Examining PT3 Projects Designed to Improve Preservice Education

By Clif Mims, Drew Polly, Craig Shepherd and Fethi Inan

One of the current goals of public school education is technology integration. This is witnessed in current educational literature (e.g., Earle, 2002; Tiene & Luft, 2001; Vetter, Sologuk, & Stammen, 2001), by the enormous sums of money schools, colleges and departments of education (SCDEs) spend to purchase equipment (e.g., Barron, Hogarty, Kromrey, & Lenkway, 1999; Earle, 2002; Jones & Paolucci, 1999) and in the emphasis on weaving technology into the fabric of the educational curriculum (e.g., International Society for Technology in Education [ISTE], 2000a, 2000b; Norris, Smolka, & Soloway, 2000; Salinas, 2000; Vetter et al., 2001).

As the integration of technology into K-12 education has become one of the major issues concerning teacher candidates in the United States, many initiatives have attempted to provide educators a clearer vision of how to better prepare teachers to integrate technology with teaching and learning. The Preparing Tomorrow's Teachers to Use Technology (PT3) grants, funded by the U.S. Department of Education (USDE), provided millions of dollars to transform preservice teachers' experiences with technology in both their methods courses and field experiences (USDE, 2004). These projects supported the purchase of technological equipment as well as professional development opportunities for faculty and field experience teachers to integrate more technology into their teaching. This article will critically examine the latter, PT3 projects that have included professional development opportunities for faculty and field experience teachers to infuse more technology into their teaching.

For preservice teachers to be adequately prepared to integrate technology into their teaching, Schrum (1999) noted that they must be exposed to: a) technology in a skills-based course, b) the integration of technology into methods courses and c) technology rich field placements. While nearly every preservice teacher takes an educational technology course (Persichitte, Tharp, & Caffarella, 1997), these classes are traditionally disconnected from methods courses and provide only basic technology skills (Moursand & Bielefeldt, 1999; Schrum, 1999). Ertmer (1999) posited that teachers must not only learn how to use technology, but also how to integrate technology into their teaching. Teaching technology skills isolated from methods courses develops preservice teachers who are competent using technology, but most are unable to use their technology skills to impact student learning (Beyerbach, Walsh, & Vannatta, 2001; Milken Family Foundation, 2000; Wang, 2002).

While various PT3 initiatives have supported both the integration of technology into methods courses and into technology-rich field placements, little research has disseminated to the field regarding the impact of these initiatives. This paper presents a critical analysis of the influence of PT3 projects that focused on preservice methods courses and field experiences.

Method

This descriptive study was a critical analysis of PT3 projects that focused on transforming preservice education courses and field experiences. More than 150 PT3 project coordinators / principal investigators were invited to share documents such as project final reports, conference proceedings and published articles for inclusion in our analysis. Thirty-three projects submitted these resources. These grants were completed by the beginning of this research process and do not include the entire second round of PT3 grants that conclude in 2006.

The authors reviewed resources for each of these 33 projects using a rubric to determine each project's alignment with the focus of this research. This rubric was created by the authors and inter-rater reliability was established by randomly selecting one of the PT3 projects from the pool of 33. Each author reviewed this PT3 project's final report and 100% inter-rater reliability was established as each researcher awarded the same ratings in each of the rubric categories. It was determined that 24 of the 33 PT3 projects reviewed were focused on enhancing technology integration in preservice courses and field experiences.

The intent of this critical analysis was to report and analyze the findings of PT3 projects focused on transforming the experiences of preservice teachers in their educational courses and field experiences and then draw implications from those findings. Modified inductive analysis was used as the analytical framework of this inquiry (Bogdan & Bicklen, 1992) and the researchers used the analytical strategy of meaning condensation to label passages and categorize topics of discussion into central themes by searching for patterns across PT3 projects (Coffey & Atkinson, 1996). The analysis yielded a number of common themes, however, due to the limitations of the scope of this article only the four most common themes will be discussed.

Findings

The purpose of this study was to analyze those PT3 projects that focused on transforming preservice education courses and field experience. The goal here is to present each of the four major findings along with supporting evidence as suggested by the PT3 projects reviewed in this analysis. Interpretation and discussion of these results can be found in the Implications section below.

