proud heritage of independence in demonstrating that they could indeed make it on their own.
That spirit of Midwestern independence is a proud and powerful value in the state of Nebraska, and its influence is still noticeable today in many of the state’s institutions. For example, the state is the only state out of the 50 states to maintain a unicameral method of government, operating with a single legislative body. Education in the state is also a good example of this midwestern independence, where more than 535 school districts operate relatively independently, with no state mandated achievement testing (districts select their own assessments). Some of the independence and variety of education in Nebraska can be examined at the extensive Nebraska Department of Education website of http://reportcard.nde.state.ne.us/. The 17 institutions of higher education that accredit teachers in the state are also very independent, and have selected unique curriculums that have resulted in strong, but also very diverse sets of learning experiences for pre-service teachers.

The Nebraska Catalyst Project was initiated into this setting of educational independence. The 17 participating institutions included both public and private institutions, and ranged in size from a very small private college of 12 teacher education students to a large research university with over 3000 teacher education students. Partnering school districts were equally diverse, and included a large urban district with more than 50% minority students, to numerous rural districts, with small numbers of teachers and students. Collaboration across these higher education and K12 school district environments, related to enhancing the use of educational technology, was relatively uncommon for these organizations. However, all these institutions did share a genuine interest in educational technology, which has been seen as an important learning tool in the classroom. Upon this shared interest, but within an environment of rugged independence, the Nebraska Catalyst project undertook its efforts to build collaboration and enhance the use of educational technology in teacher preparation.

**Building on Independence while Laying the Foundation for Partnership**

When the Nebraska Catalyst Project was funded by the U.S. Department of Education’s Preparing Tomorrow’s Teachers to Teach with Technology (PT3) program in October of 1999, it was clear that the culture of independence of the participating institutions was going to be a real challenge. Institutions were rarely open to sharing individual educational technology innovations across institutions, and some of the larger university-based organizations even appeared to be in more of a competitive rather than collaborative mode with each other. Within this context, the project sought to create a new “culture of dialogue” between institutions, and become a forum for both discussion and mutual understanding. Like many teacher preparation institutions in the United States, Nebraska found that educational technology presented a unique challenge for teacher educators (Cavanaugh, 2003; Suleiman, 2001; Burke, 2000; McCoy, 1999). Topics related to faculty support, student expectations, and modeling frequently surfaced in the initial discussions.

The challenges of starting the partnership process were considerable and often reflected a need to further define the partnership and particularly how institutions might work together and what they would work together on to accomplish. There was a realization that change would need to be documented based upon these initial definitions. To help facilitate this
definitional process, the two goals of the Nebraska Catalyst Project were frequently reviewed in initial partnership meetings. These goals consisted of 1) through an effective statewide consortium, serve as a catalyst to create systemic improvements in the preparation of new teachers to use technology, and 2) through partnerships with K-12 school districts and teachers, the project will strengthen teacher education programs statewide to prepare new teachers to effectively use educational technology in K-12 settings. The definition and goals discussion eventually formalized four task forces, which included planned efforts targeting enhanced graduation requirements, stronger institutional assessments, increased networking with K12 educators, and enhanced distance education. Such initial discussions also reflected challenges in the considerable diversity of the institutions in technology awareness, technical sophistication, levels of integration, and availability of resources.

However, from the start of the Nebraska Catalyst Project, the 17 participating institutions were very clear in their commitment and responsibility to future teachers: to effectively integrate and model the use of educational technology within their own teaching. Each of the Nebraska teacher preparation institutions expressed a real desire to better integrate educational technology into their programs, no matter what their current state of integration, from the very minimal, to the quite extensive. This mutual statewide aspiration parallels the national desire to improve in this important teacher preparation area, as reflected in national reports such as “Technically Speaking: Why All Americans Need to Know More About Technology” (U.S. Committee on Technology Literacy, 2002).

A strong working relationship between the project director and evaluator helped formalize an institutional understanding that evaluation would consistently be a strong component throughout the project. The close link between the project operation and the project evaluation was modeled by these two project leaders. Both individuals often led discussions at the site facilitator meetings, and consistently worked to build an initial institutional awareness of the importance of the evaluation process to both the project and individual institutions.

Personal visits by the project director to each institution offered an opportunity to further build a collaborative environment, and began the evaluation/assessment process. Two surveys were conducted for the purpose of needs assessment; one survey focused on the status of the institutions based on various grant objectives and project design; and the other was an institutional self-assessment on the status of teacher preparation with educational technology integration. These surveys provided institutional baseline data from two very distinct perspectives, as well as provided a data-driven foundation for many project-related discussions and concrete performance indicators for demonstrating growth in specific areas. The project director, evaluator, and the institutional site facilitators all periodically referenced the results of these two survey instruments during discussions. Most importantly however, the initial needs assessment carefully modeled the desired four key strategies of the evaluation process by illustrating the utility of well-organized reporting, encouraging collaborative work, establishing an online format, and systematically returning feedback to the individual institutions.
Many of the ongoing meetings of the Nebraska Catalyst Project sought to encourage discussion on current efforts and challenges as well as establish working relationships from which to build trust. One excellent example of this relationship building process was the formation of “strategic planning Cadres”. These Cadres were comprised of teams of at least five individuals from three or four institutions, guided through the facilitation of a PT3 colleague from a neighboring state. These original Cadres have continued to plan together, share ideas, and have maintained this special bond formed at the inception of the grant.

To further build a culture of dialogue and inclusion, the Catalyst project embraced mutual work across a broad spectrum, by helping some smaller institutions get started with educational technology, and expanding innovative ideas that larger institutions had developed. The Nebraska Catalyst also broadened the dialogue when possible, and expanded its partnership into other Nebraska stakeholder institutions, such as the Nebraska Department of Education, the Nebraska Association of Colleges of Teachers Education, the Nebraska Council of Teacher Education, the state’s Educational Service Units, the Nebraska Distance Learning Association, the Nebraska Educational Telecommunications Commission, the Nebraska Educational Technology Association, and the Nebraska Distance Learning Association. The project also initiated a newly organized group of Nebraska pre-service students called SETA (Students Educational Technology Association), to help expand dialogue with the pre-service teachers themselves.

The ongoing institutional dialogue helped to continually focus the group desire to strengthen the institutional teacher education settings as they related to training future teachers to use technology effectively. To provide additional focus of efforts, four task forces were formalized and included Task Force I, focusing on assessment development; Task Force II, focusing on educational technology related degree completion requirements; Task Force III, focusing on K-12 teacher cadre development; and Task Force IV, focusing on enhancing distance learning. Task Force I and II were eventually combined to help work more effectively together, and to undertake the development of various prototype instruments to help assess pre-service teacher’s classroom readiness in educational technology, which evolved to be a key effort within the project, and the overall evaluation process.

The integration of various national standards, particularly the National Educational Technology Standards (International Society for Technology in Education, 2000), emerged as a core theme across the four task forces. Considering standards in the planning process has been shown to be critical to effective educational technology reform (Dewert, 1999; Peck, 1998). In the Nebraska Catalyst Project, the standards in essence, became a common language for the educational reform discussions, and helped to structure the dialogue on what might eventually be accomplished by the working groups. Building strong institutional linkages to teacher competencies in educational technology and establishing a variety of high-quality assessment strategies for those competencies further emerged as operational objectives of the standards theme. A good institutional linkage between teacher competencies in educational technology, and a good assessment process for those competencies, would seem to be very important for a teacher preparation program’s successful integration of educational technology (Krueger, Hanson, and Smaldino, 2000; Smith, Harris, Simmons, Waters, Jordan, Martin, Cobb, 2000; Waugh, Levin, Buell, 1999). The common language of
Standards allowed everyone to both contribute to and benefit from the dialogue. Group discussions often sought to build upon the work and perspectives already underway at an institution, as well as sought a careful review of efforts being undertaken in other places in the country. Each organization had its own individual perspective on educational reform and ideas that surfaced within task forces were typically both passionate and creative.

**Systematic Evaluation with Four Key Strategies**

A strong evaluation process is one that is very systematic in its approach to understanding and mapping change within a project. As defined by Weiss (1998), evaluation can be considered to be “the systematic assessment of the operation and/or the outcomes of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the program or policy” (p. 4). In the Nebraska Catalyst Project, the evaluation process was carefully organized around this definition to include four key strategies of:

1) developing a well-organized reporting system,
2) encouraging joint work on institutional assessments,
3) establishing an online format for evaluation information, and
4) systematically returning feedback to the individual institutions.

**Key Strategy 1: Developing a well-organized reporting system**

The evaluation process within the project needed to be very collaborative and flexible to successfully enlist the participation of all 17 institutions. This process sought to assist the member institutions in providing the raw data to track the overall progress of the project, as well as retrieving data summaries that might help inform their individual institutions as they sought to improve pre-service education. Through this evaluation effort, focused upon blending both project and institutional needs, the participating institutions were encouraged to help decide what data elements would be particularly important at their institution, and how that data might be best summarized to contribute to the common evaluation effort. A carefully structured reporting process, shared by the 17 institutions, helped make this blending of individual and collaborative evaluation purposes more workable and convenient for the participating institutions. The evaluation component attempted to model the use of educational technology for data tracking and analysis and thus helped the Catalyst Project itself model the use of educational technology, which has been shown to be critical in the effective reform of teacher preparation programs related to education technology (Wilkerson, 2003; Whetson and Carr-Chellman, 2001; Carlson and Gooden, 1999).

The partner institutions were required to contribute institutional reports during each of the three project years. Project orientation sessions, specific to the mid-year or year-end report periods were often held, and institutions received considerable background information and support at the orientation sessions. For example, at many meetings, the site facilitator at each location was given a well-organized notebook that provided an overview of the reporting requirements for that period of the project. In addition to the notebook, a CD/Disk that had all forms loaded was also offered to facilitators. As the project developed and became more
technically sophisticated, reporting forms were made exclusively available electronically on the web so that partner institutions had convenient access to all necessary forms and an easy way to quickly submit the information, as well as have Frequently Asked Questions answered. An overview PowerPoint presentation that explained each form in detail was also made available at both the orientation sessions and on the website. Institutions were constantly reminded of the importance of prompt and accurate reporting and the need to report evaluation-related information was also tied to the ability for an institution to participate in future funding. Thus, all member institutions were usually quite prompt and supportive in their reporting process. The need and purpose for an evaluation process was continually reinforced at various project meetings, with periodic evaluation updates provided to participants as routine agenda items at task force meetings.

**Key Strategy 2: Encouraging Joint work on Institutional Assessments**

Eventually, a strong interest to develop institutional assessments measuring the integration of educational technology into teacher preparation that all institutions might use emerged from the discussions. The effective assessment of educational technology competency and use within a program was seen as a critical gap by institutions. Participating institutions, as well as other stakeholders (such as the Nebraska Department of Education), volunteered individuals to help work on this important joint effort. This shared interest greatly aided the instrumentation component of the evaluation process, and partner representatives were often ready to help retrieve data from their respective organizations, or work collaboratively to pilot a particular assessment instrument. Initial efforts on the assessment process encompassed a variety of organizational approaches and perspectives, as institutions worked collaboratively to identify or develop a wide range of assessments, such as performance/portfolio, self-report, self-reflection, focus groups, surveys, and classroom observation strategies. These assessments often were built upon existing individual interests already present at a particular institution.

The management of this wide range of assessment instrumentation also became a general interest area and key topic for discussion in the task forces. Collaborative work eventually resulted in a prototype “Assessment ToolKit” for helping manage these assessments, as well as help document their reliability and validity (the Toolkit is also available at [http://necatalys.org](http://necatalys.org)). In addition to instrument management, the toolkit also offered institutions an opportunity to interact “online” with regard to their experience with the various instruments, building a community of learners. All this focus on assessment made collecting evaluation data an almost natural by-product of these discussions and member institutions were very good about participating in the evaluation process through this collaborative instrumentation.

