Equipping the Next Generation of Teachers: Technology Preparation and Practice

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Abstract

Prior research has indicated that all U.S. teacher preparation programs provide instruction on technology integration within coursework and related requirements. This study provides a more detailed investigation into the types and content of technology experiences U.S. teacher preparation programs offer teachers in training. The researchers analyzed data obtained from an online questionnaire, interviews, and artifacts to understand the differences among programs in regard to technology experiences. Eighty percent of respondents indicated all or some of their programs required a standalone educational technology course. Personal productivity and information presentation were the most commonly reported topics taught in all programs. This article also discusses limitations of the study and areas of future research. (Keywords: preservice, technology, teacher education, assistive technology, preparation)

Preparing future teachers to understand and make good use of available digital tools is important due to technology's increasingly central role in society and K–12 education (Northrup & Little, 1996). Teacher technology skill proficiency alone does not appear to be enough to facilitate effective integration into teaching practices (Strudler & Wetzel, 1999; Vannatta & Beyerbach, 2000). Being able to orchestrate a student-centered, technology-rich lesson requires much expertise on the part of the teacher (Mills & Tincher, 2003). Acquiring such skills, however, is a process.

Technology experiences during teacher training can help preservice teachers see connections between current technology applications and the appropriate uses in a classroom (Vannatta and Beyerbach, 2000). According to a 2006 Educational Technology in Teacher Education Programs for Initial Licensure study, 100% of all teacher preparation programs in the United States provide instruction on technology integration (Kleiner, Thomas, Lewis, & Greene, 2007). Many researchers have attempted to examine the best strategies for such instruction. These various strategies include courses that blend technology skills and technology integration (Algozzine et al., 1999), technology skills courses coupled with field experiences (Brush, Glazewski, et al., 2003), project-based courses that focus specifically on technology integration strategies (Marra, 2004), a tiered series of courses that are infused within the entire teacher education program (Brush & Appelman, 2003; Sanzone, Hunt, & Bevill, 2002), and a combination of multiple approaches (Kay, 2006). Much of the research examining these various approaches consists of individual case studies, with little to no evaluative data that could provide insight regarding which approach (if any) is most effective for preparing preservice teachers with regard to technology. In fact, after a review of 68 studies discussing various strategies for incorporating technology into preservice teacher education programs, Kay (2006) concluded that "…only a handful of studies have carefully and rigorously pursued the evaluation process. The jury is still out on which strategies work best.…" (p. 395).

The content of technology experiences at the teacher training level can vary as well, including instruction on activities that teachers perform regularly, engage students in the classroom, incorporate reflection, involve professional practice knowledge, and work to further shape the profession (Iverson, Lewis, & Talbot, 2008). In considering the learning context, the nature of the learners, and the authenticity of the activities, technology integration instructors and curriculum developers can choose from a variety of strategies, projects, and resources in designing technology learning experiences for preservice teachers (Stein, Isaacs, & Andrews, 2004). Emerging technologies can also be employed to situate future teachers through simulations and communications with those in communities of practice (Herrington & Kervin, 2007; Volman, 2005).

There are some challenges to preparing future teachers in this area. Barab, Squire, and Dueber (2000) point out that teacher preparation programs have difficulty with maintaining a level of authenticity in technology experiences. Simulated authentic tasks may lack utilization within real, authentic communities, as it may not always be feasible to situate learners in authentic settings (such as a K–12 school) in every course to accomplish the activities (Barab et al., 2000). In addition, many methods faculty fail to provide appropriate modeling, as they themselves struggle with keeping up with best practices in current technologies (Brush, Glazewski, et al., 2003; Northrup & Little, 1996; Vannatta & Beyerbach, 2000). The skill levels of cooperating teachers and the availability of technology tools and applications vary greatly at field placement sites (Becker, 2001; Cuban, Kirkpatrick, & Peck, 2001; Graham, Tripp, & Wentworth, 2008; Strudler & Wetzel, 1999).

The need to specifically include instruction on using technology to support learners with special needs has also been recognized (Bausch & Hasselbring, 2004; Buell, Hallam, Gamel-McCormick, & Scheer, 1999; Dailey, Jones, & Wall, 1997; Maushak, Kelley, & Blodgett, 2001). Although a few studies report instruction on this topic within the scope of special education programs (Brady, Long, Richards, & Vallin, 2007; Judge & Simms, 2009), information concerning this area in general education programs is limited. It is evident, though, that many graduates of teacher education programs overall do not feel adequately skilled in using technology to support students with special needs (Abner & Lahm, 2002; Bouck et al., 2006; Edyburn, 2000; Todis, 1996). For example, most respondents in a study of Kentucky teachers of students with visual impairments indicated that using technology to support students with special needs was not addressed in their university coursework and that they learned what they do know on the topic through inservice workshops (Abner & Lahm, 2002). Another study echoed this finding and recommended that the training should begin in teacher preparation programs (Bausch & Hasselbring, 2004).

