Implementing Partnerships Across the Curriculum with Technology

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Abstract

As the number of computers accessible to students and teachers has increased, there has been a growing emphasis on integrating technology across the curriculum. Even though schools increasingly invest in new technologies, the actual use of computers in classrooms remains limited. This paper examines a model developed to guide the implementation of a Preparing Tomorrow's Teachers to use Technology (PT³) project and its capacity to promote improvement of teachers' ability to integrate technologies into their instructional practice. The essential conditions, identified by ISTE, provided the foundation on which this model was developed. Emphasis was placed on access, professional development, support, incentives, and assessment, with the remaining conditions embedded within. The findings indicate that the model was effective in improving teachers' technical skills and their ability to integrate technology into instructional practice.

INTRODUCTION

As the number of computers accessible to students and teachers has increased, there has been a growing emphasis on integrating technology across the curriculum. Even though schools increasingly invest in new technologies, the actual use of computers in the classroom remains limited. Researchers have identified numerous barriers to teachers' use of computers, including limited or outdated access to hardware and software, inadequate skills, minimal support, time constraints, and lack of interest or knowledge (Berg, Benz, Lasley, & Raisch, 1998; Clark, 2000; National Center for Educational Statistics, 1999; Schrum, 1999).

Many have recognized the demand for teachers who are capable of integrating technology into instruction. Yet some researchers (Schrum, 1999; Sprague, Kophman, & Dorsey, 1998; Strudler & Wetzel, 1999) emphasize that many teachers feel unprepared to meet the challenge. In 1999, the National Center for Education Statistics (NCES) reported that 79% of teachers identified technology as one of three areas about which they needed the most information. In 2001, the NCES found that only 33% of teachers felt ready to use computer-related tools in the classroom, while even fewer (20%) felt well prepared to integrate technology into instruction.

In 1999, in answer to this serious lack of preparation for the use of technology to enhance instruction, the U.S. Department of Education funded the Preparing Tomorrow's Teachers to Use Technology (PT³) initiative (http://www.pt3.org). PT³ is based on the principle that teachers must be capable of creating and delivering high-quality, technology-enhanced lessons to improve student learning. With this in mind, a model was designed to guide the implementation of a PT³-funded project at The University of Tennessee titled Implementing Partnerships Across the Curriculum with Technology (ImPACT, 2001–2004) (http://web.utk.edu/~impact).

Project ImPACT partnered with five area schools, with ongoing relationships with the teacher education program, and included preservice teacher interns, their mentor teachers, and teacher education faculty supervisors. The teacher education program is a five-year curriculum whose graduates receive a baccalaureate degree from the College of Arts and Sciences with a minor in elementary or secondary education. The final year is an internship during which preservice teachers complete license requirements under the supervision of a mentor teacher and a teacher education faculty supervisor. The mentor teacher is vital to the development of the preservice teacher. Abbot and Farris (2000) stressed that preservice teachers learn to integrate technology through working with and observing veteran teachers and students during classroom activities and that preservice teachers must be placed with exemplary users of technology. This study investigates to what degree participation in Project ImPACT has produced improvement in mentor teachers' use of technology. The following questions have guided the inquiry:

1. To what extent has participation in Project ImPACT been associated with an increase in the ability to integrate technologies into instructional practice of mentor teachers?
2. To what extent has participation in Project ImPACT been associated with an increase in the technical skills of mentor teachers?

CONCEPTUAL GROUNDING FOR MODEL

Research findings on effective strategies for technology integration have provided direction for the development of the model. Multiple barriers, such as those presented in the Introduction section of this paper, have repeatedly hindered the success of such models. To help institutions overcome these obstacles, the International Society for Technology in Education (ISTE), a professional organization dedicated to increasing the effective use of technology, has identified 10 "prerequisite factors or essential conditions that must be present in every phase of an aspiring teacher's education" to enable teachers to create learning situations that include the powerful uses of technology (ISTE, 2002, p. 16). These conditions are: shared vision, access, skilled educators, professional development, technical assistance, content standards and curriculum resources, student-centered teaching, assessment, community support, and support policies.