**Key Strategy 3: Establishing an Online Format for Evaluation Information**

Compatible with the online Assessment ToolKit concept, the participating institutions found that online formats for general evaluation reporting were particularly useful for project-related reporting requirements and were convenient for both cost and later data analysis. Evaluation data was also automatically retrieved as institutions completed various
instruments and reporting forms online. Online formats for the pre-service teacher instruments were particularly helpful, since an instructor could simply take a group of students to a computer laboratory to jointly administer the instrument, or perhaps assign the students to take the online instrument at their own convenience later in the week.

The Nebraska Catalyst Website emerged as a way to not only store and access the evaluation related assessments, but to also further organize task force efforts. Online discussions using software such as Facilitate.com extended meeting discussions outside of the face-to-face settings and greatly enhanced a partner’s ability to ask questions and generally receive informational support. Institutions could thus seek additional assistance for their various efforts, such as strategic planning, and extend the work already done within the Catalyst evaluation process, to further refine and develop their own institutional approaches. Member institutions were very good about participating through the online venues that included website interaction, listserv, online facilitation software, and online reporting templates.

**Key Strategy 4: Systematically Returning Feedback to the Individual Institutions**

The overall project evaluation process eventually became quite collaborative in operation, by allowing institutions to help lead on particular assessments and also helping them enlist the shared efforts of partners to improve and pilot various assessments, so that all institutions might use and benefit from them. Some institutions focused on portfolios, while others focused on self-reports, observation instruments, etc. The project also worked to better formalize these assessments by funding outside experts to assist with the validity and reliability, establishing pilot administrations of the instruments, and encouraging replications by participating institutions.

Summary institutional reports that reflected institutional progress on both single and joint instruments were an important feedback component of the evaluation process. As institutions had pre-service teachers take a particular instrument, participate in a focus group, or contribute to a portfolio, the evaluation process always resulted in a brief individual institutional summary, as well as contributed to the overall evaluation data. Such feedback helped the individual institutions better recognize the personal utility of the evaluation information, as well as its importance to the overall project itself.

**The Key Evaluation Strategies in Action: The Catalyst Assessments**

The development of shared assessments indeed became a real collaborative interest and target effort for the 17 participating institutions of the Nebraska Catalyst Project. These assessments also provided the ability for the four key evaluation strategies to essentially be operationalized, by contributing to a well structured reporting process, encouraging collaborative work on assessment, facilitating online formats for data retrieval, and providing a focused venue for institutional feedback. Considerable work was undertaken to make sure that project-related assessments were of the highest quality possible, whether they were from outside sources, or jointly developed within the project.
The participating institutions found that a considerable number of informal instruments that measured growth and progress of pre-service teacher’s technology skill and integration competencies were already in use by institutions of higher education (IHE’s) across the country. However, somewhat atypical were instruments that have been systematically developed, piloted, and carefully refined that are targeted at reliability in administration and validity in content, and based upon standards or competencies. This is consistent with national trends. During the last decade, many institutions appear to be moving more toward a wider variety of assessment strategies, and have embraced strategies that are generally more qualitative and performance-based in format, such as portfolios (Milman, 1999; Georgi & Crowe, 1998; McKinney, 1998; Petrakis, 1996).

As a first step, more than 50 different assessments already available nationally were shared and discussed with partner institutions. Site facilitators actively shared ideas on what might be useful to their institution, but also useful to others. When possible, they encouraged graduate students and various faculty members to become involved in the discussions. Based on the ongoing assessment discussions and collaborative work, the project partners eventually decided to view the diversity and independence of their institutions as strength rather than a weakness in the project. It was believed that since there was a wide range of ways that educational technology might be appropriately infused within a particular teacher preparation program, or used by pre-service teachers at an institution, a wide range of assessment strategies were appropriate to help monitor and evaluate that integration process. Each institution operated within its own unique context, and what worked well for one organization might not work well for another. All institutions eventually saw the potential benefit of having a wide range of assessments available to them, and thus all institutions were willing to also help contribute to the development or pilot opportunity of an assessment at another institution. The institutional assessment instruments that surfaced within the Nebraska Catalyst project were then both diverse and collaborative.

Instruments were eventually made available to all organizations through the extensive project website (http://www.necatalyst.org). The most successful assessments in the project consisted of the following prototypes, which continue to be used within various subgroups of the participating institutions.

Self-Report Instruments

In the context of educational technology reform within higher education institutions, self-report mechanisms can be an important piece of a multiple assessment strategy (Gershner, Snider, Huestis, Foster, 2000). Many institutions in the Nebraska Catalyst Project believed that a self-reporting process was a valuable approach for examining what their pre-service teachers were learning about educational technology. The Technology Ability Perceptions Self-Report Instrument (or TAPSI) was developed within the project as a general self-report instrument related to a pre-service teacher’s perceived educational technology skills and knowledge. It is currently in use at several participating institutions, and available to all interested institutions through the Nebraska Catalyst website. An online knowledge rating scale instrument was also developed and piloted. This scale was used by several Nebraska Catalyst institutions to help pre-service teachers reflect upon current knowledge levels in the
use and integration of educational technology in the teaching and learning process. Both instruments also take advantage of the convenience of an online format.

**Student Portfolios**

Student portfolios can be both effective and challenging related to examining teacher competency in educational technology (Wright, Stallworth, Joyce, Ray, 2002). What a pre-service teacher reports as technology competencies, and what they have actually had experience integrating into their teaching and learning experiences, are two very different issues. Several institutions focused on portfolio-related efforts to help demonstrate what their pre-service teachers were learning about technology. The development of a prototype for an electronic student-based portfolio was undertaken through a direct collaboration between the Nebraska Catalyst Project and the two Nebraska PT3 Implementation projects underway within the state (and particularly that of the University of Nebraska at Omaha). The initial prototype of a student portfolio, which is “institutionally flexible”, now contains information from more than 2000 students, across various classes, and has been considered by NCATE (institutional visitation team) to be an evolving model that might be recommended to other institutions. The Technology Skills Certificate effort is a similar portfolio-related effort that is continuing at a NECatalyst participating institution (The University of Nebraska at Lincoln) and is being refined as a “class-based” electronic portfolio for pre-service teachers. Within this assessment mechanism, students involved in a particular class or set of courses undertake a variety of technology-based performance assessments, which eventually result in a certificate of successful completion. Furthering the work of these initial online portfolio efforts, the project was involved in the development of a web-based qualitative grade book prototype, (called I-Beam).

**Classroom Observation Instruments**

Examining the teaching process through systematic observation has been a useful way to provide feedback to teachers and their preparation programs, and can be effectively adjusted to also reflect educational technology use (Ewens, 2001; Tseng, 1998). Having pre-service teachers actually demonstrate what they have learned about educational technology by classroom demonstration can no doubt help inform institutional decision making. This information can particularly help inform an institution about whether a pre-service teacher will actually incorporate educational technology into the teaching and learning process once they are in a classroom. Each of the Nebraska Catalyst institutions expressed an interest in a systematic way to observe student teachers and their use of technology in that field experience. In response to this interest, the Classroom Observation Instrument was created through the assistance of WestEd, the NSF Center for Assessment and Evaluation of Student Learning (CAESL), in San Francisco. This instrument was piloted during 2001, and was further used in 2002, and is structured to formalize the identification of the classroom uses of educational technology by both teachers and students. It is particularly useful in examining whether a student teacher is using educational technology within that capstone field experience. It includes a rubric for examining various levels of educational technology (as well supportive constructs such as constructivism).
Focus Group Efforts

A stakeholder focus group can be a powerful way to gather input about the general effectiveness of a program (Reynolds, 1996). In the Nebraska Catalyst Project, a focus-group reflection process for pre-service teachers was found to be an important evaluation strategy that offered a unique perspective and a useful way for institutions to examine and document their relative progress related to educational technology initiatives. An extensive focus group protocol for pre-service teachers asked for input about how well their respective institutions appeared to be preparing them related to the use of educational technology, as well as offering an opportunity for them to share their vision for technology use in education was also available to institutions. In addition to the instrument, a form report was offered as a model for institutions as they analyze data and utilize the responses for future program planning.

Student and Faculty Surveys

Simply asking students and faculty about their technology use can actually go a long way in informing an institution of technology integration needs (Denton, Clark, Allen, 2002). In a follow-up process to the “face-to-face” focus group effort mentioned above (and based upon that protocol), an online and web-based survey was prepared for pre-service teachers, for use within the Nebraska Catalyst institutions. This web-based survey broadened the input base of pre-service teachers, and provided valuable additional feedback from pre-service teachers on the perceived value and revision needs of their pre-service preparation programs. A faculty survey was also established to help gain faculty member perceptions of their institutional programs. Survey questions for both students and faculty focused on two main areas, including 1) their knowledge and experiences related to educational technology within the institutional program, and 2) their general attitudes related to educational technology. Institutions continue to have both these instruments freely available to them for potential revision and use.

Snapshots of Teachers in the Field

Asking current teachers about their perceptions of the success of the teacher certification programs that prepared them is often a useful strategy for program review (Imbimbo, Silvernail, 1999; Attwenger, 1997). In the Nebraska Catalyst Project, the perceptions of what in-service or field-based teachers learned in their teacher preparation programs was also a part of the assessment-related information for the project evaluation process. A web-based snapshot instrument was administered during February, 2000, 2001, and 2002, and focused on determining the beliefs, use of technology, and the technology based needs of Nebraska teachers, as connected to pre-service and in-service programs. A total of 7600 Nebraska teachers eventually responded, providing a rich perspective on the current practices and needs. The results were also disseminated to the Nebraska State Board of Education, and the state legislature.
The Nebraska Catalyst Project also embraced various commercial instruments within the evaluation process. The use of institutional instruments such as the School Technology Readiness (StaR) Chart, as one example, have been shown to be effective tools for helping monitor the institutional integration of educational technology (Fulton, 2000). This excellent instrument was also used to help inform the project evaluation process for the 17 Catalyst Institutions. This instrument helped the project track integration across the 17 partners, and questions provided feedback on technology integrated courses, faculty support, field experiences, and technology standards integration. The instrument also offered institutions an important perspective for planning dialogue associated with offering the skills needed for 21st century learners, through their teacher preparation programs.

The Evaluation Model Matured with Feelings of Collaborative Success

As the evaluation process continued to evolve and mature, it became a strong component within the Nebraska Catalyst Project. Institutions participated fully and completely, and appeared to feel successful in the collaborative effort to collect data and refine instruments. As the overall project matured, institutions and site facilitators even contributed more than was necessary for the reporting process by sending the project evaluation additional pieces of information, or regularly contributing samples of institutional efforts and documents being developed. Several evaluation-related assessment efforts even resulted in several master theses and two doctoral dissertations. After this continued evolution process, further evidence of the utility of the four key strategies of the evaluation model became evident.

The well organized reporting effort, as identified as the first key evaluation strategy became almost routine for institutions. After a well-timed “reminder e-mail”, institutions would go to the project website and review the reporting requirements. They would then complete the needed online or interactive forms. The collaborative assessment work, as the second key evaluation strategy eventually became a real source of synergy and partnership for the project, as institutions formed natural sub-groupings to work on particular assessment efforts. The flexibility of assessment use, with a few assessments used by all institutions, and some assessments used by just a few of the institution was a nice balanced approach for serving the evaluation needs of both the individual institutions, and the project itself. The online mechanisms for evaluation, as the third key strategy, was also well-embraced by the institutions, as institutions recognized the convenience of online formats for assessments, institutional reporting, and the sharing of information through interactive forms and listservs. A strong website helped to make this convenience a reality. Most important perhaps, was the fourth key strategy, that of closing the feedback loop to individual institutions. It was easy for the institutions to recognize the utility of contributing evaluation related information, when such information also contributed directly to a personal understanding of their own institution.

When the value of independence is as engrained as it is in a state like Nebraska, long time collaboration among diverse partner institutions is not always simple, and not necessarily always desired when institutions already feel that they are doing an excellent job in what they
are doing. However, the Nebraska Catalyst Project went a long way in establishing the belief that diverse teacher preparation institutions could indeed share strategies, work closely together in a larger context, and still maintain local control over their institutional assessment process. The evaluation process of the project eventually became the model for that shared institutional vision.