Recently, researchers have called for renewed efforts in exploring both what knowledge should be taught in preservice teacher education programs with regard to technology and how to best prepare teachers to effectively use that knowledge to support student learning (e.g., Lawless & Pellegrino, 2007; Pellegrino et al., 2007). There are few detailed cross-institutional studies available that can provide more generalizable implications regarding how to best prepare prospective teachers to effectively use technology (e.g., Strudler, McKinney, et al., 1999). As Pellegrino et al. (2007, p. 55) state, "A review of existing evaluation reports on the state of technology implementation in teacher education programs shows a lack of attention to cross-institutional and/or longitudinal studies. We found no systematic, conceptually driven effort to study the effectiveness of technology integration across multiple [institutes of higher education]."

Purpose

The present study aims to understand the differences that exist among programs of study and institutions of varying demographic characteristics in regards to teacher preparation in technology use. The study seeks to gain an understanding of the content included in these experiences and the rationale teacher educators have for selecting topics and methods for these experiences.

This study addresses two research questions:

1. What are the perceptions of technology experiences used to prepare teachers to use technology?
2. What are the perceptions of technology topics used to prepare teachers to use technology?

Method

This study is part of a larger study that is designed to determine how practicing teachers use technology and the various methods that teacher education institutions use to prepare teachers to use technology. The objective of this portion of that study is to describe the methods teacher educators use to provide technology experiences to teacher education students and the perspectives teacher educators have about the best ways to incorporate instructional technology experiences into general teacher education programs.

The study used a mixed methods approach to data collection and analysis. The first and second authors coded and analyzed open-ended responses to an online questionnaire, interview transcriptions, and artifacts using the constant comparative method to identify and refine emerging themes (Glaser & Strauss, 1967). The research team members discussed codes and themes to compare interpretations and further revise themes.

Instruments

The researchers employed an online questionnaire to facilitate data collection from educational technology faculty across the United States. We elicited expert feedback and used it to develop and refine survey questions. We also developed an interview protocol to delve deeper into issues relating to preparing teachers to use technology. Finally, we pilot-tested the protocol and submitted it to colleagues for critical review.

Participants

Using the Postsecondary Education Quick Information System, the research team identified all (n = 1,283) of the four-year U.S. teacher preparation programs that offer initial licensure in general, elementary, and/or secondary education. We obtained contact information for faculty members responsible for technology experiences in the programs from the institution websites and validated it through direct communication with the programs.

Procedure

We sent each faculty member an introductory overview of the study and a link to the questionnaire via e-mail. Faculty members who did not complete the questionnaire within two weeks were e-mailed a second time. If faculty members did not complete the questionnaire within four weeks, we contacted them by telephone to request their participation. After two more weeks, the questionnaire was closed. We obtained demographic information for responding institutions from College Navigator (2009) and added it to the research database. We reviewed the database for duplicate responses and responding institutions located outside the United States. We selected 12 respondents for follow-up interviews based on representative institution characteristics (geographic location, size of education program, and public/private funding) and willingness to participate in the interview. We obtained documents from interviewees' institution websites as well as from the interviewees.

Data Analysis

The online questionnaire contained 14 closed- and open-ended questions about

Table 1. Sample Items from Questionnaire

Question 5: Below are various technology experiences that are included in some teacher education programs. Please identify if these experiences are required in all of the elementary and secondary programs at your institution, required in some elementary and secondary programs, optional in elementary and secondary programs, or not included in any elementary or secondary programs by checking the appropriate column.

Question 6: Below are various topics that are included in educational technology courses/ experiences in elementary or secondary education programs. Please indicate if all elementary and secondary teacher education students, some of the elementary and secondary teacher education students, or none of the elementary and secondary teacher education students are introduced to these topics as part of their initial certification program at your institution.

Question 7: Describe what you believe is the most important technology-related topic or experience your institution includes as part of the requirements for initial certification as an elementary or secondary teacher.

Question 8: Describe what you think is the technology-related topic or experience included as part of the requirements for initial certification that teacher education students believe was most useful or beneficial to them in their future professional placements.

