TECHNOLOGY AND TEACHER EDUCATION: AN EXPLORATION OF CONTEMPORARY REALITIES

BY

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DISSERTATION

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Abstract

A review of literature on technology integration and teacher education programs shows that teacher education programs are not adequately preparing students to integrate technology. This study focused on three teacher education programs across the country that have acquired a reputation among their peers for having successfully integrated technology into their programs. In order to gain a deeper understanding, three research questions guided the research: (1) What are the contemporary realities of technology and teacher education programs in the three programs? (2) What are the affordances and constraints around technology integration in the three programs? and (3) What working infrastructure has been established in teacher education programs as potential affordances for technology integration?

To answer these research questions, multiple case study techniques were incorporated. Qualitative data were collected through site visits at three teacher education programs. Data sources included observations, in-depth semi-structured interviews with faculty, staff, and students, and examinations of documents and artifacts related to technology. The three case studies played a vital part in understanding which technology integration model succeeded and did not succeed. By using qualitative research methodology, this study provided more lively and convincing stories and perspectives of technology and teacher education programs.

This study described the contemporary realities of technology and teacher education programs, the affordances and constraints around technology integration, and the process of creating a working infrastructure in teacher education programs as potential affordances for technology integration. The commitment to integrate technology in the programs was an evolving process. Teacher education programs continuously sought better ways to implement technology integration. One consistent finding across all programs was the lack of technology integration throughout the programs. There were strong attempts to integrate technology across the programs through a required technology course or digital portfolio construction and laptop initiative. Cases of integration of technology existed; however, it stayed at the individual level. Several affordances and constraints, ranging from organizational to personal constraints, have contributed to the general failure to integrate technology throughout the teacher education programs. In particular, levels of technology integration, administrative support, funding, technical support, technology access, and faculty development have influenced or hindered technology integration in the teacher education programs.

For mom, Suheyla Bakir;
dad, Abdullah Bakir; and
my sisters, Aysen, Aysel, and Mevlude

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Chapter 1

Introduction

It is special task of the social scientist in each generation to pin down contemporary facts…[and] to align culture's view of man with present realities.

(Cronbach, 1975, p. 126)

My personal journey into technology integration started when I attended a workshop on creating computer-assisted language activities. At the time, I was an English as a Second Language instructor. The more I started to discover how technology could support students' language skills, the more fascinated I became. At Illinois, my technology skills and interest in and experience with technology in teaching and learning have led to a wide range of experiences. As a graduate assistant at the Office of Educational Technology, I trained and consulted with faculty and students on how to use and integrate technology into their classrooms, provided technical support, and witnessed their successes and frustrations as they struggled with technology. I worked closely with the Tech-to-Go program participants, a *Preparing Tomorrow's Teachers to Use Technology Program* (PT3) initiative. This program provided a substantial library of equipment that could be checked out by students in the teacher education program to be used in their field placements. I supported these students with current technologies and provided technical support throughout their student teaching experience so that technology became an integral part of their instruction. At the beginning of the program, students were enthusiastic about trying different technologies to integrate in their teaching. Unfortunately, their desire to integrate technology in their field placements gradually faded away. Students often were frustrated because of the time it took to set up the equipment, to deal with technical problems, and to carry the equipment from the teacher education program to their field placements and vice versa.

I became more interested and curious when I started teaching the capstone technology course in the secondary program at Illinois. The secondary education teacher education program at Illinois requires each student to develop an electronic portfolio to demonstrate competence in specific Illinois State Board of Education Standards at the completion of the program. The *CI 335: Content Area Applications of Educational Technology* course serves to meet this requirement. The purpose of the electronic portfolio is to demonstrate students' growth and maturation toward his/her goal of becoming a reflective and highly skilled educator and to serve as a means for supporting authentic assessment. The course also serves as the preliminary effort to integrate technology in the teacher education program.

In Fall 2003, I started teaching the course and was in charge of both the English and social studies sections. This was a Satisfactory-Unsatisfactory course and was taken either in the fall or spring semester of the initial year of a four-year teacher education program. The course was subject-based and team-taught by a faculty member and three teaching assistants. It was offered to English and science majors in the fall, and to the social science and mathematics majors in the spring semester. The supervising faculty met only once with the students, usually the first class, to introduce students to the course and to briefly lecture on basic visual design principles. In addition to the electronic portfolio requirement, students learned the basic skills required to use Microsoft PowerPoint or Excel, depending on their content area. The PowerPoint project was designed for students in English and social studies while science and mathematics majors created a project using Excel.

Overall, the students enjoyed constructing electronic portfolios, but the course curriculum was problematic in many ways. First, the curriculum was teacher-centered and focused on building skills instead of learning how to teach with technology. Second, although the students reflected a wide range of technology skills, from novice to expert and comfort levels, they found learning PowerPoint or Excel unnecessary and boring because most of them already possessed the skills to use these programs. As a result, some students resisted and often complained that the course was too easy, too hard, or irrelevant to their other teacher education course experiences. Because the course did not allow accommodations for different skill levels, it was ineffective for many students. The course failed to challenge students, who already possessed basic technical skills to use the software and to apply those skills to integrate technology in their teaching. Third, because technology implementation in teaching was not integrated into the overall teacher education program, there was little, if any, dialogue between the methods and course faculty and the teaching assistants. Students learned technical skills and topics in isolation from the rest of courses in the teacher education program. Fourth, holding the class sessions in a PC computer lab made it difficult to create a learning environment in which students exchanged ideas, worked together, and were able to move around. Lastly, because the computer labs were not located in the College of Education building, onsite technical support was not available at the computer labs.

In Fall 2007, the teacher education program combined the technology course and the content-area literacy course under a different faculty member. The course was still team-taught by a faculty member and three teaching assistants. This integrated course focused on students' computer-based technologies and teaching reading, writing, and vocabulary development both within and across content areas. Through redesign of the content, materials, and projects, the focus shifted from learning about technology to learning with technology. We still demonstrated some skills, but students were expected to have the necessary skills or work on the skills on their own to complete the required projects. Students possessed different technology skills, but they worked in cooperative groups and provided assistance to their peers when needed. Students constructed an electronic portfolio in addition to multimodal and WebQuest projects. We used *Moodle* as the course management system to administer the distribution of materials and resources.

The overall reaction to the course was positive and different from the previous version of the course. First, the assignments allowed students to work both within and across content areas and develop projects that they could use in their teaching. Compared to the projects students had developed in the previous version of the course, the quality of the projects changed. The assignments students created proved that the students understood more about how to integrate technology into their teaching. Second, the classes were held at the College of Education classrooms. Due to the nature of the course, laptops were more appropriate than static computer labs. We used Windows and Mac mobile labs provided by the Office of Educational Technology. The portability of the mobile labs enabled us to reduce physical constraints and to create a student-centered learning environment, which supported and demonstrated the benefits of collaborative and mentor-based instructional strategies. Students still possessed different technology skills, but they worked in cooperative groups and provided assistance to their peers when needed.

The faculty and the teaching assistants ran into some logistical problems at the beginning of the semester. First, getting the carts into classrooms was difficult because the carts were not delivered to the classroom. The teaching assistants or the faculty picked up and dropped off the carts before and after class. Second, at times, the carts were not fully charged. We solved this problem by requesting power cords to plug into the laptops. Even though we made a semester-long reservation, there were some mix-ups at the beginning of the semester. Lastly, time for set up and closure took longer than expected especially, if there was another class prior to ours.

The third change occurred when the Learning Technologies unit under the Office of the Chief Information Officer, a non-academic unit, partnered with the Department of Curriculum and Instruction to teach the technology course. The course was offered only in the fall semester and was subject-based. The lectures/content were delivered asynchronously, and the lab sessions were held in a computer lab, focusing on skill development and product work. Students still constructed an electronic portfolio, learned a variety of digital media to support teaching and learning, and designed a learning unit with an emphasis on technology integration to provide meaningful learning.

