The Preservice Technology Training Experiences of Novice Teachers

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Abstract

The researcher designed this qualitative study to identify and explore the preservice technology training experiences of novice teachers and examine their perceptions of how well their teacher preparation program equipped them with the knowledge and skills necessary to fulfill the National Educational Technology Standards for Teachers (NETS•T). The researcher collected data by following an instrumental case study design utilizing semi-structured interviews, documents, and field notes. Simultaneous collection and analysis of the data helped the researcher to create a deeper understanding of the technology training experiences of novice teachers. The findings were organized into major themes that facilitated interpretation through the lens of ISTE's Essential Conditions for Implementing NETS for Teachers (ISTE, 2000b). The data analysis revealed three major themes: (a) a disconnect between technology training and other aspects of teacher training, (b) a lack of content-area relevance, and c) inadequate retention and transfer. (Keywords: preservice, technology, teacher education, teacher preparation program, perceptions, technology training)

Given the push to train our students to possess 21st century skills, one might expect that colleges and universities would provide all the tools, assistance, and time that preservice teachers need to integrate technology into their instruction. Teacher educators may believe that they provide all the necessary training so that their graduates can go out into the world with the best 21st century skills possible, but study after study has shown that teachers do not feel adequately prepared to integrate technology into their classroom instruction for student-centered learning (Albee, 2003; Basham, Palla, & Pianfetti, 2005; Darling-Hammond, Chung, & Frelow, 2002; Doering, Hughes, & Huffman, 2003; Imbimbo, 2003; Kelceoglu, 2006; Flemming, Motamedi, & May, 2007). Even though the rate of technology use and the degree of its accessibility in the classroom have increased, most teachers and students still tend to use technology only for basic tasks such as communication, record keeping, and Internet research on instructional materials (Barron, Kemker, Harmes, & Kalaydjian, 2003; Brown & Warshauer, 2006; U.S. Department of Education, 2003; Flemming, Motamedi, & May, 2007; Henning, 2006; Imbimbo, 2003; U.S. Department of Education, 2000c; Wang, 2002). If, as these studies suggest, teachers continue to feel inadequately prepared to integrate technology despite large investments in technology training, then it is critical to reveal the underlying issues behind these feelings of inadequacy.

Purpose

The purpose of this study was to identify and analyze the preservice technology training experiences of novice teachers. By examining the preservice teachers' technology training experiences, the researcher hoped to determine which of these experiences novice teachers found to be "relevant and useful" or "not relevant and useful" once they were out in the field managing their own classrooms. Furthermore, this study examined novice teachers' perceptions of how well their teacher preparation program equipped them with the knowledge and skills necessary to fulfill the National Educational Technology Standards for Teachers (NETS•T). The final purpose of this study was to develop themes regarding what constitutes relevant and useful technology training experiences for preservice teachers. Ultimately, the goal of this study is to inform practice by recommending specific measures that teacher educators can take to enhance the technology training experiences of their preservice teachers.

Ideally, preservice teachers' technology training experiences should remain useful and relevant once those teachers are instructing students in their own classrooms. But how can teacher preparation programs ensure that the technology training experiences they provide actually serve teachers' needs in the long run? By following graduates into their schools and asking them to reflect on the meaning and value of their preservice technology training experiences, the researcher hoped to assess how well their preservice training aligned with the challenges they found themselves facing down the line.

This study was guided by the following two research questions:

1. What were the preservice technology training experiences and the meanings of those experiences for novice teachers who had graduated from a post-baccalaureate, fifth-year teacher preparation program at a Research University/Very High (RU/VH) in the southeastern United States?
2. What were novice teachers' beliefs about how well their technology training experiences equipped them with the knowledge and skills necessary to fulfill the NETS•T?

Theoretical Framework

This study was conducted and interpreted in the context of the Essential Conditions for Implementing NETS for

Teachers from the International Society for Technology in Education (ISTE). The researcher chose this framework to guide this study because the 10 conditions are accepted as "essential in creating learning environments that are conducive" to the integration of technology, and ISTE developed them to assist schools, colleges, and departments of education in overcoming the barriers to technology integration (ISTE, 2000, p. 1).