Question 9: Ideally, how would you like to see technology integrated into your institution's teacher education program? How is it similar to or different from what currently occurs at your institution?

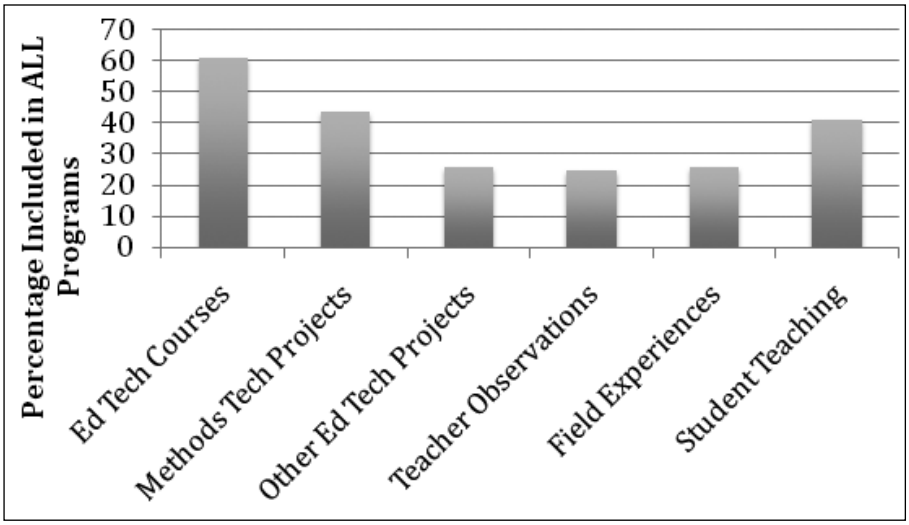

Figure 1. Educational technology experiences required in U.S. teacher preparation programs for initial licensure.

the extent of technology experiences provided in the teacher preparation programs. It also collected demographic information, including campus setting, undergraduate and graduate enrollments, student population, financial aid, ethnicity and gender makeup, size of education program, and funding. Several of the questions yielded some insights into the requirements and experiences for technology integration in teacher education programs. Table 1 lists some sample items from the questionnaire.

We did a content analysis of open response questions to detect preliminary themes. We developed and refined codes for the most important educational technology topic, based on the educational technology faculty's perspective. The first and second authors individually selected and coded 100 of the open-ended responses to establish coding agreement, compared and refined codes until reaching 92% agreement, and then coded the remaining items. Table 2 provides the codes and definitions.

We conducted telephone interviews with questionnaire respondents from 12 institutions. The interview protocol, developed to expand themes that emerged from the preliminary questionnaire data, was comprised of eight major questions and numerous follow-up questions. During each interview, one researcher conducted the interview while a second researcher recorded notes and directed the interviewer to relevant follow-up questions. Each interview was approximately 45 minutes. The researchers recorded the interviews and transcribed portions for further analysis. We used relevant documents, including programs of study and course syllabi, to triangulate the interview responses.

Results

After deleting duplicate and international responses, there were 407 responses to the questionnaire, which is a 32% response rate. Responses came from large and small education programs as well as public and private institutions from every U.S. state except Delaware and New Hampshire. Table 3 (page 34) lists respondents by geographic region, type of funding, and program size. The range of total current undergraduate and graduate students in the responding institutions was 0-2,454, with a median of 133 students. A little more than half of the responding institutions (N = 229) are privately funded, and the remaining (44%; N = 178) are publicly funded.

In 60% (N = 244) of the institutions that responded, a standalone educational technology course is required in all teacher licensure programs. This was the most frequently reported "required in all programs" technology experience (see Figure 1). An additional 20% (N = 81) of respondents indicated that a standalone educational technology course was required in some of their programs.

About 44% (N = 178) of the respondents require technology projects or activities in teaching methods courses, and an additional 39% (N = 159) require such experiences in some of their programs. Classroom observations of technology use by teacher(s) and/or students are required in all programs in 25% of the responding institutions (N = 100). An additional 30% (N = 124) of respondents indicated observations of this nature are required in some programs. Another key type of technology experience found to be prevalent among responding institutions is implementation of technology activities in field experience. In 60% (N = 245) of the responding institutions, students are required in some or all of the programs to develop and/or implement technology lessons or