My professional and academic experiences have helped me understand the relationship among teaching, learning, and technology. In addition, these experiences have colored my vision of what technology integration is and how it could be undertaken. My interactions with faculty and students have helped me identify possible missing pieces of technology integration in the teaching-and-learning puzzle. Teaching the two versions of the technology course has helped me gain an understanding what students seem to need in terms of technology integration to create meaningful learning environments. While in the first course, "technology was the end-goal, it was the means for achieving multidisciplinary" learning goals in the second course (Ertmer, 1999, p. 49). As I worked with faculty and observed my students, I began to ask questions such as: (1) What did students understand by technology integration? (2) What were their concerns about developing the projects? (3) Did they develop a better understanding of technology integration through the course curriculum? (4) Did these projects prepare students to integrate technology in their teaching? (5) How could the teacher education program provide guidance and support in helping faculty and students to integrate technology in teaching and learning? (6)

What did faculty understand by technology integration? and (7) How could faculty be encouraged or supported to integrate technology in their instruction? These questions and others have continued to impact my changing views of technology integration.

Numerous definitions of technology integration have been expressed over the years (Association for Educational Communications and Technology, 1996; Beaver & Moore, 2004; Dias, 1999; Ellington, Percival, & Race, 1993; Pierson; 2001). It is beyond the purpose of this study to argue for one understanding over another. I use one definition that is widely used and developed by the leading association in the field of technology and teacher education.

In 1998, International Society for Technology and in Education (ISTE) published its first set of National Education Technology Standards (NETS) as a national initiative to focus on teacher education and technology (ISTE, 1998). Initially, these standards focused on the technology tools students needed to learn to use and outlined the expectations for teachers to demonstrate their skills and knowledge about technology. Over the years, ISTE launched a new set of standards to meet the rapid changes in technology (ISTE, 2008). The revised standards indicate that technology's role in teaching and learning has shifted from learning about technology to learning with technology and has put new demands on educators and students. The ISTE standards are discussed in depth in Chapter 2.

My definition and vision of technology integration is grounded in the ISTE's definition. ISTE (2003) defined technology integration as "the seamless, day-to-day connection of technology to instruction for the purpose of supporting and extending curriculum objectives and to engage students in meaningful learning" (p. 218). Meaningful technology integration is to know when, why, and how specific tools should be used to facilitate overall learning since these "decisions cannot be made in isolation of theories and research on learning, instruction, and assessment” (Lawless & Pelligrino, 2007, p. 581). Technology integration does not focus on technology itself, rather, it concentrates on the learning that takes place through the use of technology and how teachers and learners work with these tools to broaden their intellectual capabilities for a meaningful learning experience. Successful technology integration is not defined by the amount, but by the nature of its use (Earle, 2002). Technology integration is neither simply a tool nor an add-on or a separate entity. Meaningful technology integration is to understand how we as educators need to change how we think about our curricular objectives to transform all parts of teaching and learning in a seamless way. It occurs when teaching and learning transforms with the support of technologies (Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2008) and new resources are incorporated “into the knowledge of a discipline in ways that enhance learning” (Dexter, Doering, & Riedel, 2006, p. 327). For the purpose of this study, technology refers to individual digital tools such computers, software programs, digital cameras/camcorders, probes, document projectors, and SmartBoards.

Wallis and Steptoe (2006) listed four components of the 21st century competencies in relation to technology integration in teaching and learning. These included (a) global awareness; (b) creativity; (c) understanding new sources of information; and (d) social skills. According to Ayas (2006), “in the 21st century, the new vision of education is to make learning accessible to all, but it is hard to reach this goal through the use of traditional methods” (p. 14). Donlevy (2006) suggested that “as the newer technologies emerge into view, students, teachers, and administrators should be incorporating them into daily teaching and learning practice” (p. 122). As a result, “new teachers are expected to enter the educational field with knowledge not only in their content areas, but of technology as well” (Ayas, 2002, p. 14) and “teachers are expected to use technology to support their teaching and to improve student learning" (Wright & Wilson, 2007, p. 80).

My experiences, like the research on technology and teacher education programs, have shown that students are not being adequately prepared to use technology (Banister & Vannatta, 2006; Bansavich, 2005; Beaver, 1990; Brinkerhoff, Ku, Glazewski, & Brush, 2001; Brooks & Kopp, 1989; Brown, 2003; Cunningham, 2004; Darling-Hammond, Chung, & Frelow, 2002; Doering, Hughes, & Huffman, 2003; Drazdowski, Holodick, & Scappaticci, 1998; Duhaney, 2001; Ertmer, 2005; Harnisch, 2002; Faison, 1996; Gray, Thomas, & Lewis, 2010; Kay, 2006; Kleiner, Thomas, & Lewis, 2007; Lambert, Gong, & Cuper, 2008; Moursund & Bielefeldt, 1999; National Association for Accreditation of Teacher Education, 1997; Okojie & Olinzock, 2006; OTA, 1988, 1995; Pellegrino & Altman, 1997; Schrum,1999; Smarkola, 2007; Strudler & Wetzel, 1999; Topp, Mortensen & Grandgenett, 1995; Willis & Mehlinger, 1996; Wilson, 2003; Yali, 2007; Yildirim, 2000).

These experiences and the findings from much research have led me on a quest to understand the affordances and constraints around technology integration in teacher education programs. When I read empirical research on the area of how teacher education programs work on preparing students to integrate technology, I found that research on integration models and strategies exist, but it does not specify how changes to the programs have influenced students in their preparation to teach with technology. I believe that determining the affordances and constraints around technology integration in teacher education programs can greatly aid programs to foster increased implementation of technology by understanding what makes well-designed and successful technology integration.

Statement of the Problem

Technology integration has been widely discussed in the past several decades as teacher education programs have been trying to find effective ways to integrate technology in teaching and learning. Computer technology has nearly a 50-year history in education. The earliest reference to educational technology was made by a radio instruction pioneer, W. W. Charters, in an interview in 1948 (Saettler, 1990). Technology innovations such as radios in the 1920s, movies in the 1930s, televisions in the 1950s, computers in the 1960s, and the Internet and the World Wide Web in the late 1990s have not achieved the promised effect of improving teaching and learning. Technology became an essential component of educational discourse in the early 1980s when computers first started to claim a physical presence in classrooms with the Apple Classrooms of Tomorrow Project.

As technology has created a new and powerful tool for teaching and learning, educators are still not sure about the role of technology (Ertmer, 1999). Preparing technology-proficient teachers to meet the needs of 21st century learners critically challenges teacher education programs across the country and has constantly received significant attention. A successful teacher education program teaches teachers well, so they can in turn teach their students well. Teachers are the link between information technology and the students. Teacher education programs are a natural place to teach students how to integrate technology (Fasion, 1996; Kay, 2006; Lemke, 1999); however, numerous challenges exist for teacher education programs. Because these challenges create considerable obstacles for faculty as they attempt to integrate technology into teaching and learning, it is important to examine the affordances and constraints around technology integration in teacher education programs.

Purpose of the Study

This study focuses on three teacher education programs across the country that have acquired a reputation among their peers for having successfully integrated technology into their programs. It examined the affordances and constraints around technology integration in these teacher education programs. This study seeks to gain a deeper understanding of the following research questions:

(1) What are the contemporary realities of technology and teacher education programs in the three programs?

(2) What are the affordances and constraints around technology integration in teacher education programs in the three programs? and

(3) What working infrastructure has been established in teacher education programs as potential affordances for technology integration?

Significance of the Study

The research is important for several reasons. First, the review of the literature has made clear that much of the research done on technology and teacher education programs has been carried out by people with vested interests in the programs being studied. Mergendoller, Johnston, Rockman, and Willis (1994) conducted case studies of four "exemplary" teacher education programs, three in-service programs in school districts, and one state-wide initiative. They, however, relied heavily on the testimony of people with strong vested interest in the programs. The use of a selected rather than broad-based sample of teacher educators brings up the question whether the responses reflect the reality of what is happening in teacher education programs. This study targets faculty and staff, people who actually teach in the teacher education programs. Drawing on Cronbach's (1975) notion of contemporary realities, I seek to understand the importance of making the distinction between what people are saying they are doing and what they are actually doing.

Second, I provide a critical look at the contemporary “realities” of technology and teacher education to show what is actually taking place in teacher education programs and technology. Third, as teacher education programs respond to the need to prepare students to teach with technology, there is little research on which to base well-designed and successful technology integration in teacher education programs. Research on integration models and strategies exist, but it does not specify how changes to the program have influenced students in their preparation to teach with technology. The goal of the study is to help teacher educators better understand what makes well-designed and successful technology integration in teacher education programs. Fourth, determining the affordances and constraints around technology integration in teacher education programs can greatly aid programs in fostering increased implementation of technology. It will also help educators and policymakers better understand what makes well-designed and successful technology integration in teacher education programs by identifying, examining, and developing practical and curricular suggestions in successful and meaningful technology integration and establishing modifications to the curriculum to service the needs of students.