A Rationale for the Focus on Perceptions

Although teachers' perceptions do not always measure what teachers actually know and do, their experiences and perceptions are important. As one researcher has argued, "These perceptions provide useful information on areas where teachers feel most knowledgeable and areas where they feel most lacking" (Imbimbo, 2003, p.7). By probing novice teachers' perceptions of their experiences, it is possible to zero in on aspects of teachers' training that affect their sense of self-efficacy and, thus, directly influence the decisions they make in their own classrooms. If we can understand what gaps in previous training teachers feel most acutely and the learned skills they exercise with the most confidence, we have a better chance of providing training that will positively influence their self-efficacy, and, thus, their teaching practices. The findings from this study may provide university administrators, faculty, and staff with relevant information for future decisions that can improve the technology training experiences for current and future students. Also, although this study was conducted at only one university, these data can be beneficial to other institutions across the country by providing them with insights into what teachers' own perceptions of the challenges they face and the skills they need.

Method

The researcher designed this study as an instrumental case study utilizing semi-structured interviews, document reviews, and reflective field notes. Creswell (2008) notes, "In qualitative inquiry, the intent is not to generalize to a population, but to develop an in-depth exploration of a central phenomenon" (p. 213). Gay and Airasian (2000) agreed: "It is not the intent of the researcher to generalize to a larger population but to describe a particular context in depth" (p. 139). Therefore, the researcher intentionally selected participants and a site that was "information rich" (Patton, 1990, p. 169) and would "help people learn about the phenomenon and give voice to individuals who may not otherwise have been heard" (Creswell, p. 214).

Site and Sample

The researcher conducted the study at a post-baccalaureate, fifth-year teacher preparation program in the college of education at a large RU/VH university in the southeastern United States. The target population from which the sample was taken consisted of novice teachers who had graduated from the teacher preparation program during the 2005–07 school years and had been out in the field managing their own classrooms for 1–3 years. Twenty participants from this target population volunteered to participate in the semi-structured, audiotaped interviews. These 20 participants came from seven school districts, 14 schools, one alternative learning center, one developmental center, and one community college. Due to the confidentiality assurances that the researcher provided to the participants, the study does not use their names. An in-depth description of the 20 participants in this study, based on demographic information obtained during the semi-structured interviews, is presented in Table 1 and Table 2.

More on the Setting for this Study

The college of education that serves as the setting for this study is dedicated to providing its candidates with the knowledge and skills necessary for them to be successful teachers in the 21st century. The college of education graduates approximately 400 new teachers per year.

Preservice teachers enrolled in the teacher preparation program are

Table 1. Demographic Information by Percentages ($n = 20$)

Characteristics	Frequency	Percentages
Gender		
Female	15	75
Male	5	25
Age		
25–29	11	55
30–39	3	15
40–49	4	20
50–59	2	10
Highest Degree Awarded		
BS	3	15
MS	13	65
EdS	4	20
Grade Levels		
K	1	5
PK–5	7	35
6–8	2	10
9–12	7	35
Higher Education	1	5
PK–8 Special Education	1	5
K–12 Special Education	1	5
School Systems		
Public	15	75
State	2	10
Private	1	5
Alternative	1	5
Community College	1	5
Years Teaching		
1	1	5
2	7	35
3	12	60
Subjects Taught		
Math	10	50
Science	8	40
English	10	50
Social Studies	6	30
Health	5	25
Art	3	15
Reading	6	30
History	1	5
# of Computers in Classroom		
1	4	20
2	9	45
3	3	15
4	1	5
5	1	5
6	1	5
25	1	5
# of Computers Connected to Internet		
1	11	55
2	4	20
3	3	15
5	1	5
25	1	5

Table 2. Demographics of Participants *(N* = 20)

Participant	Gender	Age	Academic	Grade Level	School System	Years Teaching	Subjects Taught	Numbers of Computers in the Classroom	Number of Computers Connected to the Internet
1	M	48	BS, MS	8	P	3	Math	2	2
2	F	28	BS	9–12	A	2	All subjects	1	1
3	F	40	BS, MS, EdS	PK–5	D	3	All subjects	2	1
4	F	57	BS, MS	9–12	P	2	History	1	1
5	F	59	BS, MS	9–12	S	3	All special education	6	1
6	M	33	BS, MS	9–12	P	2	English	2	1
7	F	25	BS, MS	6–8	P	3	English, reading	2	2
8	F	27	BS, MS	PK–5	P	3	All Subjects	2	2
9	F	26	BS, MS	9–12	P	3	English	4	4
10	F	26	BS, MS	PK–5	P	3	All subjects	3	3
11	F	29	BS, MS	9–12	P	3	Science	2	1
12	F	25	BS	9–12	P	2	Social studies	2	1
13	M	39	BS	9–12	S	2	All special education	1	1
14	M	47	BS, MS	13	CC	3	Math	25	25
15	F	26	BS, MS, EdS	K	P	3	All subjects	2	2
16	F	47	BS, MS	PK–5	P	3	Art	1	1
17	F	25	BS, MS, EdS	9–12	P	2	Science	3	3
18	F	30	BS, MS	PK–5	P	2	Art	3	3
19	F	27	BS, MS, EdS	PK–5	P	3	All subjects	5	5
20	M	25	BS, MS	PK–8	P	3	All subjects	1	1