Additional studies support ISTE's conditions as necessary for successful integration. Significance has been placed on accessibility, which appears to be improving nationally. Statham and Torell (as cited in Ringstaff & Kelly, 2002) suggested that, in order to achieve universal access, there should be a 5:1 ratio of students to computers in classrooms. In a study conducted in the fall of 2001, NCES reported that the national average of student-computer (with Internet access) ratio was 5.4 students per computer (National Center for Educational Statistics [NCES], 2001). Although many schools may appear to have achieved universal access, a closer look reveals that many classroom computers are outdated and thus incapable of running current software programs, or lack important hardware components. Additionally, many of the computers are underused or used improperly. In order to realize the potential of technology, teachers must have access to current technologies, software, telecommunications networks, and technology-equipped classrooms (ISTE, 2002). While studies have not determined the optimal number of computers in a classroom, clearly students need easy, reliable, and frequent access (Ringstaff & Kelly, 2002), which is affected by the location of computers (NCES, 1999; Statham & Torell, as cited in Ringstaff & Kelly). Computers may be centrally placed such as in a lab, distributed into classrooms, or arranged in a combination of the two. Research reveals that students with access to computers in their classroom show more improvement than students without such access (Ringstaff & Kelly). This is also true for their teachers (Mann, as cited in Ringstaff & Kelly). Although adequate access is undoubtedly a key to integrating technology, unless teachers are adequately trained, little achievement is possible.

For more than a decade researchers have concluded that the success or failure of technology integration is dependent on teacher training and that such training must have certain characteristics (Coley, Cradler, & Engel, 1997; Dyrli & Kinnaman, 1994; Munday, Windham, & Stamper, 1991; Office of Technology Assessment [OTA], 1995; Sandholtz, 2001; Sheingold, 1991; Siegel, 1995; Silverstein, Frechtling, & Miyoaka, 2000; Sivin-Kachala & Bialo, 2000). Former methods of professional development, often characterized by one-shot workshops, have completely failed to enable teachers to use technology as instructional tools (Benson, 1997; NCES, 1999). This finding is further supported by the 10-year Apple Classrooms of Tomorrow (ACOT) study in which, Sandholtz, Ringstaff, and Dwyer (1997) determined that in lieu of one-shot workshops, teachers must experience technology in a variety of settings. Newer methods include site-based training to allow teachers to develop understanding in realistic settings with authentic learning tasks (Ringstaff & Kelley, 2002). Furthermore, training must be consistent and spread over time so that teachers may strengthen skills and create methods of using technology with the curriculum (Beyerbach, Walsh, & Vannatta, 2001; Faison, 1996; Northrup & Little, 1996; Vannatta, 2000; Warner, 1996). Teachers need professional development that employs hands-on active learning (Ringstaff & Kelly, 2002), is directly aligned with curriculum goals, and allows for follow-up support in their classrooms (ISTE, 2002; Roblyer, 2003). Exploring the technology, reflecting on learning, and collaborating with peers promote their knowledge and confidence (Ringstaff & Kelly, 2002). Teachers must feel comfortable with technology before they can include it into instructional situations. Essentially, researchers (Sandholtz, 2001; Sandholtz et al., 1997) suggest that the principles that guide learning environments for children also apply to teachers.

Although access and professional development are basic for successful integration, support needs are just as fundamental. Categories described in the literature include technical, instructional, administrative, and community. Technical support must be consistently available because teachers rarely have the time or troubleshooting skills necessary to attack problems. Thus, schools must be willing to place technical staff on site. Sandholtz et al. (1997) reported that the needs of teachers change as they become more proficient with technology. The ACOT study revealed that as teachers learn more, they need not only technical but also instructional support that may be offered through teaming with each other and/or with staff (OTA, 1995; Ringstaff & Yocam, 1995; Vannatta & O'Bannon, 2001), pairing with mentors or coaches (Benson, 1997; Smith & O'Bannon, 1999; Thompson, Hansen, & Reinhart, 1996), and sharing information with colleagues (Oliver, 1994). Becker and Riel (2000) concur that teachers who are involved in collaborative planning and sharing their strategies for technology integration with colleagues are the most effective in the use of computers in the classroom. The support offered by administrators and the community is vital to the success of technology integration (Norum, 1997; Rice, Wilson, & Bagley, 2001). The ACOT study reinforced the necessity of administrative support. When the teachers in the study returned to their classrooms, the most crucial element to their success in integrating technology into the curriculum was the level of support they received from administrators (Sandholtz et al., 1997). Rice et al. (2001) concluded that one of the most difficult barriers reported by the teacher in their study was overcoming beliefs about traditional methods by administrators and parents.

Encouraging teachers to learn how to integrate technology into their teaching is a major challenge because of the demands of time involved in learning, developing, and implementing technology (Northrup & Little, 1996). Reward structures or incentives, such as release time and extra pay, encourage teachers to invest this time (Bitner & Bitner, 2002; Lee & Johnson, 1998).