I seek to describe the contemporary realities of technology and teacher education programs, the affordances and constraints around technology integration, and the process of creating a working infrastructure in teacher education programs as potential affordances for technology integration. The findings showed that the commitment to integrate technology in the programs was evident and an evolving process. Teacher education programs continuously sought better ways to implement technology integration. There were vigorous attempts at technology integration across the programs through a required technology course or digital portfolio construction and laptop initiative. Instances of integration of technology existed; however, they stayed at the individual level. One consistent finding across all programs was the lack of systematic technology integration throughout the programs. Several affordances and constraints, ranging from organizational to personal constraints, seemingly contributed to the general failure to integrate technology throughout the teacher education programs.

The Research Methodology

This qualitative research is a case study-oriented study. I chose the case study methodology for four reasons. First, the nature of the research questions dealt with “how” and “why” of social phenomena (Yin, 2003, p. 2). Second, it was “an intensive description and analysis of a phenomenon or social unit such as an individual, group, institution or community” (Merriam & Associates, 2002, p. 8). Third, the cases expanded the scope and breadth of the study by using different methods in different components (Greene, Caracelli, & Graham, 1989). Fourth, the research itself was inductive and was built on themes and concepts (Merriam & Associates, 2002). Fifth, I sought to produce rich and holistic accounts and understandings of phenomena based on real-life situations (Merriam, 1988), “making accessible to the reader all the information necessary to understand the case in all its uniqueness” (Patton, 2002, p. 450). The three cases allowed me to obtain a detailed inquiry related to the affordances and constraints around technology integration (Creswell, 2007). Sixth, looking at the data on both an individual level and as a group allowed for comparing and contrasting the affordances and constraints around technology integration and summarizing the characteristics of each teacher education program. Lastly, the research itself was inductive and was built on themes and concepts, and the results were descriptive meaning knowledge was conveyed through words, documents, interviews, and observations (Merriam & Associates, 2002).

A variety of qualitative data was collected to ensure that the same phenomena were explored from multiple perspectives. Data sources included observations, in-depth semi-structured interviews with faculty, staff, and students, and examinations of documents and artifacts related to technology at the three programs. The three case studies played a vital part in understanding which technology integration model succeeded and did not succeed. By using qualitative research methods, this study provided more lively and convincing stories and perspectives of technology and teacher education programs.

Limitations

There are several limitations to the study. I was able to choose the participants for the interviews except at Eastern State University where I was given a list of faculty to interview by the associate dean of the College of Education. My analysis was limited to these participants. However, I conducted candid interviews with the associate dean and faculty in the instructional technology department. The fact that the data collection at Eastern State University took place during finals week may have limited the access to more insightful experiences and observations with faculty and students.

Second, even though the interviews generated rich data, more observations would have connected what the participants said they were doing to what they were actually doing with technology in their teaching. It also would have provided a deeper understanding of their learning goals for technology integration. Most of the interview data were descriptions of the participant's perception. More observations would have addressed this limitation.

Overview of the Dissertation

The study is organized into six chapters. This chapter has introduced the study, stated the problem, the purpose of the study, the significance of the problem, the research methodology, and the limitations of the study and offered an overview of the study. Chapter 2 provides a review of the literature relevant to the study and is divided into three parts. Part One is an overview of teacher education programs and technology. Part Two focuses on technology integration in teacher education programs. Part Three describes the affordances and constraints around technology integration in teacher education programs. Chapter 3 discusses the research design, methods of data collection, data analysis, and how trustworthiness was established for the study. Chapter 4 presents three teacher education programs individually. Each program starts with a brief description of the teacher education program, followed by the affordances and constraints around technology integration section, and ends with a summary. Chapter 5, the cross-case analysis, concentrates on the affordances and constraints around technology integration across the cases. Chapter 6, the final chapter, provides the conclusion, the recommendations and outlines future research.

Chapter 2

Literature Review

> The status quo does change—by slow, painful degrees, to be sure, but it does change… . New teachers can defy the odds by creating new odds . . . the status quo is not a reason to give up on teaching, but the reason for teaching.
>
> (Oakes & Lipton, 2007, p. 471)

This literature review positions this study in the existing body of literature associated with technology and teacher education programs to provide a context and rationale for the study. The literature review is divided into three parts. Part One is an overview of teacher education programs and technology. Part Two focuses on technology integration in teacher education programs. Part Three describes the affordances and constraints around technology integration in teacher education programs.

Part One: Overview of Teacher Education Programs and Technology

A study, *Visions 2020 Student Views on Transforming Education and Training Through Advanced Technologies,* conducted by the U.S. Departments of Commerce and Education and NetDay, asked about K–12 students' use of technology. More than 160,000 students participated from public and private schools across the nation. Of those, 38 percent were in grades K–6 and 62 percent were in grades 6–12. Fifty-one percent of students were male, and 49 percent were female. Students' responses generated four themes: (1) digital devices; (2) access to computers and the Internet; (3) intelligent tutor/helper; and (4) ways to learn and complete school work using technology. The study identified potential technologies, their application for learning, and how the learning environment would need to change to take full advantage of them. When the analysis was done, the most popular concepts in students' responses produced a vision of how they wanted to use technology in learning. In their world:

> Every student would use a small, handheld wireless computer that is voice activated. The computer would offer high-speed access to a kid-friendly Internet, populated with websites that are safe, designed specifically for use by students, with no pop-up ads. Using this device, students would complete most of their in school work and homework, as well as take online classes both at school and at home. Students would use the small computer to play mathematics-learning games and read interactive e-textbooks. In completing their schoolwork, students would work closely and routinely with an intelligent digital tutor, and tap a knowledge utility to obtain factual answers to questions they pose. In their history studies, students could participate in 3-D virtual reality-based historic reenactments (p. 6).

From this description, it is obvious that technology is part of many students' lives and technology has created a new and powerful tool for teaching and learning. Yet, there is confusion among educators about the role of technology (Ertmer, 1999). In 1983, *A Nation at Risk* recommended that high school graduation requirements include a computer course (National Commission on Excellence in Education, 1983). The *No Child Left Behind Act of 2001* (NCLB) (2002) also recommended that by the end of the eighth grade all students should be technologically literate. As a result, technology proficiency has become a core requirement in schools today (U.S. Department of Education, 2004).

Even though Cuban (2001) claimed, "students' access to computers in American schools varies greatly by social class, race, and native language (p. xi), access to and the use of technology in American schools have increased (Culp, Honey, & Mandinach, 2003; Gray, Thomas, & Lewis, 2010). The U.S. Department of Education reported that there was one computer for every five public school students in 2000; and 95 percent of K–12 classrooms had Internet connectivity (Mouza, 2003). A more recent report, *Teachers' Use of Educational Technology in U.S. Public Schools: 2009*, found that 97% percent of teachers had one or more computers located in the classroom every day (Gray, Thomas, & Lewis, 2010).

With increased access to technology in schools and classrooms and in order to keep up with the students who live in a digital world, it is necessary for teachers to learn how to implement technologies into their teaching. Teacher education programs have been trying to find effective ways to integrate technology in teaching and learning. However, integrating technology into teacher education programs still remains a challenge. Kim (2008) found that student exposure to technology in teacher preparation programs encouraged "less anxiety and a positive level of intent to use technology in their future classroom" (p. 35). Even though teacher education programs are "a natural place to start with respect to integrating technology into education" (Kay, 2006, p. 384) and "most direct and cost-effective way to educate teachers about technology (Lemke, 1999, p. 166-167), the need to educate students to integrate technology in teaching and learning still remains a pressing need.