required to complete one 3-credit, standalone technology core course called Introduction to Instructional Computing (IT486). The college of education offers five sections each semester; candidates can take this course prior to or concurrent with their methodology courses or field experience. Sections are not specifically designed for initial licensure program, and the course is not integrated into the teacher candidates' specific content areas.

This course is based on and aligned with the International Society for Technology in Education (ISTE) NETS•T and state licensure standards for teachers. It provides an introduction to the integration of technology in the classroom and covers a wide variety of types of software programs, such as word processing, spreadsheets, presentation, photo editing, video editing, graphic organizers, and Web authoring. It also introduces teacher candidates to WebQuests, blogs, and wikis. Blackboard provides access to assignments, quizzes, wikis, and links to various Internet resources.

Data Collection Procedures

The data for this study came from three sources. First, the researcher conducted semi-structured interviews asking the novice teachers to share their preservice technology training experiences. The second source of data was preexisting documents, including end-of-the-course evaluations and data gathered from the Professional Year Survey and the Teacher Education Follow-Up Survey. The third source of data was reflective field notes that the researcher wrote directly after each interview. Table 3 (p. 42) provides a visual representation of the relationship between the data sources and the research questions. This chart documents that all data collected answered one of the research questions posed in this study.

Semi-structured interviews. The researcher used semi-structured interviews to identify the novice teachers' preservice technology training experiences and determine which of these experiences they found to be "relevant and useful" or "not relevant and useful" once they were in the field managing their own classrooms. The researcher asked the novice teachers to describe their technology training experiences during their teacher preparation program; what technology problems they encountered, if any; the types of technology training experiences they would have liked to have had during their preservice technology training; and their recommendations for improving technology training for preservice teachers. Furthermore, the researcher asked them to share their perceptions of how well their teacher preparation program equipped them with the knowledge and skills necessary to fulfill the NETS•T.

The semi-structured interviews served the purpose of exploring graduates' own perceptions of their technology training experiences; the data were not intended to be generalizable. To increase the integrity of the interviews, the researcher cross-referenced research questions and interview questions (see Table 4, p. 42).

Pilot study. After receiving Institutional Review Board permission, the researcher conducted a pilot study with

Table 3. Matrix of Research Questions and Data Sources

Research Questions	Reflective Field Notes	Interview Transcripts	Professional Year Survey Data	End-of-Course Evaluations	Teacher Education Follow-Up Survey Data
11. Preservice Training Experiences	X	X	X	X	X
22. Training for NETS•T		X	X	X	X

Table 4. Research Questions in Relation to Interview Questions

Research Questions	Interview Questions
11. Preservice Training Experiences	1, 2, 3, 4, 5, 6, 7, 8, 9
22. NETS for Teachers	10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

two participants who had graduated from the teacher preparation program during the 2005–2007 school years, had been out in the field managing their own classrooms for 1–3 years, and had volunteered to participate in a semi-structured interview. The researcher used the interview protocol, acquired signatures on the consent forms, and recorded the interviews. After the interviews, the researcher asked participants to make comments on the interview protocol's content and the clarity of the questions. The researcher used input from the pilot study to refine the interview protocol.