Table 2. Codes and Definitions for Open-ended Items

Code	Definition
Personal Productivity	They mention the need to build students' (or teachers') computer literacy, 21st century skills, media literacy, digital citizenship/ethics, technology skills, creating video.
Information Presentation	They typically discuss the Smart Board, projector, PPT, and anything that will help students with visualization, including showing video.
Administration/Management	They discuss using technology to help them manage their classroom (e.g., gradebook or classroom management system).
Communication	They discuss using technology for communication specifically with students and/or parents.
Electronic Resources	They discuss having either the teacher or students access, evaluate, and use electronic resources. Electronic resources include Web resources and online information.
Analyze Student Achievement Data	They discuss using technology for data-driven decision making, feedback, and assessment. Specifically looking at student data to help students improve or to improve instruction.
Document Growth	They discuss using technology for professional growth (e.g., collaboration w/other teachers, e-portfolios).
Support Activities that Facilitate Student Learning	They discuss using technology to enhance student motivation, student learning, student engagement, student collaboration, student higher-order thinking skills. Responses need to focus on student use of the technology (e.g., hands-on).
Support Students with Special Needs	They discuss using technology to differentiate instruction for students with special needs or varied learning styles. Focus on using technology to individualize instruction.
Classroom Preparation	They discuss using technology to facilitate teaching specific concepts, target specific standards, lesson planning, and preparing materials/instruction for their classes.

activities during their field experiences. This figure is slightly higher (68%; N = 275) for required development and/or implementation of technology lessons in student teaching within all or some of the programs.

Educational technology faculty selected the technology content addressed in their programs from a list of possible technology topics on the questionnaire (see Table 4, page 35). Personal productivity (78%; N = 317) and information presentation (75%; N = 305) were the most commonly reported topics taught in all programs. Using technology to analyze student achievement data was found to be the least popular topic introduced (25% all; N = 100).

Thirty percent of the educational technology faculty in this study indicated that the most important topic addressed in their teacher education program was how to use technology to support curricular goals. One respondent noted, "We insist that our students make connections between state curriculum standards, learning objectives, and technology usages. We are not interested in technology for its own sake but … to accomplish content area standards." (Respondent 50)

Similarly, an emphasis on curricular goals was found in another response: "The infusion of state standards and National Technology Standards in coursework, coupled with the infusion of technology to facilitate program participation and academic performance." (Respondent 45)

More than 20% of faculty indicated that the most important topics in their programs were using technology to facilitate professional growth and to teach computer literacy. This can also be seen in the recent report published by the National Center for Education Statistics (Kleiner et al., 2007). Results indicated that nearly all teacher education programs included topics specifically focusing on using technology to support instruction in their technology courses and experiences for prospective teachers.

Only 5% of the responses referred to using technology to meet the needs of diverse learners as the most important topic. However, respondents often identified assistive technology (AT) during the interviews as a topic in which new teachers need to be prepared. Many respondents acknowledged a need for their institutions to address AT more fully, as this comment illustrates: "I, other than talk about them, probably don't do much more than that—don't have any to display or demonstrate. You know, but we need to." (Respondent 207)

In addition to limitations in physical AT resources, respondents described limitations in faculty knowledge as a challenge to providing AT instruction at the preservice level. By acknowledging this limitation, however, some faculty have teamed up with colleagues to learn more about assistive technologies themselves, as this response indicates: "Ideally, we will do more with assistive technology in the mainstream classroom. I am weak in this area, so our special ed lead professor is going to help me get the team educated on what is available and most useful for our students to know." (Respondent 83)

Interestingly, when asked to identify the technology topic that they perceived preservice teachers found most important, most (38%) of the educational technology faculty indicated personal productivity/computer literacy. For instance, one respondent said, "All students have to create their personal website using MS Expression Web and many students said to me that they love creating their website…." (Respondent 15). Tools were often mentioned in these responses, such as this one: "Learning how to do Webquests and PowerPoint as well as learning to create Smart Board lessons and use both the Promethean and Smart Board." (Respondent 8)

Discussion

Some variability exists among teacher education programs in how technology integration instruction is addressed (Barab et al., 2000; Brush, Glazewski, et al., 2003; Dawson & Dana, 2007; Graham et al., 2008). Finding that most