A review of literature on technology integration and teacher education programs has shown that students are not being adequately prepared to integrate technology (Banister & Vannatta, 2006; Bansavich, 2005; Beaver, 1990; Brinkerhoff, Ku, Glazewski, & Brush, 2001; Brooks & Kopp, 1989; Brown, 2003; Cunningham, 2004; Darling-Hammond, Chung, & Frelow, 2002; Doering, Hughes, & Huffman, 2003; Drazdowski, Holodick, & Scappaticci, 1998; Duhaney, 2001; Ertmer, 2005; Harnisch, 2002; Faison, 1996; Gray, Thomas, & Lewis, 2010; Kay, 2006; Kleiner, Thomas, & Lewis, 2007; Lambert, Gong, & Cuper, 2008; Moursund &

Bielefeldt, 1999; National Association for Accreditation of Teacher Education, 1997; Okojie & Olinzock, 2006; OTA, 1988, 1995; Pellegrino & Altman, 1997; Schrum,1999; Smarkola, 2007; Strudler & Wetzel, 1999; Topp, Mortensen & Grandgenett, 1995; Willis & Mehlinger, 1996; Wilson, 2003; Yali, 2007; Yildirim, 2000). In their comprehensive literature review on technology and teacher education programs, Willis and Mehlinger (1996) concluded:

> Most preservice teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology…The virtually universal conclusion is that teacher education, particularly preservice, is not preparing educators to work in a technology-enriched classroom. (p. 978)

Much of the research related to technology integration in K−12 classrooms shows that teachers feel inadequately prepared to integrate technology effectively in their classrooms (Hew & Brush, 2007; Schrum, 1999; Strudler & Wetzel, 1999). Gray, Thomas, and Lewis (2010) found that 16% of secondary teachers reported never using computers during classroom instructional time and 23% reported using computers only rarely.

Many efforts have been made to ensure that students are adequately prepared to integrate technology across the country. In the next section, I will focus on studies conducted by the government and national/international associations, and grant programs related to technology and teacher education programs to discuss these efforts.

Studies conducted by the Government. The U.S. Department of Education has conducted many comprehensive studies related to technology and teacher education programs over the years. In 1986, the United States Congress asked the Office of Technology Assessment (OTA) to study the use of computers in K−12 education. The study, *Power On! New Tools for*

Teaching and Learning, found that

> The vast majority of those [teachers] now teaching or planning to teach have had little or no computer education or training. The most recent data available indicate that only one-third of all K–12 teachers have had as much as 10 hours of computer training. And much of this training focused on learning about computers, not learning how to teach with computers (p. 18).

The study concluded "graduates of teacher preparation institutions apparently do not feel prepared to use computers in teaching" (OTA, 1988, pp. 99-100).

In 1995, OTA conducted another study, *Teachers and Technology: Making the Connection,* to understand why teachers did not use technology, the outcomes of technology integration, and the factors influenced technology integration in K–12 schools. The study found that technology was not central to the teacher preparation experience in most colleges of education. Another finding revealed that only three percent of teacher education graduates felt very well prepared to use technology in the classroom. The study concluded "most new teachers graduate from teacher preparation institutions with limited knowledge of ways technology can be used in professional practice" (p. 165).

In 1996, the U.S. Department of Education released the nation's first educational technology plan, *Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge*. The plan provided widespread, effective integration of technology in education and reflected four national educational technology goals. These goals included:

1. All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway.

2. All teachers and students will have access to modern multimedia computers in their classrooms.
3. Every classroom will be connected to the information superhighway.
4. Effective software and online learning resources will be an integral part of every school's curriculum.

In 2000, the CEO Forum on Education and Technology developed the School Technology and Readiness (STaR) Chart, which grew out of the 1999 the *Professional Development: A Link to Better Learning* study. The chart provides guidelines for teacher education programs to measure their progress in integrating technology into their programs. The chart included specific goals for (a) university chancellors, college presidents, provosts, and all deans; (b) education deans and directors of teacher education programs; (c) faculty; (d) students; and (e) alumni.

Since the OTA's first study, some progress has been made. The NCES report, *Educational Technology in Teacher Education Programs for Licensure,* offered current data on the extent undergraduate teacher education program prepared students to use of educational technology for instruction. Kleiner, Thomas, and Lewis (2007) reported that "integrating technology into instruction was taught in all or some teacher education programs at all of the 4-year institutions with teacher education programs for initial licensure" (p. 6). However, they also pointed out that the reporting of technology integration was not an indication of depth or quality.

More recently, the U.S. Department of Education, Office of Educational Technology published its *National Education Technology Plan 2010: Transforming American Education: Learning Powered by Technology*. The plan pointed out "Technology should be used in the preparation and ongoing learning of educators to engage and motivate them in what and how they teach" (p. 16). It presents a model of learning powered by technology, with goals and recommendations in five essential areas:

1. Learning: Engage and Empower: All learners will have engaging and empowering learning experiences both in and out of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society.
2. Assessment: Measure What Matters: The education system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement.
3. Teaching: Prepare and Connect: Professional educators will be supported individually and in teams by technology that connects them to data, content, resources, expertise, and learning experiences that can empower and inspire them to provide more effective teaching for all learners.
4. Infrastructure: Access and Enable: All students and educators will have access to a comprehensive infrastructure for learning when and where they need it.
5. Productivity: Redesign and Transform: The education system at all levels will redesign processes and structures to take advantage of the power of technology to improve learning outcomes while making more efficient use of time, money, and staff.

Studies conducted by national and international associations. National and international associations have also paid close attention to technology and teacher education programs. In 1998, the International Society for Technology in Education (ISTE), first organization to recognize the emerging needs of technology and teacher education, created the

National Education Technology Standards for administrators, teachers, and students (ISTE, 1998). The National Council for Accreditation of Teacher Education (NCATE) has adopted these technology standards and requires teacher education programs to restructure their programs. These NCATE standards describe the essential conditions needed to support technology use in teacher education programs, and provide a foundation in technology for all teachers. NCATE (1997) communicated the need for a vision of teacher education program that fully uses technology. The components of this vision are (a) a greater understanding of the effects of technology on our society; (b) the assumption of new roles as authority over knowledge moves beyond the teacher and the classroom; and (c) an emphasis on the ability to organize and interpret information and assess the quality of information and resources in a reflective and critical manner. As a result, students in teacher education programs are expected to be proficient in technology integration in teaching and learning.

In 1997, the NCATE Task Force on Technology and Teacher Education examined its accreditation program with regard to technology. As with previous studies, the study found that faculty did not use technology in their own research and teaching and students were hardly required to apply technology in their courses. The study proposed

> The nation’s teacher education institutions must close the teaching and learning technology gap between where we are not and where we need to be . . . .Teacher education institutions must prepare their students to teach in tomorrow’s classrooms. (p. 3)

The recommendations included: (a) stimulating more effective uses of technology in teacher education programs; (b) using technology to improve the existing accreditation process and to reconceptualize accreditation for the 21st century; and (c) improving and expanding its own operations through greater uses of technology (NCATE, 1997). The American Association of Colleges of Teacher Education (AACTE) surveyed its member institutions to identify the faculty and student use of technology and institutional capacity (Persichitte, Caffarella, & Tharp, 1997). Consistent with the earlier research findings, the survey found that few students were expected to use computers.

In 1998, ISTE appointed the Milken Exchange on Educational Technology to survey schools, colleges, and departments of education to determine to what extent students were being exposed to technology in their classes, field experience, and curriculum materials. Moursund and Bielefeldt (1999) surveyed 416 institutions across the country. The findings of the study, *Will New Teachers Be Prepared To Teach In A Digital Age?,* included the following:

1. Teacher education faculty possessed comparable technology skills to the technology skills of the students they taught; yet, faculty did not model the use of technology in their teaching.
2. There was a large gap between what K–12 students needed to know about technology and what teacher education schools were teaching.
3. Teacher education programs did not provide adequate experiences to prepare students to use technology in their classroom.

Grant programs. In order to support and improve technology integration in teacher education, many public and private institutions provided funding. The Department of Education introduced its first technology grant program, *Preparing Tomorrow's Teachers to Use Technology Program (PT3)* in 1999. The program awarded a total of $337.5 million grants to 441 higher education institutions, state agencies, school districts, non-profit organization to support faculty development, course restructuring, certification policy changes, and other modifications to transform teaching and learning with technology (U. S. Department of Education, 2005). The grant projects included: (a) faculty development; (b) course restructuring; (c) certification policy changes; (d) online teacher preparation; (e) enriched-networked-virtual; (f) video case studies; (g) electronic portfolios; (h) mentoring; and (i) embedded assessments. Duffield and Moore (2006) reported that many of the studies reporting on the success of the PT3 program focused on the individual results of grant recipients. Cohen and Tally (2004) found that participating in the grants helped nearly 15,000 participating feel more prepared to use technology; however, there is a lack of research on whether or not the grants helped students became successful users of technology in their practice (Clausen, 2007) due to the limited empirical evidence about the impact of these initiatives (Mims, Polly, Shepherd, & Inan, 2006). Lessons learned from recent PT3 projects found that the most prevalent and successful strategies for technology integration were: (a) professional development; (b) collaboration for curriculum reform; and (c) incentives (Duffield & Moore, 2006).