Procedure. After receiving Institutional Review Board permission, the researcher made a request to the College of Education Office of Professional Licensure to obtain the list of all candidates who graduated from the program between 2005 and 2007. This office asks all teacher candidates to complete a Teacher Education Follow-Up Survey after completing their internships and then sends the Professional Year Survey to all graduates one year after leaving the program. The researcher sent an invitation via e-mail to 138 potential participants asking them to participate in a 45- to 60-minute interview about their technology training experiences while in the teacher preparation program. Because 31% (43) of these e-mail addresses were invalid, only 69% (95) were sent successfully. Of these 95 requests, 30% (29) of the potential participants responded to the researcher's e-mail. Of the 29 potential participants, 9 were eliminated because the novice teachers worked in another state, were not teaching, or were working in another profession. From May 1 through May 28, the researcher conducted 20 semi-structured interviews with novice teachers who had volunteered their time to participate in a 45- to 60-minute interview. Most of the interviews were conducted in the novice teachers' classrooms, and two were conducted in a public library. The researcher used the interview protocol, acquired signatures on the consent forms, digitally recorded each interview with a digital voice recorder, and transcribed the recordings for analysis. These interviews focused on Research Questions 1 and 2.

Documents. By using "secondary" or "existing data" (Tashakkori & Teddlie, 2003, p. 314), this researcher was able to gain a fuller understanding of the perspective of the participants involved in the phenomenon. The documents the researcher reviewed for this study included end-of-the-course evaluations, the Professional Year Survey data, and the Teacher Education Follow-Up Survey data.

End-of-the-course evaluations. At the end of each course, students are asked to complete a survey evaluating their faculty and courses. End-of-the course evaluations provide students the opportunity to give feedback about the instruction and course content they have received. Looking at these data, the researcher was able to triangulate in regard to Research Question 1. Question 19 on the Student Assessment of Instruction System (SAIS) Survey (Form E) asks students to rate the relevance and usefulness of course content.

Professional Year Survey data. The Professional Year Survey is conducted annually by the Office of Professional Licensure Assessment, which collects data from preservice teachers who have completed their internships. The survey asks preservice teachers to anonymously evaluate their teacher preparation program. The researcher requested to obtain the data from the College of Education Office of Professional Licensure. The researcher examined the summarized data from Question 16: "Were you adequately prepared in the use of technology?"

Teacher Education Follow-Up Survey data. The Office of Professional Licensure Assessment team conducts the Teacher Education Follow-Up Survey annually. This survey collects data from graduates who have completed the licensure requirements and have worked in the field teaching for the previous year. The survey asks graduates to share information about their employment and location as well as feedback regarding their experiences while in their professional preparation program. The researcher examined the summarized data from two open-ended questions in Section III of the survey: "What were the strengths of the teacher education program?" and "In what areas, if any, do you not feel adequately prepared?"

Reflective field notes. In addition to digitally recording the interviews, the researcher wrote reflective notes after each interview. Such reflective journaling made it possible to capture "the researcher's frame of mind, ideas, concerns … strategies, hunches, and patterns that emerge[d]" (Bogdan & Biklen, 2007, p. 118) during each interview. The researcher recorded no names or identifying information in these reflective field notes.

Data Analysis

The researcher analyzed the qualitative data using the constant comparative method (Glaser & Strauss, 1967). Though the constant comparative method is often described as a series of steps, it is actually cyclical in nature. Bogdan and Biklen (2007) state, "The series of steps goes on all at once, and the analysis keeps doubling back to more data collection and coding" (p. 75). The researcher

coded and analyzed transcripts and reflective field notes according to recurring themes using QDA Miner software. QDA Miner was used to organize, search, and code data into categories so the researcher could study patterns among the codes. The QDA Miner software was a useful organizational tool because it allowed the researcher to code the data in different segments, which then allowed the researcher to bring these different segments together to create categories or themes.

Simultaneous collection and analysis of the data helped the researcher create a deeper understanding of the technology training experiences of novice teachers. Utilizing the "Perspective Held by Subjects," the researcher developed initial codes by coding responses reflecting similar or identical perspectives (Bodgan & Biklen, p. 173, 2007). Next, the researcher combined similar codes into categories. During this process, codes with similar meaning were combined to create new categories. After establishing the different categories, the researcher integrated them to develop themes.

Validity and Reliability

To keep personal biases from intruding into the data collection process and analysis and to assure the trustworthiness, credibility, and authenticity of this study (Gay & Airasian, 2000), the researcher used these strategies: (a) staying in the field longer to obtain additional data to compare participants' consistency of responses, (b) recognizing my own biases and acknowledging them, (c) performing a member check before and after analysis of the semi-structured interviews, (d) recording all interviews with a tape recorder, (e) recording reflective field notes with paper and pencil, and (f) triangulating data sources. Table 5 is a visual representation of the triangulation of data sources and the three major themes developed from analysis of the data.