Most importantly, all 17 participating teacher preparation institutions, public and private, large and small, saw consistent progress in the project. Some participating institutions made particularly significant progress, and for the first time conducted an online course, involved faculty in educational technology training, or initiated new graduation requirements for educational technology. Others institutions took initial efforts much further. For example, the online portfolio established at one of the institutions and refined by shared feedback, is now becoming a model often requested for presentation at various national conferences, including that of a 2003 North Central Accreditation of Teacher Education (NCATE) meeting.

Strategic planning in educational technology, relatively uncommon before the Catalyst Project (only 9 of 17 institutions had ever undertaken such planning), is now common place, and all 17 of the institutions now regularly participate in such strategic planning efforts, or make it a key feature of their overall institutional planning. Assessment is another new strength area for many institutions, with all institutions now having at least some assessment strategies in place, when before the project only 6 or 7 institutions conducted any assessment of educational technology at all. Perhaps most impressively, all institutions are now involving school districts and teachers in this planning and assessment process, up from just 2 institutions when the Nebraska Catalyst Project started.

The project reports for the Nebraska Catalyst Project indeed illustrate how 17 diverse institutions can still move forward together, by systematically tracking progress on individual institutional assessments, selected or modified from the many project-related assessments. Project sub-reports contributed to both individual institution and overall project insight, with institutional sub-reports distributed routinely to each of the 17 institutions, providing a basis for continued strategic planning at their institution. Most importantly, it has been found that institutional independence can still be an asset to collaboration, when innovation is both embraced and shared across partner institutions.

In Summary, a Few Lessons Learned about Institutional Independence and Evaluation

The Nebraska Catalyst Project has found that the process of evaluating educational reform, like educational reform itself, is indeed best recognized as a collaborative venture. The independence of institutions, when recognized as a potential source of shared leadership and input, can be one of the greatest strengths of a collaborative project. If done with this in mind, the project evaluation can both help inform the project of its successes and ongoing challenges as well as help in maintaining a consistent vision for reform. We learned several simple but powerful lessons along our way that reinforce that a collaborative focus and institutional independence can exist side by side, and that such a blend can actually strengthen the evaluation process. These eight lessons learned include the following.
1) A well organized evaluation process is critical in building a coherent project partnership, and contributing to eventual project success.

2) A strong evaluation begins with a strong partnership between the project director and the project evaluator, which essentially models the collaborative environment desired within the evaluation process.

3) The planning for institutional “buy-in” within an evaluation process requires communication at all levels (dean, faculty, administrators, pre-service teachers, and local districts).

4) The diversity of organizations (large/small, public/private) can operate as an advantage within the project evaluation rather than a barrier, when shared leadership and innovation is encouraged across institutions.

5) Instruments that are online (web-based) and on-target (tied to standards) are the instruments most embraced by institutions when they are striving for efficient and low cost assessment strategies.

6) Although larger institutions may have more resources to undertake evaluation related efforts, smaller institutions have much to contribute as well, through activities such as piloting new assessment tools and trying new evaluation initiatives more quickly.

7) The periodic use of outside facilitators and consultants within the project related evaluation activities can be very helpful, such as in external review of assessments and related data summaries.

8) An awareness of what other stakeholders within a state are doing, for example in efforts like statewide distance education, technology support funding, and local control for school districts can be of critical assistance to collaborative efforts, and for establishing a context to better understand evaluation related information.

In summary, we found that after three years of extensive efforts within the Nebraska Catalyst Project, we are proud of the institutional progress. We also found that we were well-positioned for continued joint efforts, and that shared dialogue was now much easier to undertake. Such progress is founded upon a lot of hard work, a strong collaborative focus, and a careful, well planned, and flexible evaluation process.

It has been said that "You can't teach today's students with yesterday's materials, and expect them to have success tomorrow" (Teacher Librarian, March/April, 1999, p.34). It is indeed becoming a technological world of fast paced change and the preparation of our pre-K12 students for the challenges of tomorrow no doubt demands a teacher preparation program that takes full advantage of educational technology. The success of such programs will no doubt depend upon careful evaluation strategies. As our state, like many others, braces for some substantial budget cuts, better collaboration among institutions, and better monitoring of success based upon data, is becoming an ever more critical necessity for both the shared health of all institutions, and the success of individual ones. The Nebraska Catalyst Project, and its three years of collaborative project and evaluation related efforts, helped positioned Nebraska to better exist in this challenging environment; by helping all of us understand that Midwestern independence is indeed a Nebraskan trait of which to be proud, and also a
potential source of collaborative innovation and success.

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Faculty and staff at the University of Wisconsin-Milwaukee (UWM), an institution which prepares teachers to work in urban settings, utilized PT3 grant funds to support the integration and institutionalization of technology into UWM’s largest teacher education program. Collaboration, curricular reform, coursework revision, and community relationships exemplify the success of the project.

Faculty members in the School of Education at the University of Wisconsin-Milwaukee (UWM) were awarded a Preparing Tomorrow’s Teachers to Use Technology (PT3) grant in the first round of the PT3 grant competition. The grant had as its goal supporting the full integration of technology into UWM’s largest preservice teacher education program, not as a goal in itself, but as part of comprehensive teacher education reform. At the start of the project, instructional technology was not addressed in any significant way in teacher preparation. Two one-credit technology courses devoted mostly to technology for professional use existed, had not been revisited for many years, and were completely disconnected from the programs themselves. As the project ended, technology was highly visible, was institutionalized in the program, and was assessed as part of the portfolio assessment process. The success we experienced was possible, we believe, because technology integration was built on the programmatic reform that was already underway. The reform context itself served as the scaffold from which technology integration was launched.

UWM is committed to preparing highly qualified teachers to work in urban settings and recognizes that highly qualified teachers must be technologically proficient if they are to help narrow the achievement gap between students in urban schools and their more advantaged peers. This commitment is evidenced by a highly collaborative faculty who regularly examine program content and requirements to ensure they match the mission of preparing teachers to work in urban schools. Both program reform and this urban education commitment created the environment that laid the foundation for the PT3 grant work and enabled the sustainable transformation of technology use and instruction.
In this chapter we provide a description of the major aspects of our PT3 work which contributed in a unique way to the project’s success. In particular, we address the importance of creating a vision for technology integration which is grounded in curriculum, implementing the project by becoming visible and creating an approach to technology integration which considered students, faculty, and the community, considering the unique opportunities for increased technology integration through the collaboration between general and special education, and the work involved in creating sustainable change in both personnel and policy.

**Creating a Vision for Technology Integration**

During the planning phase, we thought systemically and considered different branches of the project that would be critical to effect long term, systemic change. The three branches included faculty development, student development, and community development. It was important to us to improve the knowledge and practice of the students we were preparing to become teachers. We believed accomplishing student growth in technology would require the faculty on campus and in our partner schools to extend their knowledge and use of technology as well. Accomplishing this task depended on developing a system of communication and support among faculty and students, and among our field placements in the public schools and on campus.

Within each branch of the project, parallel objectives were established that addressed growth in technology knowledge and use, particularly as it contributed to developing a more sophisticated understanding of diverse students in urban schools and increased awareness of how technology might support diverse populations. Part of that objective included learning about assistive technologies to support students with disabilities.

We set a number of specific goals to address our objectives. First, technology needed to be more available, more visible, and more embedded into the teacher preparation program. For this to happen, the structure and content of the existing stand-alone, required technology courses needed to be changed significantly so that the technology information learned was aligned with the content presented in the methods courses and a system of assistance needed to be created so School of Education and Letters and Sciences faculty could better (or, in some cases, begin to) incorporate relevant technology enhanced projects into their courses.

Second, because UWM’s teacher preparation program includes a heavy field component, strengthening the frequency and range of technology use in partner schools in the Milwaukee Public Schools (MPS) would be essential to help our students authentically translate knowledge to practice. Faculty at our three partner schools would need to develop priorities for more indepth uses of technology in the classroom. Accomplishing that goal would require readily available “experts” to work with school faculty to conceptualize and carry out logical technology supported projects.

Finally, while we had a goal of effecting sustained change at the outset of the grant, during the course of the grant, it became clear that for this to happen, permanent lines for technology staff at UWM would need to be created. To continue a positive evolution of technology
integration, our school had to recognize technology as a formal field of study and valued area of expertise and commit to securing staff who could be entrusted with the task of supporting curriculum development in this area.

The success of this grant was due in part to creating a vision for technology integration that spanned learners, learning environments and content. However, creating the vision was made easier in large part due to the pre-existing conditions of teacher education at UWM. Significant collaborative work within and across departmental units, chiefly between the Department of Curriculum and Instruction and the Department of Exceptional Education in years prior to the grant served to lay a foundation on which technology could more easily be integrated. Because faculty had carefully considered content, experiential, and dispositional outcomes for their students, the technology work served to enhance what was already there, and in some cases, transform it. We were dedicated to making sure that every interaction with technology was connected to schools and to the curriculum, and made this a consistent feature of all of our work. This commitment framed the implementation of our project.

**Implementation**

We focused our implementation on four areas. These included becoming visible, students, faculty and the community.

*Becoming Visible*

All the plans and preparation would be for naught if the resources offered by the grant were not utilized well. To guard against this possibility, one of the initial and certainly ongoing goals was to become visible and widely known in a unit that had not addressed instructional technology in teacher preparation before. Identifying and hiring an individual with both technology expertise and classroom/curriculum expertise who could focus on making technology visible, sensible, and desirable was the first step to implementation. Finding this person was easier said than done, but once accomplished was critical to our success.

Establishing visibility involved offering multiple access points so faculty and students could extend their knowledge in ways they felt comfortable. An open house was held so faculty and students would know where to come whether they needed specific help or wanted to begin thinking about ways technology could contribute to teaching and learning. Weekly emails were sent to faculty and students to remind them of staff development sessions. A webpage was created on which resources as well as information about the grant and its services were housed. Grant staff attended curriculum planning meetings, initiated hallway conversations, and made themselves available to suggest ways technology might enhance work. We also did not restrict our support solely to the targeted program. Our belief was that helping anyone would contribute to helping everyone. Soon enough, this effort paid off as a wide range of faculty began seeking our help on a regular basis.

In addition, we launched an instructional technology lab, which became a focal point for instructional technology activity. Although the actual equipment in the lab was rather
modest, it quickly gained a reputation for a place where you could “get technology done” and get immediate assistance. In addition, the staff put great value on connecting technology to the curriculum, and this message was reinforced for every student who accessed the lab.

**Students**

Prior to the grant, UWM required Middle Childhood-Early Adolescence education majors to complete two one-credit courses in technology. The courses were offered in large lecture format with some accompanying labwork. The content consisted primarily of teacher productivity tools such as word processing, spreadsheet and presentation software as well as developing web pages. No link to the methods curriculum and little suggestion as to how to use technology with children were provided. This situation was made more difficult by the lack of educational software available in the School of Education’s single computer lab.

We carefully thought through what our end goal was in terms of range and depth of knowledge and then worked backwards to ensure students acquired skills but also learned to apply them both in their courses and fieldwork. During this process, we developed a framework for acquisition and use of technology skills and knowledge that was in line with the ISTE standards and INTASC standards. We parsed knowledge into four categories – technology as a teacher’s assistant, technology roles for teachers, technology as a teacher’s tool, and technology to communicate/share. These categories were broken down further to include topics of ethics, copyright, computer-assisted instruction, particular software programs, assistive devices, web page development, and digital technology. This information was to be taught in the two one-credit dedicated technology courses. Though the courses were distinct, they were lab-based and the content made sense given the other courses students were taking in any given semester. There was careful consideration of which topics should be addressed given the content of the methods courses. For a listing of technology topics and sample assignments by semester, see Appendix A.

Assignments in the technology courses supported content learned in methods courses. For example, during the first semester of coursework, students took an integrated course in primary literacy. As part of their corresponding technology course, each student created a storybook based on the interests of the child they tutored, using Kidpix software. So Kidpix software, an elementary paint program, was taught but also taught in a way immediately useful for teaching.