Theme 1: Preparing technology competent teachers

Teacher expertise in using computers is considered to be one of the critical factors in the use of technology in the classroom. Some projects claimed that the investment in technology could not be fully effective unless teachers receive necessary training and support to become fully capable of using these technologies (Mills, 2003). For preservice teachers to become effective integrators of technology, it is important that they have experiences in which the integration of technology with teaching and learning is modeled for them. They can gain these experiences from their teacher education classes as well as from clinical instructors during their field experiences (Swain & Dawson, 2003). Recognizing the need for both preservice teachers and professors to become capable users of technology, many PT3 projects focused on enhancing technology skills for both audiences.

> *"Preparing preservice teachers to integrate technology effectively in classroom settings was a difficult and time-consuming endeavor for most PT3 projects."*

Enhancing faculty technological competency. PT3 projects followed various approaches for developing technology proficient faculties and preservice teachers. Faculty comfort and proficiency with technology was one of the primary barriers, and was thus the initial focus of many projects (Jonas, 2004; Mills, 2003). Several projects used faculty training workshops as an initial approach (Snow & Millar, 2003). Commonly, training sessions were designed and faculties asked to participate. In order to increase participation, stipends and other incentives were sometimes used. For example, Pittsburg State University (Mills, 2003) organized many workshops and summer institutes to increase the technology proficiency of faculties and teacher candidates. Faculties, teacher candidates and collaborating teachers were tested by authentic performance based assessment, which indicated potential of improvement in their technology skills.

In addition to professional development activities, grantees usually employed interns or graduate assistants to provide face-to-face and timely technical support for faculties

(Diggs, Laffey, Wedman, & Marra, 2001; Jonas, 2004; Snow & Millar, 2003). For example, the University of Missouri PT3 project created support teams who met with faculty 2-3 hours in their office for individual training sessions. Evaluation of this project indicated that these one-to-one sessions with additional workshops and learning communities lead to higher technology use in classroom activities (Diggs et al., 2001). As verification of this finding, the University of Florida considered one-to-one mentoring activities as a more effective method of professional development (Swain & Dawson, 2003) than others.

Many PT3 projects had a goal of increasing faculties' access to technologies. Frequently, mobile computer labs, donated with advance technological equipment and software, were made available for faculty use (Boccia, 2003; Paige, 2004; Snow & Millar, 2003). Some PT3 projects favored mobile computer carts as another method to increase access to technology. Survey results at the University of Nevada-Las Vegas indicated that faculty preferred mobile computer labs over moving classes into fixed computer labs (Strudler, Archambault, Bendixen, Anderson, & Weiss, 2003).

Enhancing teacher candidates' technological competency. Preparation of technology proficient teacher candidates was a main focus of many PT3 grants. Some PT3 projects revised method courses to include development of skills and competencies defined by ISTE/NETS (National Educational Technology Standards) (Boccia, 2003; Swain & Dawson, 2003). Moreover, faculties were encouraged to provide opportunities for students to hone their technology skills in courses by creating technology-enhanced products that related to the course content (Jonas, 2004). For example, the University of Mary's PT3 project found that this approach helped students to develop higher technology skills and become more technology proficient (Jonas, 2004).

In addition to technology integration courses, preservice teachers also engaged in training and workshops to increase technology proficiency of preservice teachers (Paige, 2004). Additionally, several activities were targeted to increase preservice teachers' field experiences. Usually, grantees included mentor teachers from partner schools in these workshops. These mentor teachers were included so that their skills would improve, making them better models for preservice teachers during their field experiences (Mills, 2003). While these mentor teachers were included, the majority of PT3 projects did not focus on increasing the technology available in partnering schools because PT3 grants did not allow for major hardware expenditures.

Theme 2: Technology skills versus integration

Preparing preservice teachers to integrate technology effectively in classroom settings was a difficult and time-consuming endeavor for most PT3 projects. Not only did these programs have to garner support from college faculty within various departments, they also had to teach faculty how to: use these technologies, incorporate them effectively into teaching episodes, model best practices for preservice teachers and help their preservice teachers do the same things in K-12 settings. Additionally, some programs reported the need to support technology integration among K-12 school faculty mentoring preservice students during field experiences, because of their unfamiliarity with effective practices. After engaging in these practices, faculty from one PT3 project indicated that knowing how to use specific technologies does not equate to their effective integration (Graham, Culatta, Pratt, & West, 2004).