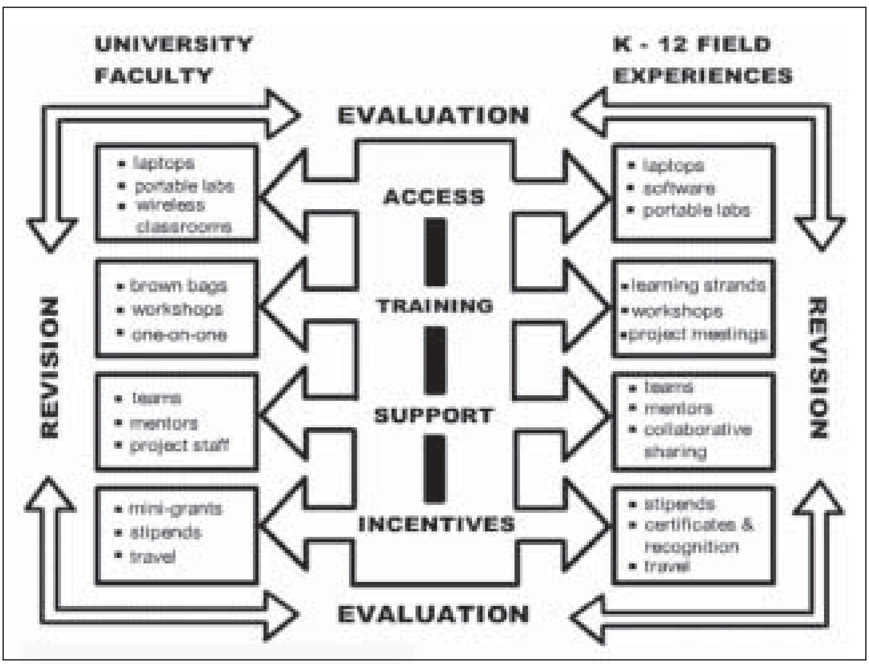

Figure 1: Project ImPACT Model

Drawing upon the 10 essential conditions identified by ISTE, we designed a multi-component model (see Figure 1) that we reasoned would develop new teachers who are capable of infusing technology into the curriculum to enhance student learning. Emphasis was placed on access, professional development, support, incentives, and evaluation; however, the remaining conditions were embedded within the model and assisted achievement of project goals.

METHODOLOGY

Participants and Context

Project ImPACT was developed in partnership with five K–8 public schools located in three counties in eastern Tennessee. These schools serve the teacher education program as placement sites for teacher interns. Of the five schools, two elementary schools are located in rural communities and serve approximately 700 predominately White students. Of the student populations in these schools, more than 60% qualify for free or reduced lunch. Two other elementary schools are located in a metropolitan area and serve diverse populations of students, with more than 75% eligible for free or reduced lunch. The fifth school is a large suburban middle school serving 1,200 predominantly White students.

During the academic years of 2001–2002 and 2002–2003, 50 individual teachers (25 each year) from the partner schools volunteered to participate in this project under the direction of the authors. In accordance, they each agreed to serve as a mentor teacher to one teacher intern for a year and participate in all project activities. A total of 50 teachers were in the sample; 47 of these teachers were female and three were male. Of these teachers, 76% practiced in elementary and 24% in middle school settings. On average, participants had been teaching for 17 years ($SD = 8.80$) and had been employed in the partner school for 12.23 years ($SD = 7.63$). Thirty-two percent held bachelor's degrees, 64% master's degrees, and 4% doctoral degrees.

Model Components

The Project ImPACT model was designed to bring about sustained changes in the teacher preparation program in both university coursework and the schools that serve as training sites for preservice interns. In accordance with the model, conditions were set up for access, professional development, support, incentives, and evaluation. An in-depth discussion of the conditions and how they facilitated improvement in teachers follows.

Access. Although access to technology in field sites is improving nationally, the "outdated and underused" situation suggested by NCES (1999) were characteristic in the classrooms in this study. At the onset of the project, all classrooms were equipped with a teacher station connected to a TV and the Internet, yet there was wide variation in the numbers, types, and ages of computers available for student use. As part of the project partnership agreement, each school increased budget allocations for technology. Over the two-year project period, these increases were used for classroom computer and software upgrades and small equipment purchases for digital cameras, printers, and scanners, with participating teachers receiving priority. In addition, three of the schools purchased multiple mobile computer carts, which were available for check-out. Finally, the project loaned each intern a laptop computer equipped with software and a network card, plus a printer and zip drive for use during the project year, adding additional access for implementation purposes during instruction. Through this increased access students had easy, reliable, and frequent access as suggested by Ringstaff & Kelley (2002).