In addition to technology faculty focusing on using the dedicated technology coursework to support content learned in methods courses, methods faculty also developed or modified existing assignments so they included technology. As part of the literacy coursework, for example, students were required to develop and maintain a database of children’s books. Each semester they added at least 60 books to their database. Students were taught to develop databases in their technology class but were expected to utilize that skill in their literacy methods classes, as well as drawing on the database for science, social studies and mathematics methods classes by creating a utility to support their organization of their growing familiarity with children’s texts. Other classes required students to create webquests, find websites relevant to particular topics, or evaluate software.
This alignment was accomplished through the collaborative infrastructure that had been developed as an integral part of the overall teacher education reform effort. Interdisciplinary faculty teams taught in each semester, or “block” of the program and met on a regular basis to discuss the curriculum for that block. With the arrival of the PT3 grant coordinator, this individual attended all block meetings and was therefore able to begin introducing suggestions for how to connect technology from coursework into the methods sequence. The strategy used was to listen carefully, figure out one or two “do-able” projects, and then work individually with faculty in each block to implement the project. As faculty comfort levels increased, the technology coordinator supported them to higher levels of sophistication.

During the course of the grant, a third one-credit class was developed and approved. This course focused on web page development as a vehicle for students to create an electronic portfolio. Students had been maintaining a portfolio of their work in paper form. The addition of the third course enabled them to create an electronic version that could house their resume, teaching philosophy, work experience, and examples of how their teaching reflected the core values of the teacher education program, accompanied by student work samples. For example, a student might demonstrate his or her value of advocating for and education children with disabilities by summarizing a lesson, explaining how particular students were included, discussing student learning, and showcasing aspects of the lesson using pictures or video clips.

The student teaching semester also included expectations for technology use. This semester allowed us to see how much our students had shifted in their expertise and understanding of technology integration. Initially, students seemed to view both the classes and the newly required technology project in student teaching as necessary but useless hoops to jump through to attain their certification. As students completed their student teaching and began interviewing for jobs, however, they discovered the currency technology knowledge buys. One student, who had been less than engaged during her technology coursework, shared with an incoming group of student teachers how in her interviews principals asked her what she knew about technology. She was surprised because she had thought since she hadn’t seen much technology in her field placements, that technology would not be part of her interview agenda. What she discovered was that even principals who did not yet have much technology still sought teachers who would be prepared to utilize technology once it was acquired. Principals asked her what programs she knew and if she could provide examples of how she had used them. The student shared how grateful she was that her technology project was part of her showcase portfolio, as well as what she had retained from her technology classes.

So, while initially students incorporated technology in minor ways, such as word processing a report, or creating fairly static Hyperstudio stacks, more recent examples of technology infused projects developed and implemented by students in the student teaching block demonstrate heightened sophistication in both knowledge and understanding of effective uses of technology. For example, one student checked out four digital cameras from the grant office for her second grade students to use on a field trip. Though the university student was apprehensive about putting cameras in the hands of children so young, she found that the children became very planful and intentional about the pictures they took and how they used them to support information they had gathered about particular animals. The students owned
the content, which was clearly seen in the quality of the written work enhanced by digital photographs. Another student used digital cameras with her first graders to take pictures of shapes in their neighborhood (e.g., stop signs, houses, tires). Then they returned to school and drew and identified the shapes they had seen using Kidpix software. In these cases, technology was more than a vehicle for presenting a product, it was a tool to help understand curriculum content. This was our goal.

Since the onset of the grant, students who have completed their teacher preparation work at UWM have left much more skilled in technology and in their ability to consider how technology can best support the learning of their students. Each cohort of students demonstrates greater sophistication on their required performances and portfolio entries than the previous one as technology becomes a stronger, more embedded element of their preparation program. This is due to the continuous improvement of their technology courses and the increasing demands to integrate technology into a much wider range of their methods courses. The work we had done with the students on campus to extend their knowledge of technology and its appropriate uses within curricular areas was paying off in the field. They used their creativity and knowledge to create their own relevant technology-enhanced projects. This type of application was repeated again and again by other students. As the expectations for technology use increased, and the skill level of our students increased through integration and dedicated coursework, their sophistication increased as well.

**Faculty**

Coinciding with the development of the framework, we began the task of working with School of Education and College of Letters and Sciences faculty to help them identify technology goals for their learning. While adopting a philosophy of “just in time, just enough” staff development, we offered a range of delivery models for providing support. We determined that this flexible approach to staff development was hugely important because faculty had differing schedules, differing investments, and differing learning approaches. So, while some faculty enjoyed formal workshops, others preferred the drop-in sessions where they could come and get help as they worked. Still others already had a vision of where they wanted to go and used our support in a one-on-one format to develop skills and complete projects that they could be independent in sustaining.

For example, during a curriculum planning meeting, a children’s literature professor shared his dissatisfaction with the cumbersome nature of using videotapes in class to teach students about aspects of storytelling. He hoped for a way to make the videos available to students to use out of class so that more class time could be utilized to discuss the content and sequence of the videos rather than viewing them. The project coordinator for the grant worked with this faculty member to create a special Hyperstudio stack containing several storytelling clips that not only showed the video but labeled it as well. Students checked out the CDs, viewed them, then discussed them in class. From this one project stimulated several others. One faculty member in the exceptional education department taught a distance education course and needed a way for her students to analyze language samples of students. By putting video in a Hyperstudio stack and creating a tutorial of how to obtain a language sample, the students could better understand, even at a distance, this aspect of their education.
Community

The school component was integral in that it enabled us to provide important staff support and development at our partner schools, schools where our students were placed for fieldwork and student teaching, as well as to keep us abreast of issues associated with integrating technology at the school level. This helped us better understand and prioritize projects for our students at the university. Each partner school received grant funds to hire a half-time technology coordinator at their school. While dedicating staff at each school to spearhead technology growth in their school was a temporary luxury afforded by the grant resources, some of the schools made technology coordinators a permanent position once grant funding ceased. The principals felt as we did, that technology was important and in order to continue the momentum begun with the grant, hiring someone permanently was essential. The coordinator of the grant worked individually and collectively with these individuals on a weekly basis to identify within and across school goals related to technology use.

Each school had different issues to explore and identified different areas of technology for their own development. In one school, the technology specialist helped each teacher identify a way they could integrate technology into a schoolwide civil rights project. One classroom was preparing a play to perform and the teacher wanted to use technology to capture the event. The grant coordinator suggested digital video and iMovie, not only because he thought it would be an easy tool to use but also because he saw this request as an opportunity to extend knowledge and support the creativity of the students. Why? How is this important to learning? Did they use the video after? By hosting training sessions before school for teachers and students, the grant coordinator helped prepare a group of students who were able to record and edit video to best capture and portray the play about Rosa Parks. The use of digital video and video editing software deepened the students’ understanding not only of technology but of audience. They had multiple discussions about angles and how best to film the play to achieve the greatest impact. Because not everyone could attend the play, by creating a digital recording, families and other students could still benefit from the content of the play. This knowledge was not used in a one-time fashion. The following fall, shortly after the terrorist attacks on 9/11, the students learned of a private religious school whose students had lost family members to the attacks. Entirely on their own, they prepared an iMovie to lend their support and well wishes to the students. These fifth grade students at an inner city school in the Midwest connected with a very different student body. Other children in the school created friendship bracelets and artwork to send. The students in New Jersey were touched by the offering and sent back their own video reply. So, technology was used not only to learn, but to heal.

The project coordinator and the three technology specialists formed a collective, which met monthly. Each technology specialist seemed to have a different expertise and so they balanced one another nicely, helping each other through such issues as networking, developing thematic technology infused projects, and hammering out effective staff development agendas. Each of the collective members found value in the meetings. It provided each person with ongoing professional support in terms of identifying technology initiatives, resolving issues, and feeling less alone. Technology specialists have expansive
responsibilities but oftentimes little professional or collegial support, in part because they are the only knowledgeable person in their field at their location. Monthly meetings among the technology specialists reduced the feelings of isolation and enabled them to support one another and share resources. Many districts provide this support at a district-wide level. MPS certainly did. However, this more intimate working group was effective in handling both short and long term issues related to technology, perhaps more effective than the support a large district collective could offer.

The children benefited tremendously from this collaborative as well. Towards the end of the grant, one specialist voiced her desire for the students at her school to have a venue for showcasing their hard work with technology. The other specialists agreed and considered how each school should be involved. Ultimately it was decided that a “Technology Expo,” where the students from each school would come and share their knowledge and accomplishments, would be hosted by the university, during the annual School of Education Urban Forum. This event was powerful for all who participated or visited. The students shared knowledge with one another – one school focused on digital video, one on digital images and compositions, and the third on technology to support inclusion. Community and university members who attended the Urban Forum visited the Expo and were impressed with the students, who could easily explain and show what they could do. School of Education faculty and students also attended the event. It was a wonderful demonstration of the impact technology can have on engagement and learning.

Connecting Technology Use in General and Special Education

Teacher education faculty in the Middle Childhood-Early Adolescence program regularly collaborate with exceptional education faculty. Students are required to take a course in collaboration between general and special education, learn about students with special needs throughout their preparation program, and are often placed in classrooms for field experience where various levels of inclusion are practiced. It was natural then to extend staff development opportunities to faculty in the exceptional education department. This goal was made easier because one of the project directors for the grant was a faculty member of this department. This faculty person incorporated technology into her courses, both as an instructional tool and as a focus of instruction.

In addition to utilizing presentation software to share her ideas in text, graphics, and video, she taught her students about augmentative communication, alternate keyboards, text-to-speech word processors and other assistive technologies to support the learning and inclusion of children with special needs. She similarly required students to learn about readily available educational technologies that could just as easily support student learning as more “special” technologies. Because of the resources provided by the PT3 grant, she was able to incorporate a lab component into her courses so that her students could learn the software and evaluate its usefulness relative to more traditional tools. This work around technology culminated in a large assignment in which students considered and prepared their own adaptations to thematic units and individual lessons. For example, the students, in small groups, had to design a weeklong thematic unit of instruction that spanned content areas such as literacy and math, prepare individual lesson plans, and create low and/or high tech
adaptations that would maximize student involvement in the lessons. This experience helped them understand how they could creatively support students but also made them aware of the time commitment involved in doing so. Understanding the time commitment involved in effectively planning for and utilizing technology to support students with disabilities helped the students understand what sorts of personnel support would need to be allocated to best serve their students.

Other faculty members stopped by on a regular basis to learn about particular programs and began teaching about assistive technology in their own classes. Several faculty members in the department asked the principal investigator to guest lecture on assistive technology in their courses but others, who shared her interest in literacy, had ongoing conversations about tools such as talking word processors, word prediction software, and graphic organizers. As a result of seeing the tools she was using regularly and discussing ways in which these tools could be helpful, they then began incorporating these technologies into their literacy and deaf education courses. Because the principal investigator was just a few doors away, they could stop for help or discussion. They didn’t feel “on their own.” They could continue to refine their knowledge of the technologies in an ongoing way, becoming more comfortable with technology as each semester passed. That their training in technology extended to this area as well reinforced the notion that all students can benefit from technology.

**Sustainability**

Grants often provide the impetus for wonderful projects or programs. The challenge is always how to sustain momentum once external funding ceases. For our part, a significant effort was made to instantiate resources and personnel so that instructional technology would not die away but instead become more and more embedded in the fabric of the teacher preparation experience. Relevant educational software was purchased or obtained through partnerships with software companies. Technology was made available for checkout to the students and faculty. In fact, technology kits which included digital cameras and video cameras, as well as a computer loaded with educational software was made available to student teachers who sometimes found themselves in school placements with limited technology resources. A small instructional technology lab was developed. These technology resources were permanent acquisitions.

In terms of personnel resources, several initiatives were accomplished. First, the grant coordinator was vital to the technology courses and faculty support. Early on in the grant, we worked to create a hard line position for an instructional technology specialist whose role would be to continue support to students and faculty. By the grant’s end, not only was a search conducted and completed for this position, but two tenure track faculty positions had been created as well. One focused on distance technology and the other on instructional technology. The addition of the instructional technology specialist, a tenure track faculty member, and a cadre of three adhoc instructors from the local school system now provide ongoing support in the area of technology.