Table 3. Questionnaire Respondent Demographics

Region		Small Programs (Fewer than 134 Students)	Large Programs (At Least 134 Students)	Totals	
Northeast	Public	5	22	27	
	Private	37	16	53	**80**
Midwest	Public	10	42	52	
	Private	65	22	87	**139**
South	Public	12	53	65	
	Private	52	16	68	**133**
West	Public	11	23	34	
	Private	11	10	21	**55**
Total	Public	38	140	178	
	Private	165	64	229	
	Total	**203**	**204**		***407***

programs utilize standalone educational technology courses is consistent with prior studies (e.g., Hargrave & Hsu, 2000; Kleiner et al., 2007; Tan et al., 2004). Many institutions that do not offer standalone educational technology courses count on technology integration-focused field experiences within methods courses to provide students with authentic opportunities for practice (Mills & Tincher, 2003; Vannatta & Beyerbach, 2000). When asked to describe changes they would make in their programs, more than half of the educational technology faculty expressed a desire to have more systemic technology integration, particularly in field experiences and methods courses. Despite the numerous barriers that teacher educators may encounter when incorporating technology experiences, the payoff of facilitating deeper understandings in amply skilled future teachers is worthwhile (Stein et al., 2004), as previous research has demonstrated that field experiences that incorporate technology positively affect preservice teachers' attitudes toward technology (e.g., Bahr, Shaha, Farnsworth, Lewis, & Benson, 2004). Providing the opportunity to practice with technology is important for preservice teachers, as teachers encounter barriers when they attempt to use technology in the classroom (Hew & Brush, 2007). If teachers can practice using technology in the classroom, they may be more likely to overcome those barriers when using technology in their own classrooms.

Another facet that warrants consideration is what the technology integration curriculum should include to ensure that the activities and content reflect the knowledge and skills used in the field. Gaining an understanding of the content of instruction from other teacher preparation programs may provide teacher educators with insights for use in the redesign and development of technology experiences in their own institutions. For instance, some institutions may have found a focus on content-oriented strategies relating to technology integration has the potential to revolutionize student work, in contrast to a more limited preparation focus on teaching for literacy of specific technology tools (Gomez, Sherin, Griesdorn, & Finn, 2008), even though technical skill is critical to the ability to use instructional technologies effectively (Becker, 2001).

In addition, there are several reasons why it is essential that teacher preparation programs consider the extent to which they are providing future teachers with experiences in using technology to support students with special needs (Smith & Jones, 1999; Tech Act, 1988). Under the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA), schools are required to make certain that assistive technology devices are provided to each student with special needs if they are a requirement of the child's special education (§ 300.105). As a student's Individualized Education Plan (IEP) team members consider a student's need for assistive technology, the student's teachers need to be able to utilize these tools to help the student be successful in the classroom (Edyburn, 2000; IDEIA § 300.324). With many recent graduates of teacher education programs reporting not feeling adequately skilled in identifying and implementing assistive technologies (e.g., Abner & Lahm, 2002; Bouck et al., 2006), it is necessary that we take a closer look at the instructional scope and methods used to prepare future teachers in this area.

Limitations of the Study and Areas of Future Research

The perceptions provided in this study are from faculty members responsible for technology experiences. Such experiences may be systematically incorporated into courses or other experiences that the respondents may not have had full knowledge of. Future research may explore the extent of technology instruction infused in methods and other coursework and incorporate the perspectives of relevant faculty members.

The response rate to the questionnaire was moderate and not representative of the population. Further, the results are limited to teacher preparation programs in the United States. The findings are therefore not generalizable to the population of teacher preparation programs that provide initial licensure in the United States and abroad. Research is needed to explore international perspectives on teacher preparation in technology to broaden the understanding of types and content of such experiences.

From the questionnaire responses, interview data, and collected documents, it is apparent that students in many general education teacher preparation programs are receiving instruction in assistive technologies as part of their educational technology coursework. However, many respondents voiced great concerns about the extent to which their institutions provide AT instruction is provided to students. Although they would like to offer more instruction in this area, they face many challenges—namely,

time and resources. Future research is needed to explore the extent of assistive technology instruction for education majors within educational technology and special education coursework and related requirements.

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Table 4. List of Technology Topic Choices on Questionnaire

List Items	Examples
Personal productivity	Word processors, spreadsheets
Information presentation	PowerPoint, digital media
Administration and classroom management	Gradebooks, attendance, seating charts
Communication with peers/parents/students	E-mail, online chats, parent newsletters, class websites
Access and use electronic resources	Websites, online databases
Analyze student achievement/performance data	Identify trends, provide remediation to learners
Facilitate teaching specific concepts	Computer-based courseware, tutorials
Document personal/professional growth	Electronic teaching portfolios
Support various student learning styles	Use of media for auditory and visual learners
Support activities that facilitate higher-order thinking	Collaborative problem-based activities, activities that require analysis and synthesis of information
Facilitate your support of students with special needs in your classroom	Assistive technology, special software, etc.
Classroom preparation	Lesson planning, gathering resources

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