Professional development. Professional development was a principal feature of the model to create a corps of skilled educators in the schools, as suggested by ISTE, who serve as models, mentors, and guides for developing teachers. According to researchers (Sprague et. al, 1998; Wetzel, 1993), the vision of how to use technology in the curriculum is a great obstacle in technology integration efforts. Accordingly, creating this vision was paramount in the training approaches that were implemented. To avoid teaching technology in isolation of curriculum, each school was asked to identify curriculum areas of the highest priority for its local population. Literacy, math, science, and special education were identified, and consequently provided the direction for training approaches. Participants received a variety of training approaches that were curriculum-based, hands-on, spread throughout the project period, and provided modeling of technology integration. Training was provided in large group, small group and individual formats through face-to-face delivery. The principal method of professional development for mentor teachers was participation in site-based Technology Learning Strands that consisted of five three-hour sessions spread over fall semester and led by a technology-using teacher. At the conclusion of the training period, teachers developed student-centered, technology-enhanced lessons that align with state curriculum standards and ISTE's National Education Technology Standards for Students (NETS•S), and provide adaptations for students with special needs. Lessons were implemented during each spring semester and are featured at the Lesson Plan Library at http://www.teach.utk.edu.

Support. In keeping with research findings, participants were supplied technical, instructional, and administrative support. Technical assistance was made available by technology coordinators as well as project staff. Each partner school employed a full-time technology coordinator whose job included providing technical assistance to teachers. In addition, the project coordinator and several graduate assistants made weekly visits to each school to contribute support to participants throughout the project year.

Instructional support was offered through classroom visits by project staff as well as teaming strategies, pairing with mentors, and collaborative sharing. Teaming strategies provided the frequency, breadth, and depth of collaboration with colleagues stressed by Becker & Riel (2000). Each intern was teamed with a mentor teacher who modeled and encouraged the effective integration of technology. Further, this pair became part of a Learning Team, comprised of other intern/mentor pairs at the school, the tech coordinator, school administrator(s), and the university faculty supervisor. These teams worked together to explore and develop best practices in the use of technology that tie into unique goals and needs.

Opportunities to share information with colleagues within and beyond one's school as suggested by Becker and Riel (2000) were plentiful throughout each year at project conferences, team meetings, school meetings, and through online connections. Interns and teachers shared ideas for technology integration with their colleagues at the mid-year Team Sharing Conference and the year-end Technology Showcase. In addition, monthly team meetings served as auxiliary sharing, training, and planning sessions. Additional experiences, which promoted the reach of the project, included the sharing of lessons in faculty, PTA, and school board meetings. Participants also used online connections to share ideas for technology integration as they entered lessons into the online Lesson Library.

Schools in the partnership had demonstrated, through previous alliances, their keen interest in the teacher education program and the desire to improve technology use in their classrooms. Prior to finalizing the partnership, the authors met with each building administrator to explain expectations and the support needed from their offices. This administrative support was provided through increased budgets for technology and participation in project activities.

Incentives. Each teacher committed to a variety of responsibilities that required a substantial investment of time. Therefore, reward structures, as suggested by Bitner and Bitner (2002) and Lee and Johnson (1998), were built into the ImPACT model, and included stipends, travel, certificates, recognition, and graduate credit. Stipends of $1,500 were awarded to each teacher, while smaller awards such as scanners, remote keyboards and mice, flash drives, software, and books with integration ideas were awarded as door prizes during project meetings. Opportunities for travel to state and national technology conferences were available to mentor teachers who excelled in their efforts to infuse technology into the curriculum. Each teacher who successfully fulfilled all project responsibilities was awarded a Certificate of Accomplishment for Technology Infusion at the year-end Technology Showcase. In addition, participating teachers were recognized as exemplary technology-using teachers at their school sites. Finally, a course was designed, *Integration of Technology into the K–8 Curriculum*, and mentor teachers were offered three hours of graduate credit for work completed during the project year. Requirements included full participation in all project meetings and training, development of technology-enriched lessons, and the creation of a teaching portfolio.

Data Collection and Analysis

Evaluation activities were conducted throughout the project period and included both quantitative and qualitative measures to adequately understand the effectiveness of the model. The method employed for the process evaluation combined an analysis of documents and focus groups conducted by an external evaluation team and interviews and observations conducted by project staff. All mentor teachers participated in focus groups that were held at each of the participating schools at the conclusion of each project year, were semi-structured in nature, and focused on each component of the project model. Focus group interviews have proven an effective methodology as they (a) generate large amounts of data in a short amount of time, (b) are well suited to questions that examine participants' experiences and perspectives, (c) produce new data and insights that might not occur through individual interviews alone, and (d) result in research findings that can stand alone or be combined with other sources of data as part of a comprehensive evaluation (Morgan, 1988; Stewart & Shamdasani, 1990). Probing was used to expand and clarify responses. Project outcome measures included pre-post surveys completed by mentor teachers. A description of the surveys follows.