Dedicated coursework was not developed to stand alone, but rather was integrally linked to the regular sequence of methods courses (see Table 1). In this way, methods faculty sustained
the skills students learned within their technology courses and broadened their use directly in classrooms. Dedicated courses are taught and undergo continuous improvement, as do all courses in the program. Faculty and instructors in the methods sequence continue to develop their own technology skills to enhance the use of technology in their courses and to link projects across technology and methods courses. The technology faculty and staff continue to work with other faculty to support the evolution of technology as it relates to program goals and revision. The energy surrounding technology remains such that, even in times of slim budgets, the work continues.

Table 1. Coordination of Technology with Coursework

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<th>Technology Course Focus</th>
<th>Project Examples</th>
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<td>Linking Seminar</td>
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<td>Reading And Children’s Literature In The Primary Grades</td>
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<td>Learning And Development</td>
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<td>Language And Urban Schooling</td>
<td>Ethics For Software And Fair Use</td>
<td>Children’s Literature Database</td>
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<td>Instructional Computing I</td>
<td>Software Review (in class and at field placement)</td>
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<td>Assistive Technology</td>
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<td>Troubleshooting</td>
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<td>Semester 2</td>
<td>Linking Seminar</td>
<td>Eportfolio</td>
<td>Construct Webpage</td>
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<td></td>
<td>Teaching Mathematics, Elementary</td>
<td>Imovie</td>
<td>Portfolio Template</td>
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<td></td>
<td>Teaching Science, Elementary</td>
<td>Digital Video And Scanners</td>
<td>Resume, Philosophy, Examples From Classroom</td>
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<td>Classroom Assessment</td>
<td>Photoshop</td>
<td>Add Science Books To Database</td>
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<td>Instructional Computing II</td>
<td>Ethics For Permission Slips And Copyright</td>
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<td>Linking Seminar</td>
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<td>Teaching Reading, Language Art And Adolescent Literature</td>
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<td>Teaching Mathematics, Middle School</td>
<td>Appleworks</td>
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<td>Instructional Computing III</td>
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<td>Seminar In Curriculum And Classroom Management</td>
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<td>Instructional Technology Project Integrated Into Classroom Unit</td>
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<td>Log of technology use throughout semester</td>
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Conclusion

The success of our experience hinged on people and vision, and a commitment to using the resources provide by the PT3 grant in a manner that would have a sustainable impact. Further, this grant was embedded within a unit where the redesign of teacher education had already been accomplished, where a commitment to continuous improvement existed, and where faculty across departments collaborated in the work of teacher preparation. Ensuring that by the end of the grant itself, permanent expectations for the role of instructional technology, and required performances, were essential to making instructional technology a deliberate, visible part of teacher preparation.

What took longer than we anticipated, and what required patience and scaffolding, was reaching success with faculty who were not “technology savvy” to embed technology within their classes. Once we broke through this barrier of uncertainty and unease on the part of faculty, most of whom had not used instructional technology before, the connections the PT3 grant staff had envisioned all along, the reciprocal nature of the entire program and the required technology coursework started to work together in a coordinated and effective way. Once faculty members began to understand how technology could support their goals and that they would have person support to integrate this technology effectively, they were more eager to consider technology for their courses. These breakthroughs have occurred more with some faculty than others, so future goals relate to expanding technology integration even further.

Our achievements with our partner schools mirror those at the university. Technology became more visible and more integrated. Just as with our faculty and courses at the university, this happened to differing degrees at our partner schools and some schools have been more successful than others at sustaining the gains in times of fiscal difficulty. However, our students continue to benefit from the increased uses of technology in these schools.

To be successful in enhancing K-12 student learning, technology cannot stand alone. It must be connected to the curriculum (Chang, Henriquez, Honey, Light, Moeller, & Ross, 1998; White, Ringstad, & Kelly, 2002). Similarly, in higher education, efforts to integrate technology also cannot stand alone. If technology redesign is not directly connected to the teacher education curriculum, and if it is not assessed as an integral part of the curriculum, it will not be sustainable. Our major recommendation for other institutions that wish to focus on technology integration is to address the larger picture of reform and embed technology as part of the effort. This means building a collaborative environment among faculty so that the teacher education curriculum is discussed and improved regularly, with technology as a major consideration within the curriculum’s conceptual framework.

We view the PT3 grant as a highly successful enterprise in our institution. Its gains are tangible for our students and for our faculty. The three years of our PT3 grant represented a period of high energy, high visibility, and new breakthroughs. Now, in times of fiscal constraints, the goal is more difficult. We are challenged to sustain the gains we have made, to ensure that new faculty and instructors are supported in embedding technology, and to
continue to be a voice for building the infrastructure that is required not only to sustain, but to fully support, technology preparation for teachers.

References


A LAPTOP INITIATIVE IN A TEACHER PREPARATION PROGRAM:
UNEXPECTED CHALLENGES AND UNANTICIPATED OUTCOMES

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The focus on improving teacher education faculty’s effective use of technology in the classroom and providing resources for hands-on experience for teacher candidates created opportunities for exploration and modeling of best practices. This chapter represents the challenges, solutions, and unexpected outcomes from a wireless laptop initiative in teacher education classes.

Background

The Michigan Teacher Technology Initiative (TTI, http://michk12.org/) and wireless laptop programs (Freedom to Learn, http://wireless.mivu.org/) created a vision of how teacher education programs would have to change to meet the needs of technology-rich K-12 classrooms. Tomorrow’s teachers reside not only in the K-12 classroom but also in higher education. Focusing on improving teacher education faculty’s effective use of technology in the classroom and providing resources for hands-on experience for teacher candidates created opportunities for exploration and modeling of best practices. The purpose of our PT3 initiative was to enhance technology components in existing teacher preparation courses. The initiative included faculty professional development activities and the introduction of laptops and wireless technology in a range of teacher education courses including mathematics education, language arts education, special education, pre-service student teaching field experiences, and general courses in curriculum and instruction. Approximately 300 students received wireless Apple iBooks for teacher education classes each semester for four semesters.

As with the introduction of any new tool, resource or assignment, the instructors for the laptop courses anticipated that they would face new challenges when integrating the technology into existing course structures. Knowing that innovation often requires more initial class time and preparation time, instructors were prepared to make adjustments as needed in order to maintain the integrity of the courses and to meet the required course objectives. Although technology assignments and course outcomes were unique to each of the classes, common themes began to emerge as the classes unfolded. During the course of the project, teacher candidates and faculty increased their technology comfort zone and developed strategies and problem solving skills for implementing technology rich learning environments in future university and K-12 classroom settings.
Unexpected Challenges

Many of the challenges faculty and teacher candidates encountered were unexpected. Although students satisfied the university computer literacy competency requirement prior to enrolling in the teacher education courses, many students exhibited a lack of general computer literacy skills and understanding of basic technology concepts. This notion was supported by survey data collected from the first year project evaluation. Most of the students (67%) participating in the project during the first semester reported that they were not very experienced with laptops, while 28% felt somewhat experienced, and 5% felt very experienced. Only a few students had prior experience with a Macintosh desktop or laptop before receiving their Apple iBook for the semester. Basic computer skills including managing the desktop, saving files, sending attachments, and emailing were by no means second nature for many of the students. At the end of the semester when students were asked to identify the greatest challenge they faced related to technology during the semester students frequently cited submitting assignments electronically, accessing the University web mail system, using the Macintosh operating system and saving files. One student commented, “In the beginning everything was so foreign to me, so I would have to say the greatest challenge would be getting started.”

Faculty and students approached the first day of classes with a healthy mix of excitement, enthusiasm and apprehension. Students in the laptop classes felt “special” because their instructor was able to secure laptops for them for the semester and bragged to fellow students about their good fortune. The heightened enthusiasm quickly turned to frustration during the first semester of the initiative as faculty and students hit the wall early in the semester. Faculty and students alike quickly learned to expect the unexpected. Faculty learned almost immediately not to assume anything related to the students’ facility with technology. This presented the first unexpected challenge for laptop instructors. It became painfully clear from day one that attending to basic computer technology skills was an unavoidable task.

Challenge: Operating systems, platforms, connectivity, and basic technology concepts.

Solution: A variety of levels of support.

Based on the feedback from both students and faculty after the first semester, intensive support was provided before and at the beginning of each class during the first two weeks. Each laptop class had an initial orientation to using the laptop that included instructions on connecting the laptop peripherals, using the wireless network, turning the laptop on and off, and basic desktop navigation. Many students exhibited a lack of understanding of basic technology concepts that can often help in solving technology issues and were initially hesitant to explore. To avoid taking precious class time for technology support, subsequent training support occurred in a variety of ways. A technical support team of Digital Wizards, student assistants hired with PT3 funding, provided support for at least one half-hour before each class session for at least three weeks into the semester or until the students no longer required intensive support. Digital Wizards are teacher education students who exhibited a high level of technical skills and a willingness to explore and learn about technology. They research and find solutions to technical questions raised by laptop students and faculty and
either demonstrate solutions in class or in one-on-one support sessions. They also created online tutorials that were posted to class Blackboard sites. Additional support was provided through the college technology center located in the same building.

Questions typically focused on Internet dial-up connectivity at home, using the wireless network at school, transferring files electronically, printing at home or at school, the Apple operating system, some software specific questions, and managing files. The Digital Wizards not only worked with the students in the classroom, but also addressed technology questions by creating brief job aids that were posted to the course Blackboard.com, a course web site creation service, and made available in hard copy for those who felt more comfortable having something in hand. Digital Wizards were also available to answer questions via email or by appointment in the technology center. A subscription to Atomic Learning (http://www.atomiclearning.com) was made available to students and faculty both on campus and at home which offered online tutorials for operating systems and software programs.

This intensive initial support averted many of the problems students encountered during the first semester of implementation and accommodated each student’s technology experience level. One important key to arriving at the stage where teacher candidates can overcome their technology challenges and begin to effectively use the technology is support. As students became more confident using the laptops, they started thinking beyond the technical issues and considered the impact of ubiquitous use of the laptops. An enthusiastic student observed, “Notebooks weigh less than or equal to most textbooks, and can contain oh so much more information.”

**Challenge:** Getting from here to there, communicating effectively.

**Solution:** Standardizing formats, creating student-to-student on line tips, consistency.

Several problems experienced by the students evolved from issues that were often overlooked because of their simplicity. In a world where email and Internet use is commonplace, we assumed that students would be comfortable using these tools. At a university that requires students to use word processing for class assignments, we anticipated that students would understand some basic fundamentals like file name extensions, copying and pasting, and file management. On a campus that uses a course management system (Blackboard), we expected that students would have experience with downloading and sharing documents. We found this was not necessarily the case and needed to be addressed. Most of these issues were addressed through the Digital Wizard support team, student-to-student support or by individual faculty.

An additional challenge that faculty faced related to electronic communication was managing electronic data. A dramatic increase in email messages including student assignments, pleas for help, and general classroom questions, required faculty to rethink how they could more effectively organize incoming data. With increasingly sophisticated filter systems, email messages with subject lines like “Help” or “Urgent” or “I have a question” were often deleted as junk mail. When students submitted assignments with a generic name like “Assignment 1,” files were easily lost in the flurry of incoming mail. Faculty found that they
could more effectively keep track of incoming mail and use filters to sort assignments by instituting standardized formats for both the subject heading of the email and the name of student assignment files. For example, one faculty member required students to use the course number, assignment name, followed by the student’s 3 initials and the file extension; 5100 (course number).L1(Lab1).skr (student’s initials).gsp (Geometer’s Sketch Pad). This convention allowed the instructor to filter all incoming assignments to a specified mailbox so that they did not interfere with other incoming mail and could easily be viewed later. File naming and subject heading conventions allowed instructors to sort incoming emails by assignment, student, or date/time submitted. Specifying standardized formats for assignments (e.g. rich text format and including file extensions like .rtf or .doc) eliminated significant frustration and facilitated effective communication.

Faculty also found that students themselves were a rich resource for resolving technical problems. It was not unusual for a student to explore and, by trial and error or diligent research, find solutions to problems that were then shared with their classmates. Some faculty found that encouraging students to share these solutions in a more public forum (e.g. on the class online discussion board), gave them even more confidence and created a sense of partnership in contributing to the learning experience.