Table 5. Matrix of Responses in Theme Outline

Categories	Interview Transcripts	Reflective Field Notes	Teacher Education Follow-Up Survey Data
Disconnect			
Big Push/Expectations	X	X	
Connections	X	X	X
Contradictory	X	X	X
Retention and Transfer			
Isolated	X	X	X
Crash Course	X	X	X
Time Constraints	X	X	
Relevance			
Value	X	X	X
Exposure/Modeling	X	X	X

Results

As noted above, this study was predicated on the assumption that understanding teachers' perceptions of their own learning experience is as important as assessing teachers' actual training and abilities. As one researcher noted, "These perceptions provide useful information on areas where teachers feel most knowledgeable and areas where they feel most lacking" (Imbimbo, 2003, p. 7). The Essential Conditions for Implementing NETS for Teachers served as the lens through which the researcher analyzed and interpreted the data. In the process of data interpretation, three major themes regarding the Essential Conditions became evident: (a) a disconnect between preservice teachers' technology training and other aspects of their professional education, (b) a lack of content-area relevance, and c) inadequate retention and transfer.

Disconnect

Participants in this study perceived a disconnect between their technology training and the rest of their teacher preparation program. Over and over again, they remarked that the program had made a big push for them to incorporate technology into their classroom presentations, lesson plans, and internship experiences, but paradoxically they perceived a lack of emphasis on technology training outside the one required technology course. These novice teachers understood that they were expected to develop student-centered, technology-rich lessons, but most of them said that they lacked the confidence to do so because, in their own view, they had not had a sufficient range of authentic experiences using technology in their own professional education. They were not able to see many connections between their one required technology course and the teaching theories and methods that they were learning in their other courses; they expressed a strong sense of contradiction between the ways they were asked to use technology within their teaching and the ways their own teachers—the faculty of their teacher education program—integrated technology into their classes. The findings from this study provide evidence for the concern raised by Bullock (2004) and Brzycki and Dudt (2005) that, unless the connections between technology and other aspects of teaching are explicitly demonstrated to pre-service teachers, they may not be able to transfer the knowledge and skills gained from their technology courses to their own future classrooms. This study also offers support for Brzycki and Dudt's view that teachers in training need authentic learning experiences throughout their teacher education program and direct experiences of the connections between theory and practice. As Bullock (2004) said, preservice teachers need to see models for how educational practices transfer from "university classroom to real-life situations" (p. 234).

Relevance

Another key theme that emerged from this study concerned perceived "relevance." Many studies have established how important it is for teachers to develop

an appreciation for the relevance of their technology training to their broader teaching objectives, especially with regard to their particular content areas. Kanaya et al. (2005) has similarly determined that when the relevance of skills is explained or demonstrated as part of training, teachers' perceptions of the value of the training are increased. Lambert (2005) argues that preservice teachers are only going to be able to see the relevance of using technology tools within their particular content areas if faculty members in those content areas model these technology tools. Lambert has stated that "a more comprehensive curriculum would provide students with a background in teaching and learning and tools, instructional strategies, lesson plans, and standards to be able to apply the skills throughout their methods courses and student teaching" (p. 6).

This study confirms these previous findings and exposes a problem: The majority of the preservice teachers interviewed for this study described the software packages they had learned in their one required technology course as not being relevant to their particular content areas. When asked to comment further, many remarked that, to create student-centered, technology-rich lessons for their own classrooms, they would have needed to see their content-area professors model technology integration. Yet perhaps the most striking report from these novice teachers was that during their university studies, they rarely had the opportunity to experience, as learners, the particular ways that technology could enhance instruction in the content areas that they would later be teaching.

From the perspective of these novice teachers, their one isolated technology course provided them insufficient exposure to the appropriate uses of specific technology tools in their particular content areas. Repeatedly, the participants in this study expressed the belief that isolating the technology training in a single course did not allow them to retain and transfer the information gained from this course to their present classroom teaching. This perception points to one final theme that emerged from the data gathered for this study: retention and transfer.

Retention and Transfer

Although the novice teachers in this study liked that their technology course exposed them to a variety of educational technologies, they expressed concern that this required technology course seemed like a crash course. They believed that the concentration of all of their technology training into a single course made the learning process too intense, even overwhelming. To retain the new technology skills they had learned in their technology course, the teachers said they needed more time to practice, reflect, and plan student-centered, technology-rich lessons. The limited amount of time they were able to spend on each technology project was not sufficient to allow them to experiment and refine their knowledge and skills in regard to technology integration. In their view, the time constraints of the course made it difficult for them to retain and transfer the knowledge and skills necessary into their present classroom teaching. The teachers also expressed a desire for more time to process information regarding the NETS. Across the board, these teachers said they would have liked to have seen these technology standards incorporated into all of their courses so that they could have gradually built confidence in their ability to implement the standards.