Mentor Teacher Educational Technology Survey

To measure the degree of improvement in technology integration and technical skills, mentor teachers completed a survey at the beginning and end of each project year. This instrument was designed with two sections (see Appendix) and was based on the ISTE Technology Performance Profiles and adapted from the ISTE surveys at Profiler (http://profiler.hprtec.org/). First, mentor teachers responded to 10 items that indicated their current practice of technology integration. The second section related to technology tools and participants responded to 13 items that rated their technical skills in using various technology tools. All items used a four-point Likert scale ranging from 1 (Not at All) to 4 (Can teach others). In addition, teachers were asked to rate, on a scale from 1 (beginner) to 3 (advanced), their technology expertise and ability to integrate technology into classroom instruction. The internal reliability (Chronbach alpha) of the 25-item survey was found to be .97. The responses from the two years were compared and found to have no noticeable differences, so the data were combined for this report. A total of 25 pairs of contrasts were used in this study. To control Type I error rate for each contrast, the alpha had to be adjusted accordingly (Kirk, 1982)—by dividing the nominal value of 0.05 by the number of pairs of contrasts (25); in this case: 0.05/25 = 0.002.

Exit Survey

Teachers completed a 14-item self-designed exit survey assessing the importance of the four components of the model for integration of technology into their teaching. Teachers rated each item on a five-point scale ranging from 1 (not important) to 5 (very important). Items addressed the importance of having access (e.g., laptop, software), support (e.g., tech coordinator, project staff, team meetings, collaborative sharing), professional development, and incentives for integrating technology.

RESULTS

Technology Use and Integration

Table 1 presents the mean scores and the standard deviations on the pre- and post-survey items on teachers' ability to integrate technologies into their instructional practice. Descriptive statistics indicate that classroom technology use and integration are fairly low among teachers at the beginning of the project. In the post-survey items, progress was impressive; none of the items had a mean score of less than 2. However, their posttest scores did not exceed the confident criterion (3.00) on any of the technology indicators.

Table 1. Mean Pre and Posttest Scores on Technology Use and Integration

Technology Indicators	Pretest		Posttest		S.M.D. Effect Size	Paired *t*-test
	M	*SD*	*M*	*SD*		
1. I plan lesson sequences that effectively integrate technology resources and are consistent with current best practices for integrating the learning of subject matter and student technology standards.	1.87	.95	2.90	.80	1.07	*
2. I plan technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and/or creation of original products.	1.84	.90	2.91	.76	1.19	*
3. I plan for the management of student use of technology resources as part of classroom operations and in specialized instructional situations.	2.02	.84	2.91	.70	1.06	*
4. I implement technology-enhanced learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.	2.02	.88	2.88	.62	.98	*
5. I implement the management of student use of technology resources as part of classroom operations and in specialized instructional situations.	2.11	.78	2.71	.59	.77	*
6. I implement a variety of instructional technology and grouping strategies.	2.06	.87	2.79	.73	.84	*
7. I teach students methods and strategies to assess the validity and reliability of information gathered through technological means.	1.57	.86	2.23	.73	.77	*
8. I evaluate the management of student use of technology resources as part of classroom operations and in specialized instructional situations.	1.91	.78	2.63	.61	.92	*
9. I guide students in applying self and peer assessment tools to critique student-created technology products and the process used to create those products.	1.46	.70	2.32	.71	1.23	*
10. I facilitate students' use of technology that addresses their social needs and cultural identity and promotes their interaction with the global community.	1.63	.87	2.37	.72	.86	*

*$p < .002$.

Note. Each domain includes four performance levels, with three considered "confidently."

Significant differences were found between pre and posttest scores on all of the technology use and integration indicators. Effect sizes were calculated to provide an indication of the practical meaningfulness of the results as well as compare results across outcomes and independent variables measures in different metrics (Kirk, 1996). The standard mean difference (SMD) effect provides an estimate of the magnitude of the result independent of n-size. The SMD effect size was calculated by dividing the mean difference for each variable by the pretest standard deviation. According to Cohen (1988), an effect size of .2 is small, .5 is medium, and .8 is large. Overall, 8 of the 10 items produced large effect sizes. Medium effect sizes were obtained for 2 items: "Implementing the management of student use of technology resources as part of classroom operations and in specialized instructional situations" and "Teaching students methods and strategies to assess the validity and reliability of information gathered through technological means."