From the faculty prospective, organizing and providing specific instructions to students had great benefits. One faculty noted “I found that once we were in the groove, I was able to provide prompt and meaningful feedback in less time than with hardcopy assignments. When I happened to be online one evening checking student work, a question about an assignment came in an email from a student and I was able to send a quick suggestion. He commented that it was like instant messaging.” Opportunities to provide timely support for students clearly motivates students and enhances their intellectual commitment.

At the end of the semester students were asked to identify their most important achievement related to using technology. Their comments reassured faculty that the time dedicated to solving unexpected challenges was well worth the investment. One student reported that she “felt more comfortable than I ever have on my computer.” Students frequently commented that having the laptops not only facilitated their learning in the laptop class but in their other classes as well. It was clearly evident that the technology integration went well beyond the laptop specific course assignments.

One student noted their most important technology achievement was “the daily use of the laptop for retrieving, completing and sending homework through email and word processing systems. I saved at least one tree!” This sense of achievement clearly motivates students to explore and experiment.

**Unanticipated Outcomes**

Each of the faculty members embarked on the laptop initiative phase of our PT3 project with specific student goals and outcomes in mind. Goals for students included using content specific application software to achieve course objectives, researching best practices in
teaching and learning via laptops and wireless technology, developing presentation skills using a variety of technology enhanced tools, and facilitating communication and reflection via technology. Implicit was the underlying concept of enhancing the learning experience and modeling effective use of technology. In almost every instance not only were faculty able to meet or exceed their projected goals but they also achieved unanticipated outcomes with technology serving as a catalyst.

Practicing flexibility, adaptability, and persistence

Best instructional practices demand flexibility and the ability to adapt instructional strategies along the way to meet the needs of learners. This is a practice that often distinguishes veteran and novice teachers. Novice teachers enter their classrooms with detailed plans and are thwarted by events that require that they veer from their carefully planned path. Veteran teachers know that teaching often requires improvisation and the ability to refocus and redefine goals according to students, time constraints and resources. This is particularly true when new technologies are involved. No matter how much time is spent in preparation, you can count on the unexpected: networks fail, practices and procedures are not as seamless as one had expected, operating systems are not compatible, software has glitches, not to mention the human element.

An unanticipated outcome in the laptop classes was the role that overcoming challenges played in the development of teacher candidates attitudes toward technology use. The unexpected challenges faculty faced presented teachable moments where faculty routinely had the opportunity to model flexibility, adaptability and persistence for teacher candidates. When confronted with a “bad technology day” faculty found that it was important to step outside of the lesson or activity for a moment and explicitly discuss how they were changing course rather than to attempt to make the adaptations appear to be part of a predetermined plan. Many of the problematic situations that were initially viewed by both teacher candidates and faculty as negative experiences shifted to positive outcomes by the end of the courses. Teacher candidates learned important lessons from the instructional decisions that faculty made when they encountered problems during the semester. At the end of the semester they expressed confidence in their ability to solve problems related to technology innovations in their own future classrooms. When asked what she had learned about using technology in her classroom, a student responded, “To go with the flow!!!! There are always ‘bad days.’ Just keep on moving forward and be flexible enough to teach with other tools when one tool is not working and come back with plan B, C and D the next day if necessary.” Another student learned that, “A person should be patient and precise when using technology. It is very important to follow directions…a person is the one who controls the laptop and not vice versa.” Experiencing and overcoming adversity and solving problems provided a problem-solving model for teacher candidates that they could carry forth into their classrooms of the future.

Learning as you go through exploration

The information age has dramatically changed teaching and learning environments. Gone are the days when the teacher was the all-knowing dispenser of knowledge. The learning process
as well as the acquisition of specific skills paves the way for students to meet challenges presented by our rapidly changing world. A social constructivist model for teaching and learning opens the door to collaboration between students and teachers, as teaching and learning becomes a venture between students and the instructor rather than the successful execution of a teacher-directed plan. The journey, not just the destination, offers opportunities for learning lessons that will carry students forward into the world of tomorrow.

The complexity and ever changing nature of technology presents an ongoing challenge for teachers to work out of their comfort zone. These are murky waters for novice and veteran teachers alike to wade into. If faculty and teachers wait until they know everything there is to know about new technologies before bringing them to their classrooms, technology will never “happen.” Technology provided many opportunities for faculty to model the importance of learning as you go through exploration for teacher candidates. One teacher candidate revealed that she discovered that “I just had to play around and experiment with the computer in order to learn how to makes things work.” Being open to learning with students creates a risk free environment where technology can flourish. Several faculty members noted that risk free exploration provided an entrepreneurial atmosphere in their classrooms where students frequently discovered new uses for the tools they had been introduced to and exceeded the instructors’ expectations. Having the laptops available 24/7 during the semester often meant that students committed more time to using the new technologies to explore their assignments. A teacher candidate who self reported that his background with computer applications was “poor” at the beginning of the course was pleased to report that “As the course moved on, I began to gain confidence with the technology and felt comfortable applying new tools to enhance my assignments.”

**Facilitating a community of learners**

One of the seven principles for using technology as a lever identified by Chickering and Ehrmann (2003) is that good practice develops reciprocity and cooperation among students and faculty. Chickering and Ehrmann note that, “The extent to which computer-based tools encourage spontaneous student collaboration was one of the earliest surprises about computers.” This fact was clearly evident in all of the laptop classes. For busy commuter students with classes that meet one time per week, communication was no longer bounded by the physical boundaries of the classroom or campus setting. The laptop innovation provided the catalyst for a natural synergism and sense of community that developed during the semester. At times students were united by the common struggles they faced and at other times they shared in each other’s successes. The common denominator, however, centered more often than not around their technology experiences. When asked what resources students turned to when they were challenged by the technology, the majority of the students identified classmates either individually or as a group. One student commented that, “Eric’s name will stay in my address book forever.” Another student reflected that, “My group was a great resource and helped me understand a lot of things and made me comfortable learning things.” Faculty noted that students frequently arrived well in advance of the beginning of class to share their accomplishments and their challenges, an almost of unheard of phenomena on a campus populated by commuter students, many who also have family
commitments and are working fulltime. Almost a year after the first classes of students participated in the laptop initiative, an instructor received a breezy email from a student, “I just wanted you to know that I just got home from dinner with Kathy and Britt. Our laptop class still talks.” This was yet another testimony to how laptop classes establish and facilitate a lasting community of learners.

When asked for suggestions for future laptop classes one student reflected that “my group found it very useful to share our homework through email before class started. This made us less stressed when our homework was due. When everyone else was trying to correct each other’s work at the beginning of class, we talked very briefly about the homework, then moved on to other issues …this might be a change you want to implement. It will cut down on class time used for groups to discuss their homework.” It is clear that this teacher candidate was making the transition from a student using technology to thinking how she would use technology as a teacher for tomorrow. The impact of these courses clearly went well beyond the course objectives as teacher candidates and faculty collaborated as a community of learners to move beyond initial apprehensions and limitations to establish a “can do” environment where technology flourished.

The Bigger Picture

We discovered that implementing a technology initiative in a teacher education program is often frustrating, but the rewards offered by the unanticipated outcomes far exceed the unexpected challenges. Overcoming the technical problems took time, patience, and creative problem-solving skills. Preparing our teacher candidates to effectively use the technology professionally and in the classroom produced opportunities for learning, sharing, and growing. Faculty learned how to enhance students’ technology comfort zone and create a safe environment that encourages exploration and collaboration. Students acquired technology problem-solving skills and gained confidence in their ability to infuse technology in their future classrooms.

Lessons learned from this laptop initiative indicate that while having the technology ubiquitously available was significant to gaining new skills, the critical factor was the ability of the faculty to create the type of environment that fosters learning and professional growth. Opportunities to model best practices under less than ideal as well as ideal situations allows teacher candidates to experience and learn how to address the inevitable challenges they will face in the future. What better way to prepare teachers for the classrooms of tomorrow?

References


Michelle wanted to be an English teacher because she loved the discussions she had in her literature classes. Intrigued by novels about other cultures, she thought about living abroad after she graduated, working in the Peace Corps or teaching English in Japan. She loved “English because of its molding quality. I can incorporate all of my interests into English and I feel that students can, and should, too.” It is unusual for an English major to be crazy about computers, but, Michelle, more than most, found herself frustrated every time she had to get one of her papers to print out right. She would so much rather be reading, or hiking outdoors, her second love. When she learned that her literature methods course, the capstone class in her program to prepare her to teach high school English, was going to be taught in a computer lab, Michelle was a little worried. She tried to tell herself that it would be all right, that it was only one class anyway. At least the lab wasn’t one of those rooms with large computers in rows. In this room all of the desks were on wheels, the computers were laptops, and connections were without wires.

In *Teaching the Elephant to Dance*, (1990) James Belasco details the difficulties of institutional change in large organizations. Belasco claims that once an elephant has been trained to stay tied to a stake in the ground, one that they could easily pull up, nothing short of the tent on fire will get them to move beyond the stake. However, even after the equivalent of a tent burning, large organizations, including universities are often slow to change and require absolute dedication and patience to a goal. Thus, we were faced with the challenge of teaching the university with its large number of faculty to dance to the ever increasing beat of the pace of technology.

Over 4,000 preservice teachers, 480 faculty members and 160 K-12 teachers were served by the Western Michigan University (WMU) Preparing Tomorrow’s Teachers to Use Technology (PT3) program ([www.wmich.edu/pt3](http://www.wmich.edu/pt3)). According to an external evaluator’s report, “WMU with its PT3 program has paid significant and sustained attention to both
infrastructure and its internal ability to support technologically sophisticated teacher preparation. This has entailed faculty development, course and curricular innovation, hardware and software acquisition, and explicit attention to the institutional culture surrounding these advances.”

The PT3 program at Western Michigan University grew out of an ambitious goal that every preservice education graduate should be able to meet or exceed the ISTE National Educational Technology Standards for Teachers (NETS-T). Thus, it not only entailed a university wide effort to reach every preservice student and faculty member, but to also reach nearly 1,000 mentor teachers at 55 Michigan school districts who work with WMU interns. Thus, four target groups were identified: the elementary and secondary education programs, preservice faculty and the K-12 Intern program.

The PT3 staff included representatives from the College of Education, the Colleges of Arts and Science and Fine Arts, the Intern program, other faculty representatives, an Associate Dean, and the evaluator. To coordinate activities, this group met two or three times per months in a variety of committee and subcommittee assignments. Three faculty appointed managers were assigned to work with the College of Education Intern program and the Colleges of Arts and Science and Fine Arts. The WMU PT3 Director, Dr. Leneway, a university research associate, supported the three managers’ activities with both students and faculty at every turn and helped to ensure continuing collaboration between the College of Education and the Colleges of both Arts and Science and Fine Arts. The managers and Project Director focused collectively on the goal of faculty development.

In the WMU College of Education, all elementary education students are required to take an introductory technology class. This course was radically redesigned around the NETS-T standards to immediately impact over 600 preservice students per year. The revised curriculum syllabus and class web can be found at www.wmich.edu/pt3. New online tools were incorporated in this model course including the use of Profiler, Homepages, NC learning style survey tool, Taskstream lesson planning, ThinkQuest for preservice teacher, Iwebfolio, Blackboard for course management and Zoomerang for online evaluation.

Because no introduction to technology course existed in the secondary program, focus was placed on working with innovative faculty in each of the 35 different content areas. Through the use of mini grants faculty developed model programs. In addition, a series of ten different workshops were developed and offered to both Interns and their supervising teachers at the schools where they were Interning.

Michelle’s story above, although unique to her, can also be considered representative of thousands of preservice students in one of the largest teacher education programs in the country. The secondary English education program alone has more than 550 majors. PT3 at WMU took aim to create technology proficient teachers from scores of academic programs. A small group of secondary English faculty were identified and supported by the PT3 program to serve as models of technology integration in the curriculum. In addition to mini grants, several faculty members were invited to participate in the ThinkQuest national
training and collaborative web development program for preservice teachers, which was funded by a PT3 Catalyst grant with fourteen other university partners.