Recently, the American Recovery and Reinvestment Act of 2009 provided $650 million in funds for the Enhancing Education through Technology program. The program aims to improve student academic achievement by using technology in schools, and to create teacher training and curriculum development that encourages effective integration of technology (U.S. Department of Education, 2009).

Part Two: Technology Integration in Teacher Education Programs

Over the years, there has been much debate about the most effective ways of teaching technology integration in teacher education programs. However, the National Educational Technology Standards (NETS) developed by ISTE have been widely used as guidelines to improve technology integration in their programs.

National technology standards. ISTE created the National Education Technology Standards (NETS) to promote systemic reform across the country (ISTE, 1998). These standards have specific implications for the preparation of students to integrate technology in their teaching.

In 1998, ISTE published its first set of technology standards for K–12 students (National Education Technology Standards for Students [NETS−S]). These standards consisted of six categories: (a) basic operations and concepts; (b) social, ethical, and human issues; (c) technology productivity tools; (d) technology communications tools; (e) technology research tools; and (e) technology problem-solving and decision-making tools. They described what technology skills and knowledge students needed to have and outlined the expectations teachers' skills and knowledge about technology.

However, the standards from 1998 did not meet the rapid changes in technology, student demographics, and the shift in technology's role in teaching and learning. In 2008, the chief executive officer of ISTE, Don Knezek, noted,

> In 1998, it was enough to define what students needed to know about and be able to do with technology. Now, we're defining what students need to know and be able to do with technology to learn effectively and live productively in a rapidly changing digital world. (ISTE, 2008, p. 1)

ISTE had revised the 1998 standards in 2007. With the new standards, the foci shifted from learning technology to learning with technology in order to "truly provide students the opportunity to learn effectively for a lifetime and live productively in our emerging global society and increasingly digital world" (ISTE, 2007, p. 1). The current standards include six areas: (a) demonstrate creativity and innovation; (b) communicate and collaborate; (c) conduct research and use information; (d) think critically, solve problems, and make decisions; and (e) use technology effectively and productively.

The National Education Technology Standards for Students (NETS−S) standards were the beginning point for NETS for Teachers (NETS−T) in 2000 and NETS for Administrators (NETS−A) in 2002. The NETS−T standards laid the groundwork for teacher education programs and defined the fundamental concepts, knowledge, skills, and attitudes for applying technology in educational settings. The NETS−A standards described what administrators needed to know and be able to do as leaders in the effective use of technology in schools. Over the years, these standards were also revised.

The first NETS−T (2000) standards focused on six areas: (a) technology operations and concepts; (b) planning and designing learning environments and experiences; (c) teaching, learning, and the curriculum; (d) assessment and evaluation; (e) productivity and professional practice; and (f) social, ethical, legal, and human issues (ISTE, 2000, p. 9). These standards addressed what new teachers should be able to do with technology upon entering the classroom (ISTE, 2000). However, these standards were revised in 2007 and 2008. The revised standards included (a) facilitating and inspiring student learning and creativity; (b) designing and developing digital-age learning experiences and assessments; (c) modeling digital-age work and learning; (d) promoting and modeling digital citizenship and responsibility; and (e) engaging in professional growth and leadership. Current standards explain what new teachers should be able to do with technology upon entering the classroom. Teachers are expected to acquire a broad range of methods and skills to enhance teaching and support learning with technology.

In 2002, The Collaborative for Technology Standards for School Administrators (TSSA Collaborative) developed the Technology Standards for School Administrators, which were adopted by ISTE NETS. These standards were organized under six categories: (a) leadership and vision; (b) learning and teaching; (c) productivity and professional practice; (d) support, management, and operations; (e) assessment and evaluation; and (f) social, legal, and ethical issues.

The revised NETS−T (2008) and the NETS−S (2007) raised the bar for school leaders. For administrators to create and sustain a culture that supports digital-age learning, they must become comfortable collaborating as co-learners with colleagues and students around the world.

Similar to NETS−S and NETS−T, these standards were revised in 2009 in order to meet the needs of the students and teachers due to rapid changes in technology. They include five areas: (a) visionary leadership; (b) digital age learning culture; (c) excellence in professional practice; (d) systemic improvement; and (d) digital citizenship.

As Knezek stated,

> Integrating technology throughout a school system is, in itself, significant systemic reform. We have a wealth of evidence attesting to the importance of leadership in implementing and sustaining systemic reform in schools. It is critical, therefore, that we attend seriously to leadership for technology in schools. (ISTE, 2009, p. 1)

The National Standards provide a framework for educators to create environments in which technology is part of teaching and learning in consistent, systematic ways. Many states have also produced their professional standards and have included technology integration in their standards.

Approaches in Technology Integration in Teacher Education Programs.

In order to meet the needs of students in regards to technology integration and the national and state technology standards, teacher education programs across the country have used different strategies to incorporate technology in their programs. Strudler, Archambault, Bendixen, Anderson, and Weiss (2003) identified one or a combination of components in relation to technology integration: (a) educational technology courses; (b) integration of technology into methods and other content courses; and (c) integration of technology in the field placements. In a more recent study, Kay (2006) examined 68 referred journal articles and identified 10 approaches to introducing technology to students in teacher education programs. These approaches included: (a) integrating technology in all courses; (b) using multimedia; (c) focusing on education faculty; (d) offering a single course; (e) modeling how to use technology; (f) collaboration among students, cooperating teachers, and faculty; (g) offering mini-technology-workshops; (h) providing access to technology and support; (i) focusing on cooperating teachers; and (j) practicing technology in field placements. For the next part of the literature review, I will focus on studies related to technology integration via single courses, across curriculum, and field placements.

Technology integration via a single course. This was the earliest, typical approach in most teacher education programs (Handler & Strudler, 1997; Hargrave & Hsu, 2000; Honawar, 2008; O'Bannon & Pluckett, 2007; Pope, Hare, & Howard, 2002; Moursand & Bielefeldt, 1999; Stuhlmann & Taylor, 1999; Wentworth, Graham, & Tripp, 2008; Willis & Sujo de Montes, 2002). Moursand and Bielefeldt (1999) found that 85 percent of teacher education programs across the nation offered technology instruction via a single course. A recent survey of teacher education programs across the country, *Educational Technology in Teacher Education Programs for Initial Licensure 2009,* reported that 51% offered 3− or 4 credit and 34% offered 1−or−2−credit stand-alone courses in educational technology in their programs (Kleiner, Thomas & Lewis 2007).

These introductory educational courses primarily focused on basic computer technology skills (Doering, Hughes, & Huffman, 2003; Downs, 1992; Hargrave & Hsu, 2000; McKenzie, 1994; Niess, 1991; Raiford & Braulick, 1995). On one hand, one course has not been seen enough to acquire the necessary knowledge and skills (Bai & Ertmer, 2008; Wang & Holthaus, 1999) and does not assure technology integration in teaching and learning (Mehlinger & Powers, 2002). Moursand and Bielefeldt's (1999) study found that students did not benefit from single technology courses because learning in isolation (Gunter, 2001; Whetstone & Carr-Chellman, 2001) did not give them the skills and the abilities necessary to integrate technology into teaching (Brown & Warscher, 2006; Moursand & Bielefeldt, 1999; Wang & Holthaus, 1999). On the other hand, these classes changed students' attitudes toward educational technology (Milbrath & Kinzie, 2000), their perceived self-efficacy (Albion, 2001, Gunter, 2001; Milbrath & Kinzie, 2000; Persichitte, Caffarella, & Tharp, 1997; Willis & Sujo de Montes, 2002), their technology skills (Hargrave & Hsu, 2000; Strudler et al., 2003), and provided an overview of different uses of technology (McRobbie, Ginns, & Stein, 2000). Often, these courses serve as a transition to the integration of technology across methods courses and are eventually phased out (Bielefeldt, 2001). Other studies reported that students did not integrate the technology skills and knowledge in their methods courses or in their field experiences (Pope, Hare, & Howard, 2002; Strudler, McKinney, Jones, & Quinn, 1999). Belson and Larkin (2004) argued that the single course approach gave "students the impression that they too can simply 'add-on' technology when they are teaching and not use it throughout their lessons" (p. 22).