In order to help future teachers effectively integrate technology in their classroom instruction, many PT3 projects targeted education faculty. They believed that once these faculty members knew how to use the technology, they would redesign their courses and model their practices to preservice teachers. In order to learn these skills, faculty members completed workshops, lecture series and technology courses. These activities demonstrated specific uses of technology, provided the faculty with hands-on technology experiences and presented examples about how to incorporate technology into classroom practices. Typical topics for these sessions included using presentation, movie editing and mind-mapping software, electronic portfolios, digital cameras, scanners, Internet search tools and computer assessments. Following these workshops, additional support was provided to these faculty members to help them model these resources in their own courses. Similar activities occurred for preservice teachers. Several enrolled in mandatory courses designed to teach technology skills so that preservice teachers could incorporate technology in their future classrooms. Additional workshops, portfolio projects and course redesigns established by PT3 projects also helped preservice teachers further their technology skills. Indeed, most PT3 annual and final reports include questionnaire and survey analyses documenting growth in technology skills among faculty and students.

Yet, these projects also quickly realized that skill acquisition was inadequate for technology integration. Indeed, following these workshops, lectures and hands-on activities, many faculty and preservice teachers required additional support to apply the technologies effectively to classroom activities. While the level of this support is described later in this paper, these individuals not only needed to learn how to use technologies, but also how to integrate them in the classroom. To ensure that preservice teachers learned how to both use and apply technology skills in classroom settings, one of Arizona State's PT3 grants focused on helping preservice teachers design lesson plans using classroom technologies. Once these lessons were created, preservice teachers implemented them with students in professional development schools (Brush, Glazewski, Rutowski, Berg, Stromfors, Van-Nest, Stock, & Sutton, 2003). While surveys and questionnaires indicated that faculty and preservice teachers learned how to use several technologies during this grant, project directors also wanted to ensure that these skills could be applied to classroom learning and instruction; technology skills do not necessarily equate with technology integration. Many PT3 projects presented similar findings (e.g., Claxton & Bedford, 2003; Graham et al., 2004; Resta et al., 2004; Strudler, Archambault, Bendixen, Anderson, & Weiss, 2004).

Theme 3: Importance of personalized technology support

While most teacher education faculty and students agree that technology integration is essential for student success, few feel prepared to integrate it into their classrooms (Claxton & Bedford, 2003; Persichitte et al., 1997). PT3 projects provided this support through technology training workshops, technology courses, lecture series, collaborative partnerships and collaborative exchanges between grant programs. These supports were also facilitated in many projects by allowing education faculty, preservice teachers and school mentors to pursue technology integration through personally meaningful projects founded upon hands-on activities and actual practices (DePaepe, 2005; Jonas, 2004; Nave, 2004; Waddoups, Wentworth, & Earle, 2004).

While these supports aided technology integration, many reports suggest that one-on-one technology support for education faculty, preservice teachers and clinical instructors can be valuable in curriculum redesign. Of the PT3 projects meeting requirements for inclusion in this paper, eight directly mentioned the need for one-on-one support to integrate technology into academic courses and field experiences (Jenkins, 2005; Diggs et al., 2001; Jonas, 2004; Ludwig & Booz, 2001; Nave, 2004; Resta et al., 2004; Strudler, et al., 2004; Waddoups et al., 2004;). In addition to these eight programs, others hinted at such practices but did not explicitly mention one-on-one support — instead described support staffs that consisted of university students and technology-savvy teachers and faculty (Brush et al., 2003; Claxton & Bedford, 2003; DePaepe, 2005). Indeed, the majority of projects in our study relied on support personnel to help individual faculty and preservice teachers learn technology skills, design lessons around these technologies and incorporate them in classroom settings.