On the first day of class, Michelle’s professor, Dr. Webb displayed the course syllabus with a data projector. The syllabus was on the Internet, and Michelle thought it was cool that so many online resources were a substantial part of the class reading. The syllabus featured links to professional organizations for English teachers, state and national standards, and syllabi of parallel courses at other universities. There was even an extensive website designed to help English secondary teaching. The Internet was shown to be the new media for creating and publishing their writing for a world wide audience. An audience that could eventually include her future tech savvy students.

On the second day of class Professor Webb explained that all of the students were going to make a website targeted at their future students. When he said the basic pages and framework of the sites should be finished in two weeks, a shiver went down Michelle’s spine and her neck tightened up. “Do we really need to know so much about computers to teach English?” she asked. Even though only one student in the class had ever made a web page before, the others seemed to go along with the idea as they followed the professor’s instructions and started developing their home page on the classroom laptops. As luck would have it, just as she got a few links on to the page she was making in using Dreamweaver for the first time, Michelle’s computer froze, had to be shut down, and her work was lost. She wanted to cry. Her professor emphasized that the technology was there to enhance good English teaching, not replace it, that envisioning a website was more an intellectual process than a technical one. The next week Michelle wrote in the class computer conference,

“I have to be honest and say that there is no hard evidence that my website has made progress since Tuesday. However, it has. I have never been a huge computer person, meaning that I don't enjoy spending hours in front of a screen and searching for things. My brain gets overwhelmed easily and when I have too many choices, I seem to come up with no answers. So, rather than go to the computer and try and sift through the millions of images that are out there, I have spent some time thinking about how I want my website to look. I've decided that since I have numerous interests, I would like my background to be a world map of some sort. Then, I want each page to be a different way to "see" the world. As for doing the website, I really think that it will be very useful to know and am glad that I will be learning it.”

To Michelle’s surprise developing skills at web publishing came quickly. The professor showed the class models of previous student’s teaching websites, but did not devote much time to demonstrating techniques of web design. Working in the university’s Educational Technology Lab, a cooperative program between the Office of Informational Technology and the PT3 program with one-to-one student technology tutoring support was enormously helpful to students, Michelle included. Four days later she wrote,

“I finally made some progress with my website! Wow, I was beginning to wonder if this day would ever come! On Friday, I went to the Technology Lab and got some one-on-one help. It was great, even though I was still lost by some of the computer lingo. I was able to create the outline for my page (meaning that I have a separate page for all the required sections) and I've started putting some images on my homepage. It felt so good
to finally feel like I had made some progress. However, that good feeling has worn off over the weekend because I know that there is still a lot to do for my page to be completed. I am confident that it will all work out though, somehow and some way! If any of you are wondering about going to the lab, go! It was a huge help. My website is going to rock the house once I'm all finished!"

Less than three weeks into the course students presented their teaching websites to each other. That evening Michelle wrote:

“I have to say that I have been truly amazed by everyone's website! They all look so awesome and came together so nicely! I am anxious to get the content on all the pages and utilize what I have learned in this class, thanks to everyone!”

As the semester progressed, Michelle was relieved to learn that the course would turn more to the questions of the teaching and learning of literature that she was expecting. However, during the rest of the semester students continued to develop their teaching websites, expanding the content and resources on the site with their future secondary English teaching in mind. Components of students’ professional teaching websites included their developing philosophical statements about their approach to teaching writing and reading, language arts assignments, specific unit and lesson plans, “handouts” for students, rubrics, class newsletters for parents, and resources for colleagues. As these materials accrued, the teaching website became an electronic portfolio with its audience to include the professor, future employers, and future secondary school students and their parents – the very people Michelle and her classmates planned to teach. It was not surprising that Michelle and her fellow students found prospective employers more impressed by a working website designed for use in the real world and with real world public school students, than by a static collection of undergraduate work in a traditional portfolio.

As a way of providing a better authentic assessment of students’ mastery of the NETS, the WMU PT3 program decided early on to push for electronic portfolios. Each of the elementary students developed their portfolios using Dreamweaver in the introduction technology methods class. The secondary subject area faculty, like Dr. Webb, were individually encouraged and trained by the PT3 program to do the same with their students. It was explained to them that each student assignment could be woven in an Internet based, portfolio tapestry of the students’ work.

One of the links that Michelle created for her website was the Thinkquest preservice library. This site, built by other preservice students at WMU, will support her students’ development of their own content-based websites. Michelle explains:

“For a link on my student web webpage, I chose Thinkquest. This website focuses on a content-based program where students create their own web pages and submit them to be judged. Students are required to form a team and choose one area (such as humanities or sciences) to focus on for their site. This site is a great tool for both students and teachers because it provides a way for students to participate in their own learning, hands on. Not only will students become knowledgeable in the subject area that they choose, but they will also become familiar with the software used to create a webpage. Students will become efficient in the building of a webpage and be able to
During the PT3 grant, nearly 400 student teams, representing over 1,500 students at WMU worked together with students from other ThinkQuest participating universities to develop collaborative web sites, and add to the ThinkQuest library (preservice.org/projectlab). The WMU PT3 implementation grant working with the ThinkQuest Catalyst grant helped develop a program that is clearly one of the most advanced in the world in the integration of technology into language arts teacher education.

The WMU English Education program truly takes advantage of the freedom and flexibility that a wireless campus has to offer. The program has designed the English Education Lab (EEL), the classroom of the future, with partial support of the PT3 grant, modeling successful integration of multimedia tools and technology and high speed wireless access into teaching and learning. Two carts of laptops, a data projector, and printers all wirelessly connect to each other and the Internet. Desks and tables in the EEL are mounted on wheels and entirely mobile, allowing the classroom to be arranged in rows, small groups, islands, or theater seating while maintaining the functionality of a computer lab. While the room functions superbly as a traditional classroom, the resulting flexibility makes the EEL a perfect environment for students to collaborate on technology projects.

The home website for the English Education Lab, created by faculty through the support of PT3 mini grants, has emerged as a leading website for the integration of the Internet into English teacher education. TeachEnglish (www.wmich.edu/teachenglish) has extensive resources for literature and composition instructors who seek to use the internet in their classroom. These resources include streaming video, resources for classroom websites, electronic communities, guides to Webquest development, on-line resources for teaching literature, links to digital archives of literary works, and a host for literary moos. A virtual tour of the English Education Lab documents how students are using this innovative learning environment.

As Michelle learned on the first day of class, English education methods courses use on-line syllabi that create a kind of electronic textbook with a wide diversity of Internet sites providing much of the basic reading material of the course. Projects such as Dr. Webb’s on-line syllabi were made possible by the PT3 funded mini grants. Through Dr. Webb’s on-line syllabi, links were created to professional organizations such as National Council of the Teachers of English to facilitate membership and participation in conferences. For example, students can use the NCTE Co-Learn professional development site with its extensive archive of educational publications for teaching English.

Part of the PT3 effort also provided professional development to faculty on various forms of electronic communication with their students. For example in Dr. Webb’s courses, on-line conferencing provides a forum for students to extend class discussions and reflections. Classes of undergraduate aspiring English teachers are paired with graduate classes of currently practicing teachers to discuss a wide range of issues in English education. Leading
English educators and book authors have been able to join these conferences, as well. After their methods course is over, students use the conference to stay in touch with each other and their methods professor during their intern teaching.

Michelle’s enthusiasm for creating websites for her future classes is typical of the aspiring teachers in the English education program. Guided by dedicated on-line resources, the websites they create offer entry points for their future students, parents, and colleagues. Acting as a digital portfolio for their English and teacher preparation work, these websites are thus designed with real world application in mind. Syllabi, Webquest, links to literary works, on-line learning activities, teaching philosophies are all available on these classroom websites. (www.wmich.edu/~tchengl/subpages/technology/classwebsite.htm).

WMU English education students are also helping to develop a national online library of K-12 resources. A total of 378 teams of WMU students have worked together to design and publish education related web sites for the ThinkQuest for Tomorrow's Teachers (T3) library (t3.preservice.org/projectlab) The T3 Project combines the practice of the Guiding Partner Approach, a student-centered constructivist pedagogy, with a structural approach to curriculum-based, Internet-enriched activity designed to provide an ideological basis for systems change in preservice education. The emphasis is on exploration, collaboration, and facilitation as future teachers prepare electronic resources to support practicing teachers world-wide. In WMU English education courses, student teams have developed ThinkQuest collaborative sites that emphasize the teaching of literature from reader response and cultural studies perspectives. One student team developed and published a ThinkQuest site on 'Exploring Slavery Through Literature' (t3.preservice.org/T0211442/) that was independently judged as the top T3 preservice ThinkQuest web site in the nation. The ThinkQuest PT3 program sponsored a student to travel to receive the award on behalf of the team and meet with faculty members and student team representatives from the other fourteen ThinkQuest Catalyst PT3 grant participating colleges located throughout the U.S.

Among many new emerging digital engagement practices, digital storytelling is perhaps the most exciting, in that the ancient practice of storytelling is being used in combination with powerful new communication and video technologies. Thanks to support from the PT3 initiative, the English education program is effectively and creatively developing the digital literacy of future English teachers. A digital story is told not only through words, but also through music, photos, video, stock images, text, and sound effects. These media commonly include personal artifacts, i.e. family photos, home video, personal letters, a favorite coffee mug, etc. If the use of multimedia opens up this possibility of expressing oneself through a variety of modalities, it is the use of the computer that facilitates the manipulation, and collating (construction) of these pieces into a whole.

The director of the WMU Third Coast Writing Project Site of the National Writing Project, another WMU PT3 partner, helped facilitate a workshop on digital storytelling sponsored in part by the PT3 grant and held in the English Education Lab. This summer workshop developed digital story collaborations between preservice related faculty, practicing and preservice English teachers. The Writing Project emphasis on authentic expression and
“writing what you know” led to the creation of moving digital stories about the teaching of English. (See www.wmich.edu/pt3/dshome.htm for examples.)

Practicing and aspiring English teachers also develop literature-based Webquests drawing on Bernie Dodge’s model. The cultural studies approach to teaching literature that guides the WMU program links literature study to historical, political, cultural, and artistic dimensions and lends itself perfectly to integrating literature study with the Internet. Professor Dodge identified Webquests made by English education students at WMU as outstanding models. One WMU student Webquest addressed the literature of Afghanistan. It was used by Professor Dodge during the war in Afghanistan as the basis for an international on-line conference on Webquests design.

To support these and other PT3 sponsored digital engagement learning activities for English teachers, new technical support systems have been established. For example, as part of the TeachEnglish web site, an E-Community Forum has been developed (www.wmich.edu/~tchengl/subpages/community/ecomm.htm) that includes a Secondary Worlds MOO (www.wmich.edu/teachenglish/encore). This MOO has become a rich interactive text-based virtual reality learning environment where students can experience literature in new ways. Meanwhile, another PT3 mini grant supported professor in the English Education program used Wikis and other writing efforts in a Best Practices in Writing web site. (www.wmich.edu/teachenglish/subpages/composition/comp.htm) Wikis at WMU are a digital engagement tool being tested as an innovative web-based technology used in collaborative writing projects. As Dr. Bush explains:

“A wiki is an open-source web page that can be modified by anyone who has a web browser and a few simple formatting commands at the ready. This may make the wiki the most democratic form of all web publishing, since no special skills are required to create and modify a web page. The wiki is the perfect tool for collaborative work, since wiki pages can be accessed and revised anywhere and anytime. The best example of a collaborative wiki may be the wikipedia, an online encyclopedia where anyone can post entries. Though still in their early stages, wikis, like blogs, are making the web more dynamic and a little more user friendly.”

Jerome McGann, literary scholar at the University of Virginia, has pointed out that “the cultural archive has moved to the web.” The model technology PT3 sponsored mini grant project have led many more WMU’s English Department faculty to work on a variety of projects and bring the enormous corpus and variety of on-line literary and historical archives into the secondary and the university literature classroom. The canon is exploded as students, independently and in groups, explore an enormous variety of literary texts previously not included in literature textbooks or anthologies. Indeed students are now designing specialized and general textbooks, compare original manuscripts and diverse translations to contemporary editions, and developing their own hypertext noted literary works. For example, graduate students in English 680, Advanced Methods of Teaching Literature, also taught in the EEL, have developed and presented classroom research projects on the integration of on-literature archives into classroom teaching MA student and public school English teacher CJ Gilbert developed a unit for her high school sophomores to explore
mythology. Using freely accessible digital archives her students engaged in close comparative study of myths from around the world that otherwise would have been inaccessible to them.