Technology integration in all courses. Research has shown the importance of how technology should be integrated across the curriculum (Collier, Weinburg, & Rivera, 2004; Dershimer & Dershimer, 1991; Doering et al., 2003; Hess, 1992; ISTE, 2003; Pope, Hare, &

Howard, 2002; Milbrath & Kinzie, 2000; Moursund & Bielefeltdt, 1999; Niess, 2005; Wetzel, 1993; Wetzel, Zambo, & Buss, 1996). According to Belson and Larkin (2004), this more desirable strategy allows students to “have more opportunities to practice a variety of technologies in a more realistic context” (p. 22) and to learn with technology instead of about technology (Doering et al., 2003; Milbrath & Kinzie, 2000).

In order to sustain technology integration across the curriculum, research emphasizes the importance of modeling of technology use by instructors and teachers in methods courses (Adamy & Boulmetis, 2006; Bai & Ertmer, 2008; Brown & Warschauer, 2006; Dexter, Doering, & Riedel, 2006; Drazdowski, 1994; Handler, 1993; Faison, 1996; Franklin, 2007; Luke, More, & Sawyer, 1998; Lloyd, Merkley, & Dannenbring, 2001; Moursund & Bielefeldt, 1999; Northrup & Little, 1996; OTA, 1995; Parker, 1997; Persichitte, Caffarella, & Tharp, 1997; Schrum, 1999; Schrum & Dehoney, 1998; Stuhlmann, 1998; Strudler et al., 1999; Widmer & Amburgey, 1994; Zachariades & Killingsworth, 1995; Vannatta, 2000a; Wetzel, 1993; Willis & Tucker, 2001; Willis & Mehlinger, 1996).

Methods courses play a vital role in the development of students as future teachers. Wang (2002) argues that:

> Preservice teachers’ beliefs and perceptions play a crucial role in shaping their future teaching behaviors. Understanding preservice teachers' beliefs will help improve their professional preparation . . . . With computers becoming an essential part of the learning process in classroom settings, it is imperative to investigate preservice teachers’ perceptions of their roles as teachers in such a learning environment. (p. 152)

Thus, modeling becomes important because it allows students to do the following:

1. Learn and observe new and existing technologies in their teaching (Lloyd, Merkley, & Dannenbring, 2001; Schrum & Dehoney, 1998; Willis and Mehlinger, 1996)
2. Increase technology proficiency and preparation (Schrum & Dehoney, 1998; Vannatta & Beyerbach, 2000), become successful, confident users of technology (Crowe, 2004; Pope, Hare, & Howard, 2002; Stuhlmann, 1998), and increase students' positive attitudes towards technology (Smith, Frey, & Tollefson, 2003)
3. Practice a variety of technologies in a more realistic context (Belson & Larkin, 2004).
4. Integrate technology (Cassady & Pavlechko, 2000; Crowe, 2004; Duhaney, 2001; Krueger, Hansen, & Smaldino, 2000; Laffey & Musser, 1998; Luke, Moore, & Sawyer, 1998; Persichitte, Caffarella, & Tharp, 1997; Schrum & Dehoney, 1998; Stetson & Bagwell, 1999; Wetzel, Zambo, & Buss, 1996; Yildirim, 2000) by observing positive, appropriate, and effective technology integration in their classes (Matzen & Edmunds, 2007; Wang, Ertmer, & Newby, 2004).
5. Improve student learning (Hastings & Tracey, 2005; Kozma, 2003; Winn, 2002).
6. Build lessons and implement technology integrated teaching (Collier, Weinburgh, & Rivera (2004).

However, the research also shows that teacher education faculty have not modeled technology integration in the courses they teach (Adamy & Boulmethis, 2006; Brown, 2006; Moursund & Bielefeldt, 1999; NCATE, 1997; OTA, 1995; Topp, 1996). The goal of teacher education is to prepare students in their content areas so that they can provide effective learning experiences for their students. If the statement most teachers teach the way they learned (Becker, 2000; Bull & Cooper, 1997; Cuban, 1986; Dunn & Dunn, 1979; Handler, 1993; Niederhauser & Stoddart, 2001; Norum, Grabinger, & Duffield, 1999; Schifter, 1997; Scholz, 1995; Stitt-Gohdes, 2001; Yildirim, 2000) is true, "teacher preparation programs must have delineated goals for technology infusion and provide consistent modeling of effective uses of technology in the classroom and in curriculum" (Faison, 1996, p. 59).

In methods courses, students are introduced to specific teaching strategies that allow them to observe and experience models of teaching and learning to use in their teaching (Bai & Ertmer, 2008). As a result, modeling how to integrate technology should be part of their teaching (Vannatta, 2000b; Willis & Tucker, 2001) in order to transfer technological skills to their future classroom instruction (Brown & Warschauer, 2006). Coffman (2009) suggested that teachers must be provided "with the latest information and research on how technology can address a diverse array of learning needs and styles" (p. 21). The extent to which students are trained to teach with technology depends on the beliefs and practices of their content-area methods instructors (Berson, Mason, Heinecke, & Coutts, 2001).

Technological pedagogical content knowledge (TPACK). Over the years, developments in preparing students to teach and learn with technology have taken place. One recent development is the Technological Pedagogical Content Knowledge (TPACK). Over the several years, this framework has become an increasingly important in teacher education. The TPACK framework is based on Shulman's formulation of ''pedagogical content knowledge'' (PCK), which addresses what teachers should know and be able to do (Mishra & Koehler, 2006). According to Shulman (1986), PCK "represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (p. 8). The TPACK framework "emphasizes the connections among technologies, curriculum content, and specific pedagogical approaches, demonstrating how teachers' understandings of technology, pedagogy, and content can interact with one another to produce effective discipline-based teaching with educational technologies" (Harris, Mishra, & Koehler, 2009, p. 396).

TPACK focuses on "understanding and communicating representations of concepts using technologies; pedagogical techniques that apply technologies appropriately to teach content in differentiated ways according to students' learning needs" (Harris et al., 2009, p. 401). Swenson, Rozema, Young, McGrail, and Whitin (2005) stated that TPACK "involves asking how technology can support and expand effective teaching and learning within the discipline, while simultaneously adjusting to the changes in content and pedagogy that technology by its very nature brings about" (p. 222).

Many research studies within the TPACK framework have been conducted. In science content courses (Jimoyiannis, 2010; Khan, 2011; Syh-Jong, 2010, Trautmann & MaKinster, 2010); in mathematics content courses (Browning & Gorza-Kiling, 2010; Hardy, 2010; Richardson, 2009); in social studies (Brush, & Saye, 2009; Bull, Hammond & Ferster, 2008; Doering, Scharber, Miller, & Veletsianos, 2009; Harris & Hofer, 2011; in special education (Marino, Sameshima, & Beecher, 2009); and in instructional technology courses (Neiss, 2005; Thompson & Mishra, 2007; Wetzel, Foulger, & Williams, 2009). Understanding and developing TPACK is crucial. As Polly and Brantley-Dias (2009) point out "TPACK gives a holistic perspective of the knowledge associated with effectively integrating technology into learning environments, accounting for what teachers know and what teachers do" (p. 46).

Technology integration in field placements. Research has been conducted on the importance of technology integration into the field experience (Abbot & Faris, 2000; Balli & Diggs, 1996; Beyerbach, Walsh, & Vannatta, 2001; Drazdowski, 1994; Dawson & Dana, 2007; Novak & Berger, 1991; Mullen, 2001; Smarkola, 2007; Strudler, McKinney, Jones, & Quinn, 1999; Strudler, 1991; Wentworth, Graham, & Tripp, 2008; Wetzel & McLean, 1997; Whittier, 2005).