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PT3 projects engaged in one-on-one support using several unique methods, all of which appeared to be successful. One common method included placing education faculty, partnership members, preservice teachers and technology savvy students into curriculum design teams and letting them rely on their collective expertise to tackle integration problems. By supplementing the knowledge and perspectives experienced by each team member with additional mechanisms indicated above, teams were able to support each other in personally relevant curriculum redesign activities (Diggs et al., 2001; Ludwig & Booz, 2002; Waddoups et al., 2004; Wentworth, Waddoups, & Earle, 2004). Another common method involved the formation of an internal technology support team composed of students and faculty (Brush et al., 2003; Diggs, et al., 2001; Graham et al., 2004; Ludwig & Booz, 2001; Nave, 2004; Resta et al., 2004; Strudler et al., 2004; Wentworth et al., 2004). Unlike curriculum redesign teams, these individuals served the needs of the entire program, making technology suggestions, planning and implementing workshops and facilitating technology-rich field experiences among preservice teachers. Finally, some programs hired external technology mentors to oversee faculty and preservice teacher technology integration and training (Claxton & Bedford, 2003; Collin County Community College, 2005; Jonas, 2004). Similar to the previous method, these individuals coordinated technology support for the entire program but did not exist within the university prior to the grant.

Additionally, combinations of these support methods were often available within the same institution to different groups of people. For example, some programs placed technology mentors in public school settings to aid cooperating teachers and student teachers. The same programs hired university students to help faculty and preservice teachers in department settings. One program even mentioned the importance of informal faculty communication in the hallway as a means to keep ideas flowing and moral high (Waddoups et al., 2004). Regardless of methods, one-on-one technology support was a necessary part of curriculum redesign and technology integration as addressed by most programs we reviewed.

Theme 4: The design of comprehensive initiatives

A number of PT3 projects supported comprehensive initiatives that aimed to impact faculty in the arts and sciences, teacher education faculty, preservice teachers and K-12 inservice teachers. These comprehensive projects each had slightly different goals. These included supporting faculty in course redesign, developing technological skills, building preservice teachers' capacity to integrate technology in K-12 schools and increasing the amount of technology used in SCDEs.

These comprehensive projects employed a variety of approaches, such as workshops, one-on-one mentoring, assistance with course redesign and the development of course materials. Table 1 describes the comprehensive projects that met the standards for inclusion in this study.

Impact on faculty. These comprehensive PT3 projects impacted both arts and sciences and teacher education faculty. Workshops were used in each of the comprehensive projects to support faculties' skills with and uses of technology. Workshops alone have been cited as relatively ineffective professional development approaches (Loucks-Horsely, Love, Stiles, Mundry, & Hewson, 2003). However, these projects combined workshops with one-on-one mentoring, assistance with co-planning and other support that was individualized to meet faculty members' needs.

These multi-faceted approaches showed promise in developing teacher educators' technology skills. The InTime project at the

Project Name/ Institution	Goals	Primary Activities
InTime, University of Northern Iowa	Provide resources for methods faculty to include models of technology integration in their courses.	Development of videos of exemplar cases of technology integration. Methods faculty attended workshops to learn about these cases and used these in their courses.
Pittsburg State University	Build technology fluency among faculty, preservice teachers and cooperating teachers.	Workshops, one-on-one mentoring to help redesign courses to include more technology-rich activities in both the arts and sciences and teacher education.
University of Massachusetts at Lowell	Increase the amount of modeling of technology integration in SCDEs and support technology-rich field experiences.	Workshops and one-on-one mentoring for faculty as well as assistance with course redesign.
University of Missouri	Increase the amount of instructional technology used by teacher education faculty and preservice teachers.	Workshops and one-on-one mentoring to help faculty integrate more technology in their methods courses. Preservice teachers were paired with K-12 teachers to observe, design and implement technology-rich instruction.
University of Nevada-Las Vegas	Provide preservice teachers with experience with technology integration in course activities and field experiences.	Workshops and one-on-one mentoring with faculty. Minigrants to support the development of technology-rich course activities. Activities supporting preservice teachers' integration of technology in their field experiences.

Table 1. Comprehensive PT3 initiatives

University of Northern Iowa provided teacher education faculty with video-based exemplar cases of technology integration to use in methods courses. On a post-survey, faculty reported that they integrated technology 35% more than previously and that they were assessing preservice teachers' technology skills 36% more (Krueger, Boboc, Smaldino, Cornish, & Callahan, 2004).