The English Education lab has also facilitated the teaching of experimental English courses that allow instructors to imagine new ways to integrate the internet into English teaching. For example, “Literature on the Web” considers the impact of cyberculture on reading, writing, and learning. This innovative course critically examines hypertext writing, internet e-zine publishing, electronic text archives, on-line literature resources, cyber-science fiction and film, collaborative on-line environments, and computer games as literary narratives. The final project in this class is an open-ended opportunity for students to develop websites to experiment with writing hyperfiction, develop dedicated websites for specific literary works or authors, and/or on-line create literature teaching resources.

Another PT3 supported example of rich digital engagement that has also developed in this context is a website created by Dr. Webb and his students in a 500-level postcolonial literature course. Created largely by undergraduates, the Colonial and Postcolonial Literary Dialogues site is now one of the four or five most sophisticated sites devoted to postcolonial literature and is used by students and teachers from around the world who wish to bring multicultural perspectives to literature teaching. The site has also been designed to serve students as a free electronic textbook. (www.wmich.edu/dialogues/)

English is only one example of PT3 supported programs that have reached into many courses and programs at WMU. Its mission has been to ensure that all teacher education graduates at this 30,000 student university meet or exceed the National Educational Technology Standards for Teachers (NETS-T). The NETS-T standards serve to focus the project efforts on providing students with rigorous set of nationally recognized technology knowledge and skills measures. Taken together the PT3 program components constitute a holistic pedagogy-based approach to the integration and use of digital and Internet technologies as tools in the teaching and learning process.

In the end Michelle Ringle’s dreams came true. On completion of her degree she spent a rich year teaching English in Japan. At WMU, not only is the elephant hearing the music, but it is now moving in time with the gradually increasing beat of technology. As this chapter demonstrates, the impact in English education has been profound. Many more students and faculty who previously had little conception of the possible links between language arts pedagogy and digital and internet resources now have a full vision of their integration.

References

About the Contributors

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Steve Rhine is associate professor of education at Willamette University in Salem, Oregon. He is in his fourth year as director of the Oregon Technology in Education Network (OTEN), which was supported by a PT3 grant, and has been instrumental in OTEN’s recently funded Teacher Quality Enhancement grant. Dr. Rhine was on the writing team for the International Society for Technology in Education’s (ISTE) National Educational Technology Standards for Teachers (NETS•T). He has published a number of articles and has presented on such topics as constructivist-based practices with technology, algebraic thinking, and issues of diversity, particularly related to English language learners.

Mark Bailey has been teaching and learning with students of all ages for more than 25 years. An early childhood educator at the start of his career, he began to explore emerging educational technologies at the University of Wisconsin in Madison in the 1980s. Since receiving a degree in educational psychology, he has been teaching for more than a decade in the College of Education at Pacific University in Forest Grove, Oregon. He continues to work with students and colleagues to examine the confluence of technological innovation, educational empowerment, and social justice.

ASU’s Integrated Field-Based Technology Model: A Legacy of Collaborative Regeneration

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If at First you Don’t Succeed…Learning from Mistakes and Developing a Better Student Portfolio

Christy L. Coleman is an associate professor in the Department of Educational and School Psychology at Indiana State University. She currently teaches graduate-level statistics courses. She earned a doctorate in counseling psychology from the University of California, Los Angeles. Her research interests include stress and coping and the role of values and interests in career decision-making. She serves as the director of evaluation and as a co-principal investigator for ISU’s PT3 grant.

Kenneth Janz, M.S. is currently a doctoral candidate at Indiana State University in higher education administration. Mr. Janz served for five years as ISU's College of Education director of Information Technology and is currently the University's director of Instructional and Research Technology Services. His current responsibilities include envisioning, leading, designing, planning, implementing, and directing technologies to support teaching, learning, and research for the entire University. Since August of 1998, Mr. Janz has authored and manages over $6.26 million in grants and contracts in the area of educational technology for the University. He is the project director and co-principal investigator for ISU’s PT3 grant.

T.H.E.|QUEST: A Statewide Initiative

Rebecca A. Callaway received an Ed.D. in Curriculum and Instruction from Louisiana Tech University. She received a M.Ed. and a B.S. from Northwestern State University of Louisiana. Rebecca is Coordinator of Instructional Technology at Louisiana Tech University.

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Catherine R. Letendre holds a B.A. and a M.A. in Elementary Education from Louisiana Tech University. Catherine was recently selected as District Middle School Teacher of the Year. She is currently working toward National Board of Professional Teaching Standards certification.

The Building Teams and Tools for Teaching (BT3) model: Higher education and K-12 working together to improve teaching and learning

Robin Etter Zúñiga is Associate Director of the Flashlight Program of the non-profit Teaching, Learning and Technology Group. She has more than 17 years experience designing and implementing comprehensive program evaluations on the use of technology in instruction for colleges and universities, including St.
Edward's University's "Building Teams and Tools for Teaching" PT3 program. She was formerly a research associate with the Western Cooperative for Educational Telecommunications. Ms. Zúñiga holds a Master's degree in public policy analysis from the University of Massachusetts.

**Allison McKissack** is a former public school teacher frustrated by the lack of basic computer technology available for use in her classroom, McKissack became director of the Building Teams and Tools for Teaching, a program at St. Edward’s University that helps pre-service teachers, inservice teachers, and university faculty develop and implement technology-integrated curricula. McKissack has presented on technology integration at more than 20 conferences. She has also established a program to recycle and distribute the university’s used technology equipment to local nonprofit educational entities.

**John R. Paige** CSC earned the Bachelor’s degree in Physics from the University of Notre Dame, holds Master’s degrees in Mathematics from Wesleyan University, and in Applied Theology from the Graduate Theological Union, Berkeley, and was awarded the Doctor of Philosophy degree from the University of Maryland at College Park. Dr. Paige currently serves in Rome, Italy, as Vicar General of the Congregation of Holy Cross. Formerly Dean of the School of Education at St. Edward’s University, Austin, Texas, Paige served as Project Director of the Building Teams and Tools for Technology (BT3) program at St. Edward’s University.

*The Stanford Technology in Teacher Education Project: Supporting Teaching and Learning*

**Rachel A. Lotan** is Director of the Stanford Teacher Education Program and associate professor (teaching) at Stanford University School of Education. Her teaching and research focus on aspects of teaching and learning in academically and linguistically diverse classrooms, teacher education, sociology of the classroom, and the social organization of schools.

**Susan E. Schultz**'s teaching and research interests focus on science education and the education of pre-service as well as professional development for in-service teachers. Her research examines issues of reliability and validity of alternative assessment techniques (i.e., concept mapping and performance assessments), cooperative learning strategies, and equity.

*Using Technology in Meaningful Ways with First Year Teachers: Triumphs and Tribulations Encountered with PT3 Initiatives*

**Molly Romano**, PhD. is an Assistant Professor in the Department of Teaching and Teacher Education at the University of Arizona. Her research agenda includes work in teacher reflection, teacher education, and teacher induction practices. She served as Co-PI on a three-year PT3 grant, with a special emphasis on using technology with first year teachers.
Utilizing Case-Based Reasoning Principles in Technology Integration Education

Tawnya Means is a doctoral student at the University of Missouri-Columbia in the School of Information Science & Learning Technologies. She has her B.S. in Early Childhood Education and her M.S. in Educational Technology. She has served as project coordinator for the Knowledge Innovation for Technology in Education (KITE) project and the Improving Teacher Readiness through Active Experiences (iTRAX) tracking system project.

Feng-Kwei Wang is an assistant professor in the School of Information Science and Learning Technologies (SISLT) at University of Missouri - Columbia. Before moving to University of Missouri in August 1999, he served as a corporate consultant working on systems development projects for several Fortune 500 companies including AT&T, IBM, Delco Electronics, and Eli Lilly. Dr. Wang is interested in the process of designing and developing learning and knowledge management systems and the uses of multimedia and network technologies to enhance human learning and performance. His primary teaching areas in SISLT include information systems design and development, knowledge management, and networks and telecommunications.

Midwestern Independence and Educational Technology Use: Evaluation Strategies of the Nebraska Catalyst Project

Neal Grandgenett is currently the Peter Kiewit Distinguished Professor within the Department of Teacher Education at the University of Nebraska at Omaha. Dr. Grandgenett is active in the examination of technology-based learning environments and has published over 70 articles and papers related to the topic. He is well experienced in project evaluation and has directed more than 20 different large-scale evaluations in projects funded by NASA, NSF, and the U.S. Department of Education. His evaluation and curriculum development work has resulted in several awards including the NASA Mission Home Award and the Nebraska Technology Professor of the Year Award.

Jean Jones is past Director of a PT3 Statewide Federal Technology Grant. Her work has been directed toward grant management, facilitating community initiatives, and teaching a variety of graduate courses at Concordia University and the University of Nebraska. Dr. Jones has published several articles related to abuse and resiliency, and is currently editing a book with three colleagues to be published in 2005 by Haworth Press. Her most recent work is at Concordia University in Seward, NE, where she is serving as the interim Integrated Marketing director.
Reform in Teacher Education as a Scaffold for Technology Integration

Amy Staples, an assistant professor of special education at the University of Northern Iowa, was a visiting assistant professor at UW-Milwaukee during the study detailed herein. She received her Ph.D. in educational psychology at the University of North Carolina at Chapel Hill. Her research focuses on the impact of technology on the inclusion of students with disabilities.

Marleen Pugach, Professor and Director of UW-Milwaukee’s Collaborative Teacher Education Program for Urban Communities, received her Ph.D. from the University of Illinois at Urbana-Champaign. Her research and scholarship focus on preparing teachers for working with diverse populations in urban schools.

D.J. Himes, Instructional Technology Specialist at UW-Milwaukee, received his Master’s degree from North Carolina State University. He teaches courses in instructional technology.

A Laptop Initiative in a Teacher Preparation Program: Unexpected Challenges and Unanticipated Outcomes

Mary L. Waker, Ed.D., is the Director of the Education Technology Center in the College of Education at Wayne State University. She is responsible for developing and implementing technology initiatives in the college. She is the current president of the Consortium for Outstanding Achievement in Teaching with Technology (COATT, www.coatt.org) and occasionally teaches graduate courses in Instructional Technology. She is the principle investigator on a 2001 Preparing Tomorrow’s Teachers to Use Technology grant.

Sally K. Roberts, Ed.D., is an Assistant Professor of Mathematics Education in the College of Education at Wayne State University. She teaches mathematics content and methods courses for teacher candidates and graduate students. She is a long time advocate for instructional technologies and is currently chairing the Technology Committee for the College.

Pursuing DEEP Learning: Digital Engagement for English Preservice Students

Robert Leneway was recently name the 2005 Educator of the Year by Michigan Association of Computer Users in Learning (MACUL). He is a former PT3 Implementation Grant Director with Western Michigan University. He is currently the Program Coordinator and an Assistant Professor for the Educational Technology program at WMU. He also been very active with the ThinkQuest for Tomorrow’s Teacher PT3 Catalyst grant and is currently involved as WMU representative to the Michigan COATT PT3 Catalyst grant. He also served for 25 years in the Michigan Department of Education in various educational development, administration and consulting roles.
Allen Webb is a Full Professor of English, English Education, and Postcolonial Studies at Western Michigan University, he is author of Literature and Lives: A Response-Based, Cultural Studies Approach to Teaching Literature, Making Subjects: Literature and the Emergence of National Identity, and Teaching and Testimony, as well as numerous articles and reviews. Professor Webb is a member of the Executive Committee of the Conference on English Education and of the Michigan Council of the Teachers of English. His PhD in Comparative Literature is from the University of Oregon, a state where he taught high school for six years. His professional website is: www.allenwebb.net.