Field placements are important because they enable students to do the following:

1. Become familiar with technology integration and understand its potential in their future classrooms (Lehman & Richardson, 2003).
2. Have authentic technology teaching experiences (Balli & Diggs, 1996; Belson & Larkin, 2004; Beyerbach, Walsh, & Vannatta, 2001; Mullen, 2001; Wetzel & McLean, 1997) to effectively integrate technology into their teaching (Bahr, Shaha, Farnsworth, Lewis, & Benson, 2004; Dawson & Dana, 2007; Evans, 2004; Wentworth, Graham, & Tripp, 2008).
3. Connect theory and knowledge into practice and see examples of technology-supported learning (Balli & Diggs, 1996; Brown & Warschauer, 2006; Downes, 1993).
4. Help students to integrate technology by observing cooperating teachers effectively integrate technology (Downes, 1993; Handler, 1993).
5. Gain confidence in their own integration of technology in their teaching (Doering et al., 2003).
6. Become more confident in their abilities to function as teachers integrating technology (Sthulmann, 1998).
7. Change their perceptions and attitude toward technology integration (Mason, 2000).

It is important to place students in classrooms where technology integration is modeled appropriately so that students observe and learn how to integrate technology effectively in their teaching (Wetzel & McLean, 1997). Bryzcki and Dudt (2005) found that integration of technology into field placements could "enrich observations and field experiences, expanding the range of observations that could occur, making it possible to see technology use in the classroom, and enabling student teachers to share insight" (p. 627). Research suggests that teacher education programs become more involved in the selection of cooperating teachers so that students are placed with teachers who are exemplary users of technology (Abbot & Faris, 2000; Bullock, 2004; OTA, 1995; Wetzel & McLean, 1997).

Strudler et al., (1999) stated that

> While exposure to educational computing and technology in coursework lays a much needed foundation, integration of technology into field experiences is arguably the most critical need for preparing graduates to use technology-and clearly, it is the most sorely lacking. (p. 124)

Many students, however, may not be placed in these types of environments since "technology is not always considered as a factor for student placements" (OTA, 1995, p. 165). Doering et al. (2003) reported that four of the 10 students who participated in their study indicated that their cooperating teacher did not always support technology integration. Bosch and Cardinale (1993) surveyed 186 students and found that students neither observed computer use nor used technology and saw little modeling of technology integration during their field placements.

Part Three: Affordances and Constraints around Technology Integration in Teacher Education Programs

Teacher education programs have struggled to find effective ways to prepare students to integrate technology in their teaching and learning. However, they face many challenges. Understanding these challenges is crucial. The research has identified the three types of constraints around the integration of technology for teacher education programs to integrate technology: organizational, individual, and technical factors (Abdal-Haqq, 1995; Graves and Kelly, 2002; Zhou & Xu, 2007). For the purpose of this study, the constraints to technology integration will be examined under these categories by incorporating other research studies conducted on this topic.

Organizational factors include (a) administrative support;[1] (b) absence of programmatic goals;[2] (c) funding;[3] (d) vision;[4] (e) training;[5] and (f) institutional support.[6] Individual factors consist of (a) knowing how to use technology;[7] (b) time constraints;[8] (c) lack of belief in technology's role in teaching and learning.[9] Technical factors are composed of (a) technical support[10] and (b) access to equipment.[11] Research shows that some programs have been successful in meeting these factors, even though the obstacles might appear overwhelming and challenging.

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[1] Moursund & Bielefeldt, 1999; Schoep, 2004.
[2] Abdal-Haqq, 1995; Baron & Goldman, 1994; Topp, Mortensen, & Grandgenett, 1995.
[3] Baron & Goldman, 1994; Chizmar & Williams, 2001; Duhaney, 2001; Mehlinger & Powers, 2002; Topp, Mortensen, & Grandgenett, 1995.
[4] Mehlinger & Powers, 2002.
[5] Abdal-Haqq, 1995; Baron & Goldman, 1994; Duhaney, 2001; Franklin, 2007; Kleiner, Thomas, & Lewis, 2007; Mehlinger & Powers, 2002; Schoep, 2004; Butler & Sellborn, 2002; Vannatta & Beyerbach, 2000.
[6] Butler & Sellborn, 2002; Chizmar & Williams, 2001; Mehlinger & Powers, 2002; Moursund & Bielefeldt, 1999; Schoep, 2004.
[7] Butler & Sellborn, 2002; Colburn, 2000; Mehlinger & Powers, 2002; Moursund & Bielefeldt, 1999; Mumtaz, 2000; Schoep, 2004; Staudt, 2001; OTA, 1995; Otero et al., 2005.
[8] Abdal-Haqq, 1995; Adams, 2002; Beasley & Wang, 2001; Beggs, 2000; Bunch & Broughton, 2002; Brzycki, & Dudt, 2005; Chizmar & Williams, 2001; Glenn, 2004; Kleiner, Thomas, & Lewis, 2007; Mehlinger & Powers, 2002; Rakes & Casey, 2002; OTA, 1995; Schoep, 2004; Wetzel, 1993.
[9] Baron & Goldman, 1994; Butler & Sellborn, 2002; Otero et al., 2005.
[10] Abdal-Haqq, 1995; Baron & Goldman, 1994; Bullock, 2004; Duhaney, 2001; Mehlinger & Powers, 2002; Schoep, 2004; Topp, Mortensen, & Grandgenett, 1995.
[11] Abdal-Haqq, 1995; Ali & Ferdig, 2002; Baron & Goldman, 1994; Brzycki, & Dudt, 2005; Bullock, 2004; Duhaney, 2001; Grabe & Grabe, 2001; Moursund & Bielefeldt, 1999; Klenier & Lewis, 2007; Mumtaz, 2000; Topp, Mortensen, & Grandgenett, 1995; Wetzel, 1993.

Studies on the Exemplary Teacher Education Programs

Many researchers have identified teacher education programs that have responded successfully to technology integration in their programs. The Office of Technology Assessment (OTA) of the U. S. Congress contracted with the Beryl Buck Institute for Education to conduct case studies on (a) University of Northern Iowa, (b) University of Wyoming, (c) Curry School of Education at the University of Virginia, and (d) Peabody College at Vanderbilt University. Mergendoller, Johnston, Rockman, and Willis (1994) undertook these case studies to understand what can be learned from each program and to outline policy options that might support integration of technology use in teacher education programs. These programs were designated as "exemplary" because educational technology was observed to be an integral part of students' professional preparation, examples of this included modeling use of technology integration by university professors and K–12 teachers, course requirements incorporated technology, and video conferencing and distance learning technologies. Strudler and Wetzel (1999) conducted follow-up case studies on the four exemplary teacher education programs to understand their current technology integration efforts by each program. The researchers aimed to describe the changes that occurred at the teacher education programs since the original study. Conclusions from the study indicated the following:

1. The deans had important roles in supporting and expanding the technology integration. All of the deans had a vision of what technology could do to support students' teaching and learning.
2. The need for faculty training was recognized and addressed among the four teacher education programs. Support and training for faculty included group workshops for particular technology applications and one-on-one opportunities. In

addition, all of the teacher education programs offered professional development to their faculty through various initiatives.

3. Faculty and students were provided with access to hardware, software, and a variety of classroom spaces with varying types and quantities of technology. There was a good balance of pressure on and support faculty to integrate technology into their classes.
4. Technology integration was part of the larger plan to prepare students to teach with technology. Two major factors contributed to the programs' systemic efforts were college-wide planning for technology integration and the use of national standards.
5. Even though this was an area that still needed much work, all programs expressed the importance of providing students with the opportunity to observe and teach with technology in their field experiences.

In 2002, ISTE acknowledged six programs that exemplified successful integration of the National Educational Technology Standards for Teachers (NETS−T) into their teacher education programs. These programs included (a) Arizona State University West; (b); University of Texas; (c) Curry School of Education, The University of Virginia; (d) Ohio State University at Mansfield; (e) Hope College; and (f) Wake Forest University. The findings included the following.

1. Students had one-to-one access to laptop technology. Students were provided with mobile devices to be used in field placements in K–12 buildings.
2. Technology integration was integrated across the curriculum including education courses, content courses, and field placements.

3. Faculty collaborated among themselves and with K–12 teachers. K–12 teachers served as mentors for students, and students served as technology integration mentors for teachers in the field.
4. Evaluation supported monitoring, planning, implementation, reflection, and exhibition (Bucci & Petrosino, 2004).