In addition, significant differences were found between pre and posttest scores of teachers' self-rating on their technology expertise and ability to integrate technology into classroom instruction. At the beginning of the year, approximately 46% of teachers rated themselves as a beginner in technology expertise, while 60% rated themselves as a beginner in their ability to integrate technology into classroom instruction. In contrast, at the end of the project year, only 17% rated themselves as a beginner in technology expertise and 21% rated themselves as beginners in technology integration. Additionally, 19% of teachers rated themselves as advanced in their ability to integrate technology at the end of the project year. Significant differences were obtained for both items.

Technical Skills

Table 2 presents the comparison of teachers' technical skills with various technology tools over time. At pretest, mentor teachers were approaching the confident level on only four items (word processing, basic computer operation, e-mail, and search tools). By the posttest, mentor teachers' averages on all technology tools exceeded three (considered confident) on four of 13 tools and were approaching the confident level on two items. The standard mean difference (SMD) effect size was again calculated by dividing the mean difference for each variable by the pretest standard deviation. Overall, only presentation software produced large effect sizes (1.02). A medium effect size was obtained for multimedia software, search tools, Web page construction, e-mail, and graphics. Small effect sizes were noted for mailing lists, basic computer operation, word processing, and spreadsheet. Significant increases in computer use were found between pre and posttest scores except in the use of databases, educational software, and assistive devices.

Evaluation of the Model

Data from the focus groups and exit survey were used to evaluate the different components of the model. In addition, valuable feedback from the focus groups allowed us to refine the components of the model further to address teachers' concerns and needs. Responses to the focus group questions were unitized on the basis of specific conditions that encourage the use of technol-

Table 2. Mean Pre and Posttest Scores on Technology Proficiency

	Pretest		Posttest			
	M	*SD*	*M*	*SD*	S.M.D. Effect Size	Paired *t*-test
Computer Use						
Basic computer operation	2.89	.80	3.26	.71	.46	*
Word processing	2.95	.78	3.30	.79	.45	*
Database	1.84	.84	2.17	.93	.39	
Spreadsheet	1.89	.92	2.30	.94	.45	*
Graphics	1.80	.91	2.33	.97	.58	*
Presentation software	1.93	1.00	2.95	.87	1.02	*
Multimedia software	1.93	.88	2.56	.89	.72	*
Educational software	2.46	.81	2.80	.83	.42	
Assistive devices	1.46	.67	1.69	.76	.34	
Internet Use						
E-mail	2.89	.82	3.39	.61	.61	*
Mailing lists	1.57	.92	2.00	.90	.47	*
Search tools	2.82	.88	3.43	.54	.69	*
Web page construction	1.20	.65	1.61	.86	.63	*

*$p < .002$.

Note. Each domain includes four performance levels, with three considered "confidently."

ogy in their teaching expressed by respondents. One-half of these statements were selected at random and categorized using the constant-comparative methods described by Glaser and Strauss (1967). Themes that emerged that aligned with the essential conditions on which the model was developed were access, professional development, and support. The exhaustiveness of these categories was then assessed by attempting to group the remaining statements into one of the categories. More than 96% of the statements fit into one of the existing categories. Some statements could not be categorized due to their ambiguity, their reference to general technology use rather than integration of technology, or both. These statements were omitted from further analysis.

Access to technology was vital to the change brought about in the practice of employing technology in instruction for the mentor teachers. They reported that many of their computers were old and would not run current software programs. Teachers also pointed out that having access to the software used in training allowed them to support each other as well as the interns. The addition of cameras, scanners, and printers offered new opportunities for instruction. The laptop supplied to the intern made a huge hit with teachers, as they said that it allowed for small group work that would otherwise be prohibitive. Teachers reported that the portable carts allowed computer access to greater numbers of students at one time, thus bringing computer activities that were once only completed in centers into the full classroom. The increased use of technology shifted to the remaining teacher population as the year progressed and access to the new portable technology in the buildings grew to be quite competitive among the teachers. This indicates that teachers increased the use of technology in their classrooms. One participant voiced the impact that new access had on the possibility of integrating technology, "Before the project some [of the] teachers had computers that were 10 years old and wouldn't run current software. Having [the] new workstations, intern laptop, and portable carts made the use of technology in the classroom possible."