The overall conclusion of this study is clear: In order for preservice teachers to see a connection between the words and actions of university faculty regarding the importance of technology integration, in order for them to see the relevance of technological skills to their content areas, and in order for them to have sufficient time to retain and reflect on the technology skills they have been exposed to, they need to be provided with authentic learning experiences using technology throughout their teacher preparation program. It is essential that our preservice teachers receive continuous instruction in technology integration across the curriculum and have many opportunities to observe, practice, and reflect on student-centered, technology-enriched lessons. A single, isolated technology training course is not sufficient to achieve these goals.

Implications

What can university administrators, faculty, and staff take away from this study? What insights does it offer about how to enhance the effectiveness of preservice teachers' technology training experiences? This study has several implications for the university administrators, faculty, and staff charged with making decisions about the direction of technology integration training for the future.

As noted above, this study was conducted and interpreted in the context of the Essential Conditions for Implementing NETS for Teachers. The first Essential Condition from ISTE is shared vision. It states that there must "be a proactive leadership and administrative support from the entire system" (ISTE, 2000b, p. 1). This study's findings suggest something about the form that such support must take if it is to be effective. The participants in this study felt their teacher education faculty and administration did share a vision for technology integration, but they felt that this vision took the form of "a big push" disconnected from authentic learning experiences. One implication of this study is that deeds must match words in the effort to promote and support technology training throughout the system. The faculty who instruct preservice teachers must be qualified to demonstrate and model the vision of technology integration that they promote.

A related implication focuses on authentic learning and hands-on experiences. Future preservice teachers need to be provided with authentic learning experiences so they can connect the theory to the practice in relation to technology integration. Furthermore, they need more hands-on experiences in creating student-centered, technology-rich lessons throughout their teacher preparation program. This recommendation is consistent with the conclusions drawn by other researchers, including Bullock (2004) and Moersch

(2003), but the current study lends even more urgency to the recommendation by highlighting the confusion—perhaps even cynicism—engendered by the disconnect between words and deeds that these teachers perceived in their preservice training.

The second Essential Condition from ISTE (2000b) concerns access. It states that teacher education faculty "must have access to current technologies, software, and telecommunications networks" (ISTE, 2000, p. 1). Access was not a problem for the university in this study: Both faculty and students had ready access to a wide range of technologies, both in and outside their classrooms. Yet many participants expressed a concern that they rarely used these technology-rich environments, aside from the required technology course. Thus, another implication of this study is that access to technology, while perhaps a necessary condition for effective training in technology integration, is not sufficient. Curriculum and learning experiences need to be structured so that preservice teachers and their faculty are motivated to employ the resources available to them.

Yet another implication of this study relates to the seventh Essential Condition, student-centered teaching, which suggests that "teaching in all settings encompasses student-centered approaches to learning" (ISTE, 2000b, p. 1). The seventh essential condition reminds us that a student-centered, hands-on approach is necessary for learners to develop confidence in their skills. As noted above, the majority of the participants in this study perceived that they did not receive sufficient hands-on technology training throughout their program, and, as a result, many of the teachers in this study expressed feelings of inadequacy with regard to technology integration.

For university faculty to develop effective, student-centered, hands-on learning activities for the preservice teachers in their classes, they must themselves be skilled in using the technologies. This need is expressed in the third Essential Condition, skilled educators, which recommends that all "teacher education faculty must be skilled in using technology systems and software appropriate to their subject area and model effective use as part of the preservice teachers' coursework" (ISTE, 2000b, p. 1). This necessity is also acknowledged in Essential Condition 4, professional development, which recommends "personnel in teacher education and field experience sites are provided with ongoing professional development" and Essential Condition 5, technical assistance, which suggests "educators have technical assistance for maintaining and using technology" (ISTE, 2000b, p. 1). Were these conditions met at the university that was the focus of this study? Although the researcher did not collect data on the level of technical expertise of the faculty of this teacher education program, she did observe that the campus provides ongoing professional development and technical support for its faculty, academic teaching staff, and graduate teaching assistants. In addition, Essential Condition 10, support policies, recommends that "school and university policies, financing, and reward structures should be in place to support technology in learning" (ISTE, 2000b, p. 1). Although policies associated with accreditation, standards, and budget allocations were in place at this university, the researcher did not investigate the personnel decisions in the teacher education program or the field experience sites in regard to technology integration (perhaps another research study). Furthermore, ISTE suggests "retention, tenure, promotion, and merit policies reward innovative uses of technology by faculty" (ISTE, 2000b, p. 1). These policies were not implemented within the teacher preparation program. One implication of this study may be that technology integration needs to be more highly valued and rewarded within the university to encourage faculty across the curriculum to make the necessary investment of time and effort to enhance their skills.