At the University of Missouri, faculty who participated in workshops and a mentorship program participated in a pre-project and post-project survey. Faculty reported statistically significant gains in their technology skill in communication, inquiry-based learning, feedback and metacognition, and problem-solving skills (Howland & Wedman, 2004). Pittsburg State's efforts to enhance the technology skills of both arts and sciences and teacher education faculty resulted in increases in all areas on a survey that gauged faculty's perceived technology fluency (Mills, 2003).

Impact on preservice teachers. Preservice teachers also benefited from these comprehensive programs. Comparisons between preservice teachers' pre-project and post-project surveys at the University of Missouri reported statistically significant gains in regards to their technology skills related to inquiry-based learning, feedback and metacognition, and some areas of communication. One preservice teacher in the InTime project reported, "Because of these learning experiences, I have a better understanding of what it means to integrate technology into the classroom" (Krueger et al., 2004, p. 204). InTime faculty reported that 51% more preservice teachers were proficient in integrating technology into general lessons than prior to the project and that 42% of preservice teachers were proficient at integrating technology into the curriculum (Krueger et al., 2004).

Impact on methods courses. The comprehensive projects included in this study incorporated efforts to integrate technology more into their courses. This integration took on numerous forms, including the use of video cases, web-based discussion boards and activities where preservice teachers designed technology-rich instruction for K-12 students. At the University of Massachusetts at Lowell, 6 of the 18 methods courses (33%) met the target level of technology integration on a rubric designed by the project staff (Boccia, 2003). At the University of Nevada-Las Vegas, seven faculty redesigned their courses to integrate technology into their methods courses (Strudler et al., 2003). In the InTime project, while the focus was on video cases, faculty reported using more technology, such as online discussion boards, e-mail and simulations of classroom interactions (Krueger et al., 2004).

Impact on K-12 inservice teachers.

These comprehensive projects also impacted K-12 inservice teachers. K-12 teachers in the University of Nevada at Las Vegas project were given workshops to develop their technology integration skills. The project directors planned to pair preservice teachers with technology-rich inservice teachers. However, the lack of inservice teachers who used technology limited the intended partnership (Strudler et al., 2003).

"Following … workshops, lectures and hands-on activities, many faculty and pre-service teachers required additional support to apply the technologies effectively to classroom activities."

Preservice teachers at the University of Massachusetts at Lowell reported on a survey that only 21% of the clinical instructors integrated technology into their teaching (Boccia, 2003). However, the pre-service teachers who rated their clinical instructors as high-level integrators of technology reported that they had high levels of comfort with using and integrating technology. Boccia (2003) concluded that, "Placing student teachers with technology-proficient mentor teachers in the partner districts was not a priority" (p. 9).

Implications

Consistent with current literature and based on the PT3 projects that we reviewed, it appears that integrating effective uses of technology in methods courses and K-12 instruction involves several strategies. These may include learning basic technology skills including what technologies are available and what they do, gaining hands-on access to these technologies and being able to explore their features and functions, seeing these technologies modeled in curricular activities, designing and implementing technology-rich lessons and obtaining personalized support throughout this learning/implementation process. These approaches are essential in developing basic technology competency as well as technology integration skills. The implications of both of these will be discussed further.

Development of technological competency

In order for teachers to use technology in their classrooms, they must first learn which technologies are available to them. Many PT3 projects facilitated faculty, preservice and inservice competency about available technologies through workshops and other hands-on activities. These activities appear to be effective in raising awareness about available resources. Yet, this knowledge must be supplemented with one-on-one support by individuals who are, at a minimum, committed to technology integration and preferably have mastered the technology in question. Furthermore, these mentors/coaches should focus on the needs and interests of individual faculty and preservice teachers rather than rely on scripted or generic instruction. Because faculty, preservice and cooperating teachers enter education programs with varying levels of technological proficiency, technology facilitators should be able to quickly assess their needs and tailor instruction and support based upon them. PT3 projects throughout the United States have shown the effectiveness of using surveys and questionnaires to track technology proficiency over time. Teacher education programs should continue to use these instruments as they tailor support to meet the needs of their learners.

"Mentors/coaches should focus on the needs and interests of individual faculty and preservice teachers rather than rely on scripted or generic instruction."