Teachers agreed that having professional development activities in the field sites with school equipment and software was conducive to building their confidence for using technology in their classrooms. One teacher quickly expressed her increased confidence by saying, "My involvement in Project ImPACT has taken away the fear of implementing technology in my classroom." Additionally, professional development efforts with teachers resulted in changes in students. Marked changes were noted by teachers in the areas of student interest, time on task, and enthusiasm. In addition, increases were reported in thinking, reading, and problem solving skills. One teacher noted "Students feel very comfortable in going to the computer and doing research on their own." Another added, "Completing research on the computer has increased students' thinking skills as well as their problem solving skills because they don't have pat answers and realize that they must find them." Another remarked, "First grade students made a lot of books with the computer and by learning to read the sentences they generated has been a plus for them." Another added that knowledge of vocabulary increased, "If a student came across a word that they did not know, they went online and found the meaning. I then projected it on the computer and reviewed for the entire class."

Teachers stressed the importance of training with their interns as they indicated that the pairings allowed for peer interaction during the learning process. In addition, this connection allowed for a deeper bond between the mentor teacher and the intern. Exit survey data further indicated that 77% of the teachers rated the importance of training with their intern as highly essential for integrating technology.

They indicated that integration ideas shared in the Technology Learning Strands by the facilitator as well as other participants encouraged the generation of new ways to integrate particular technology tools into the curriculum. As one teacher noted, "Integrating technology into the existing curriculum adds a new dimension of learning for both the students in my class and for me as a veteran teacher. This fresh energy gives life to tedious lessons and challenges us to be innovative problem solvers."

Even though participants generally had positive reactions to the training, there were three areas where they desired change: (a) scheduling, (b) amount of information covered, and (c) difference in training for various ability groups. They felt that weekly scheduling of the sessions was too stressful and that they needed more time to practice and think about ways to infuse the technology. The teachers with more advanced technology skills wanted more complex training while teachers with lower abilities felt that there was too much information covered. This reinforces that there is no "one size to fit all" training.

Mentor teachers expressed the importance of the many support conditions that were implemented and how these facilitated their growth and success. Significant themes were: support from building principals, teaming with an intern, collaborative sharing, and technical support. Confidence to use technology was reported to be increased tremendously by the support systems in place. As confidence grew, teachers were willing to try new methods of technology integration. Teachers' responses on the exit survey further confirmed this finding. Sixty-eight percent of the teachers rated support provided by the building level technology coordinator as highly essential, whereas 59% rated support by project staff as highly essential for integration of technology.

DISCUSSION

The purpose of this evaluation was to investigate the extent to which teacher participation in Project ImPACT was associated with an improvement in the use and integration of technology and an increase in technical skills. Overall, posttest scores were statistically significantly higher than pretest scores except in the areas of technical skills in the use of databases, educational software, and assistive devices. We conclude that this was a result of the content of the professional development offered to mentor teachers, given that their training focused on the integration of presentation, multimedia, and word processing software. The results indicated that participants integrated significantly more instructional technologies in their teaching as a result of Project ImPACT. The increase was both statistically and practically significant. These results indicate support for the overall goals of Project ImPACT, which included providing participants with the technical skills and pedagogical knowledge necessary to integrate technology meaningfully into their curriculum.

Also indicated by the results are components of the model that may influence the effectiveness of preparing teachers to infuse technology into the curriculum. Results indicate that the conditions set forth by ISTE—particularly access, professional development, and support—facilitated the success of these changes. Data from the focus groups indicated that teachers observed changes in their students as a result of their participation in the project. Changes in students' confidence, motivation, and time on task were noted, which supports previous research (O'Bannon & Vannatta, 2001–2002; Pask-McCartney, 1989; Roblyer, 2003; Summers, 1990–1991) as well as changes in problem solving, vocabulary, and reading skills.

Generalization of findings beyond this sample should be undertaken with caution for several reasons. The project partnered with five schools with existing strong relationships with the teacher education program at this university. All schools were either Professional Development Schools or university/partner schools. All teachers and interns elected to participate in the study and were not randomly chosen. The incentives offered (stipends, travel) may have served as an enticement for teachers to volunteer; however, none of the teachers took advantage of the opportunities for travel to conferences and less than five percent signed up for graduate credit. Another limitation is that the majority of the measures were based on self-report surveys. Such data may be susceptible to bias.