The final implication of this study concerns time: Teachers need time, both during and after their preservice training, to observe, plan, practice, and reflect on student-centered, technology-rich lessons so that they can retain and transfer the knowledge and skills they have gained in regard to technology integration. One major benefit of integrating technology training across the curriculum would be to give teachers in training more opportunities to practice using technology, to get feedback on their efforts, and to reflect on the value that technology adds to their teaching. This cannot be accomplished in a single semester but must take place throughout their teacher training program. The trajectory of technology training should also extend into their teaching internships and perhaps beyond. Future preservice teachers would benefit from being able to consult with experts in technology integration as they begin to work in their own classrooms. ISTE's Essential Condition 9, community support, recommends that "teacher preparation programs provide teacher candidates with opportunities to participate in field experiences at partner schools where technology integration is modeled" (ISTE, 2000b, p. 1). Throughout the interviews, participants consistently commented on the lack of technology support they received during their internships. Several also noted that their mentoring teachers did not use technology. Many stated they would have appreciated some technology support from the university during their internship so they could feel more confident in presenting technology-rich lessons.

Recommendations for Future Research

Many researchers have surveyed students before, during, and immediately after completing their teacher preparation programs; however, little research has been done to follow teacher education graduates into their careers. As this study has demonstrated, such research can yield valuable insights about teachers' self-efficacy, and more of it should be done.

Also, although the findings from this study cannot be generalized and may not produce similar results at other universities, a replication of this study at a state or national level should be conducted so

technology training experiences of novice teachers who have graduated from different RU/VH Universities across the state or across the nation have the opportunity to share their technology training experiences. Examining these novice teachers experiences may provide insights that could promote change within teacher preparation programs across the United States and enhance the effectiveness of preservice teachers' technology training.

Another recommendation for future research would be to expand this study by interviewing the designated technology teachers from each school and/or the technology coordinators to see what types of technology training experiences they believe preservice teachers need. Because they help teachers every day, these on-site experts see firsthand what kinds of additional training our novice teachers need.

Finally, research is needed on how university faculty are using technology in their own teaching and to what extent these uses align with the NETS•T. All 20 participants in this study requested more modeling of technology integration from faculty in their content courses and within their methods courses. Research is needed to confirm these participants' reports that university faculty members tend to use technology only for a limited range of tasks—delivering content in PowerPoint presentations, accessing information on the Internet, or communicating via e-mail—and not in the ways that K–12 teachers are likely to need most.

Conclusion

The overall conclusion of this study is that, to be authentic, relevant, and retained, technology training needs to be infused throughout the education of preservice teachers. It should be addressed as an aspect of all the educational topics and standards covered in their classes, modeled in all of the instruction that they receive, and utilized in all of their practical experiences. A single technology course is not sufficient. Second, all faculty members throughout the teacher preparation program need to incorporate the NETS•T within their teaching so that present and future preservice teachers receive adequate exposure to these technology standards.

Integrating technology and the NETS•T throughout the teacher education program will require administration and faculty to not only think differently about technology, but also to adjust their own behavior. As Jacobsen, Clifford, and Friesen (2002) observe, "Learning how to teach and learning in new ways with technology requires imagination, intellect, creativity, and no small courage" (p. 368). The integration of technology into all aspects of teacher education must be, as Mills and Tincher (2003) have pointed out, a developmental process. In fact, the disconnect that so many of the preservice teachers in this study perceived is likely evidence that we are in the midst of the process, struggling to match words with deeds and provide the kinds of support teachers will need in a quickly changing technology environment. However, as we move through the process, it is important for teacher educators to have the goal in sight of a time when technology is integrated into learning across the curriculum, both in K–12 settings and the educational institutions where preservice teachers receive their training.

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