Aside from gaining an understanding of current technologies, educational faculty and preservice teachers should also be cognizant of technologies available in K-12 settings and how their functions compare with those available in the teacher education program. Furthermore, these technologies must be modeled in field experiences and methods courses to show preservice teachers how they may use these resources for instructional purposes. As described in our findings, future teachers cannot be expected to integrate technology in their classrooms by merely teaching them how to use these resources. They also need to learn how to integrate these technologies with teaching practices.

Development of integration abilities

Aside from instructing education faculty and preservice teachers how to use current technologies, PT3 projects examined also included efforts to integrate technology into both university level and K-12 teaching. Moving beyond skills acquisition, these projects focused on support for technology-rich lesson development and implementation. The InTime project, for example, provided preservice teachers and teacher education faculty with video-cases of exemplar technology-rich lessons (Krueger et al., 2004). The project at the University of Nevada at Las Vegas paired several preservice teachers with inservice teachers who effectively integrated technology in their teaching (Strudler et al., 2003). In both projects, education and inservice faculty helped preservice teachers go beyond preservice teacher use of technology by modeling effective classroom practices and individually supporting preservice teachers' experimentation and implementation of personally relevant, technology-rich lessons.

Professional development literature advocates programs that are based on contemporary views of learning (National Partnership for Excellence and Accountability in Teaching, 2000), specifically constructivist views (Putnam & Borko, 2000). While most recommendations for professional development are tailored for K-12 teachers, these approaches are relevant to professional learning for university faculty as well (Howland & Wedman, 2004). Faculty, preservice teachers and inservice teachers should be allowed to participate in activities that are similar to what they expect to teach and consider how these activities could be used in their own teaching (Loucks-Horsely et al., 2003). Clearly, for faculty, preservice and inservice teachers to learn how to integrate technology, professional development activities must go far beyond simply showing teachers how to use technology.

Future research

The projects examined in this study set forth the goals of increasing the amount of technology used by faculty, preservice teachers and inservice teachers. However, there was discontinuity in some projects between the goals of enhancing participants' technology skills and preparing participants to integrate technology in meaningful ways in their classroom.

ISTE established standards specifically delineate technology competencies that teachers should have (ISTE, 2000a, 2000b). These standards advocate teachers employing technology as a tool for communication, problem solving, productivity and research (ISTE, 2000a). These recommendations echo the sentiments of scholars (Bransford, Brown, & Cocking, 2000; Cognition and Technology Group at Vanderbilt, 1997; Hannafin, 1992; Papert, 1993). While the PT3 projects examined here effectively enhanced the attitudes and skills of faculty, preservice teachers and inservice teachers in regards to technology, little evidence exists about these participants' prolonged ability to integrate technology into their classroom.

Future research studies should be designed to examine participants' integration of technology in both their university courses, K-12 field experiences and into induction. Additionally, research questions that inquire about participants' teaching practices require methodologies that extend beyond survey data (Guskey, 2000). Such methodologies would include classroom observations and analysis of participants' specific uses of technology in their teaching.

Conclusion

The integration of technology into the school curriculum has the potential to improve the quality of teaching and learning. However, this potential will not emerge without educators considering how computer use relates to the process of learning and learning environments in schools (Ertmer, 1999; Schank & Cleary, 1995). Having basic computer literacy is not enough. Teachers should understand the connections between technology and learning and use this understanding to bring the two together in such a manner that makes each indispensable to teaching and learning (Lowther, Bassoppo-Moya, & Morrison, 1998).

If teacher educators ignore the impact of computers and fail to adequately prepare preservice teachers, then our programs will once again be accused of failing to serve the real needs of classroom teachers (Anderson, 1983; Office of Technology Assessment, 1995). Our future teachers must be prepared in today's world to meet tomorrow's challenges. Those who teach today's children are equipping the Cyberspace citizens of tomorrow (Wakabayashi, 1997). Seymour Papert (1993) saw this impact in terms of evolution, not revolution brought about by a reform. He believed that students have not only attained a new kind of sophistication about technology but also about ways to learn and new methods of research. In order to prepare teachers to effectively use technology in their classrooms, they must be exposed to effective practices within their methods courses, and be continuously supported as they develop and implement their own technology-rich lessons.

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