As suggested by Sandholtz et al. (1997) in the ACOT study, becoming a technology-using teacher is a process of change that takes place over time. Researchers

(Atkins, 1997; Vannatta & O'Bannon, 2001) confirmed that the longer teachers work with technology, the more confident they become, thus increasing their ability to use it effectively. Although teachers in this study have made sufficient increases in their ability to integrate technology, they need continued access, professional development, and support to sustain the rate of change in the future. To accomplish such feats, schools must adopt technology plans that have budgets for the timely acquisition and maintenance of equipment and software and network access, and must place computers in the classrooms with teachers and students. In addition, continual hands-on professional development opportunities must be planned and implemented to increase teacher familiarity, confidence, and skill in choosing and mastering software and integrating technology into the curriculum. And finally, various avenues of support to teachers must be in place for change to occur. Administrators at the district and building level should support technology integration with funds, incentives, and active participation. In addition, technology staff should be placed in every building to assist with the curriculum and technical needs of teachers. Support can also be realized through teaming and collaborative sharing at faculty and grade level meetings. With these conditions in place, change can occur. Such changes occurred in this project as a result of the model put into place. The Project ImPACT model was effective in changing this teacher education program and developing mentor teachers in the field who play such an important role in the development of new teachers.

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APPENDIX

Mentor Teacher Educational Technology Survey

Part A: Educational Technology Indicators

This section of the survey lists practices related to your use of educational technology. Please respond to each statement by circling the number that best identifies your proficiency.

	1 = Not at All	2 = Minimally	3 = Confidently	4 = Can teach others
I plan lesson sequences that effectively integrate technology resources and are consistent with current best practices for integrating the learning of subject matter and student technology standards (as defined in the ISTE National Educational Technology Standards for Students).	1	2	3	4
I plan technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and/or creation of original products.	1	2	3	4
I plan for the management of student use of technology resources as part of classroom operations and in specialized instructional situations.	1	2	3	4
I implement technology-enhanced learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.	1	2	3	4
I implement the management of student use of technology resources as part of classroom operations and in specialized instructional situations.	1	2	3	4
I implement a variety of instructional technology and grouping strategies.	1	2	3	4
I teach students methods and strategies to assess the validity and reliability of information gathered through technological means.	1	2	3	4
I evaluate the management of student use of technology resources as part of classroom operations and in specialized instructional situations.	1	2	3	4
I guide students in applying self- and peer-assessment tools to critique student-created technology products and the process used to create those products.	1	2	3	4
I facilitate students' use of technology that addresses their social needs and cultural identity and promotes their interaction with the global community.	1	2	3	4

Part B: Educational Technology Tools

This section of the survey lists educational technology tools. Please respond to each item by circling the number that best identifies your proficiency at using these tools.

	1 = Not at All	2 = Minimally	3 = Confidently	4 = Can teach others
Computer	1	2	3	4
Digital Camera	1	2	3	4
Scanner	1	2	3	4
Word Processing	1	2	3	4
Database	1	2	3	4
Spreadsheet	1	2	3	4
Drawing/Graphics Programs	1	2	3	4
Electronic References (e.g., Encarta, World Book)	1	2	3	4
Discussion Groups/Listservs	1	2	3	4
Content Specific Instructional Software	1	2	3	4
Presentation software (PowerPoint)	1	2	3	4
Multimedia (e.g., HyperStudio, KidPix)	1	2	3	4
Email	1	2	3	4
Use of Internet to access and gather information	1	2	3	4
Web site Development	1	2	3	4
Assistive Devices for Special Needs Learners	1	2	3	4

Part C:

Overall, how do you rate your technology expertise?

Beginner Intermediate Advanced

How do you rate your ability to integrate technology into classroom instruction?

Beginner Intermediate Advanced

Comments:

Exit Survey

Please rate the importance of each of the following in your integration of technology into your teaching this year. Use ratings from 1 to 5 on the following basis:

1 – not important, should be eliminated in the future
2 – very little importance
3 – somewhat important, it helped in some areas
4 – fairly important but could have been more effective
5 – very important, essential

	Not Important				Very Important
Provision of a laptop computer for your intern	1	2	3	4	5
Having your intern participate in training with you	1	2	3	4	5
Learning Strands	1	2	3	4	5
Support provided by project staff	1	2	3	4	5
Support provided by the tech coordinator	1	2	3	4	5
Team meetings at your school site	1	2	3	4	5
Project meetings	1	2	3	4	5
Project listserv	1	2	3	4	5
Project website	1	2	3	4	5
Online lesson and resource library	1	2	3	4	5
Software that was distributed	1	2	3	4	5
Creating technology enriched lesson plans	1	2	3	4	5
Creating an electronic portfolio	1	2	3	4	5
Receiving course credit	1	2	3	4	5