Hofer (2005) examined the first teacher education programs to receive the ISTE NETS−T Distinguished Achievement Award in 1994 and compared them with 2003 teacher education programs. His findings were similar to Bucci and Petrosino, 2004; Mergendoller, Johnston, Rockman, and Willis, 1994; Strudler and Wetzel, 1999). His findings included the following:

1. Technology integration occurred throughout the curriculum.
2. Administration and faculty shared a vision for technology integration.
3. Integration of the National Educational Technology Standards occurred in an average of nearly eight methods courses per program.
4. Technology was integrated into field experiences much more frequently than past programs. These field experiences enabled students to experience technology in teaching within K–12 classroom environments. Nearly 20% of the ISTE standards were taught through field experiences.
5. Faculty and students were provided with adequate infrastructure, instructional support, and technical support.

Overall, leadership, training and support, access, pedagogical fit, technology integration across the curriculum, and technology in field experiences played vital roles in effective implementation of technology in these programs.

Summary

A history of research reports that students are not being adequately prepared to integrate technology in their classrooms. Many comprehensive studies have looked at the status of technology and teacher education programs over the last two decades. Much of what has been studied since OTA's first report shows that teacher education programs have come a long way in terms of generating awareness of technology's importance in teaching and learning and different approaches of preparing students to teach with technology. Yet, research still shows that students do not feel they are prepared to integrate technology in their classrooms.

Accreditation agencies such as NCATE proposed guidelines and standards for technology integration in the teacher education programs. Local, state, and national standards identify the technology skills and knowledge students and teachers should posses. Research describes a range of approaches to integrate technology in the teacher education program curriculum: single technology course, across curriculum, and field placements. Teaching isolated skills is not as effective as grounding it within contexts of relevance to students so that they can understand how the technology skills learned in their classes could be applied to their teaching. Basic technology skills must be developed before integration into instruction can be achieved. Providing technical skills training to students in the use of technology is necessary but not enough. Students' knowledge of technology integration should not end with their own achievement of computer literacy (Vannatta & Reinhart, 1999). In order for students to integrate technology effectively, they should be provided with appropriate modeling throughout their teacher education programs, including their field experiences with cooperating teachers. Research shows that students should learn about technology integration not in stand-alone technology courses but in courses that are contextually and socially situated.

In order to improve the effectiveness of teacher education programs for successful technology integration, the research had made the following recommendations: (a) integrating instructional technology into all teacher education courses, (b) modeling of technology integrated teaching and learning by teacher education faculty, (c) field experiences with mentor teachers who support and encourage students as they practice teaching with technology (Moursund & Bielefeldt, 1999). These recommendations are confirmed by other research on effective teacher preparation programs (Smith, Houston, & Robin, 1995; Strudler & Wetzel, 1999) and are similar to the findings on the exemplary programs.

The research has summarized the three types of constraints existing around teacher education programs for integrating technology: organizational, individual, and technical factors (Abdal-Haqq, 1995; Graves & Kelly, 2002; Zhou & Xu, 2007). However, some teacher education programs seem to have shown progress in their technology integration efforts. The affordances around technology integration included: leadership, training and support, access, pedagogical fit, technology integration across the curriculum, and technology in field experiences.

Chapter 3

Research Methodology

"The trick is to figure out what the devil they think they are up to."

(Geertz, 1983, p.58)

Research Design

To better understand the affordances and constraints around technology integration in three teacher education programs, I undertook multiple case studies (Stake, 1995). Three research questions guided the research: (1) What are the contemporary realities of technology and teacher education programs in the three programs? (2) What are the affordances and constraints around technology integration in teacher education programs in the three programs? and (3) What working infrastructure has been established in teacher education programs as potential affordances for technology integration?

The intended audience for this research is deans, department chairs, faculty, and policymakers in teacher education programs. This exploratory and essentially descriptive study used in-depth interviews, observations, and documents and artifacts in order to provide a rich picture of the contemporary realities of technology integration in teacher education programs and to understand what makes well-designed and successful technology integration in teacher education programs. I seek to provide practical and curricular suggestions.

This qualitative research is a case study-oriented study. I chose the case study methodology for four reasons. First, the nature of the research questions dealt with "how" and "why" of social phenomena (Yin, 2003, p.2). Second, it was "an intensive description and analysis of a phenomenon or social unit such as an individual, group, institution or community" (Merriam & Associates, 2002, p. 8). Third, the cases expanded the scope and breadth of the study by using different methods in different components (Greene, Caracelli, & Graham, 1989). Fourth, the research itself was inductive and was built on themes and concepts (Merriam & Associates, 2002). Fifth, I sought to produce rich and holistic accounts and understandings of phenomena based on real-life situations (Merriam, 1988), "making accessible to the reader all the information necessary to understand the case in all its uniqueness" (Patton, 2002, p. 450). The three cases allowed me to obtain a detailed picture related to the affordances and constraints around technology integration (Creswell, 2007). Sixth, looking at the data on both an individual level and as a group allowed for comparing and contrasting the affordances and constraints around technology integration and for summarizing the characteristics of each program. Lastly, the research itself was inductive and was built on themes and concepts, and the results were descriptive meaning knowledge was conveyed through words, documents, interviews, and observations (Merriam & Associates, 2002).

Data Sources

A variety of data was collected to ensure that the same phenomena were explored from multiple perspectives. Data sources included observations, in-depth interviews with faculty, staff, and students, and examinations of documents and artifacts related to technology integration at three teacher education programs, at State University, Northern University, and Eastern State University.

I chose these three programs because (a) they were located in the Midwest; (b) they represented a diverse group in terms of size, the number of faculty and students, their institutional mission, and course organization and focus; (c) they were identified as exemplary, or had received awards in their efforts to integrate technology, or has been ranked as one of the nation's wired universities; and (d) they made extensive attempts to systematically introduce technology integration in their programs.

Conducting interviews and observation enabled me to "[have] direct and personal contact with people under study in their own environments" (Patton, 2002, p. 48). The following table presents the number of faculty, staff, and students interviewed, the duration of the visits, and the observations conducted at each teacher education program.

Table 1

Data Sources

Institution	Days Spent	Faculty/Staff/Teaching Assistant Interviews	Student Interviews	Observations
State University	4	18	8	5
Northern University	4	18	8	5
Eastern State University	3	12	4	3

In-depth interviews. A total of 47 interviews were conducted. Faculty and students in different programs such as elementary, secondary, and special education were interviewed. Faculty participants in the study varied in age, gender, teaching experiences, technology skills, and beliefs about techology's role in teaching and learning. Prior to the interviews, interviewees were given a consent document that explained the purpose, benefits, risks, confidentiality, voluntary participation, right to withdraw from the study, and ultimate use of interview information. Participants signed this form to indicate consent. Each participant was interviewed once, with interviews ranging in length from 15 minutes to an hour. All the interviews were semi-structured, which allowed participants "to speak in their own voices, to control the introduction and flow of topics, and encouraged to extend their responses" (Mishler, 1986, p. 69). These in-depth interviews helped me obtain specific experiences and examples from the participants (Rubin & Rubin, 2005).

The participants were interviewed with open-ended questions in places and under conditions that were comfortable for and familiar with such as their office or classroom (Patton, 2002). These pre-determined open-ended questions were essential and served as a checklist to ensure a benchmark of information was obtained from each participant. I sought to ask questions that were clear, brief, and reasonable (Krueger, 1998). I audio-taped all the interviews which helped me focus more on listening to my participants instead of taking notes quickly. I used an interview protocol that allowed me to use the limited time for the interviews and keep the interactions focused (Lofland & Lofland, 1984).

The faculty and staff interview data enabled me to gain a deep understanding of how each program utilized various technologies for teaching and learning, the current status of technology integration in the teacher education curriculum, and the affordances and constraints around technology integration. The interview protocol for faculty and staff, contained mostly, but not exclusively, the following topics: (a) background information (professorial rank, undergraduate programs taught, years of teaching); (b) level of technology integration in teaching; (c) reasons for or lack of technology integration in teaching; (d) affordances and constraints around technology integration (administrative support, funding, professional development, technical support, technology access, technical problems). During the interviews, based upon the participants' responses, probing was used to clarify and expand on emergent issues or themes (Patton, 1990).

The student interviews focused on how technology was integrated in their classes and students' concerns about technology integration. As with all names of the participants, pseudonyms were used for the teacher education programs and their services. The interview protocol for students, contained mostly, but not exclusively, the following topics: (a) background information (undergraduate program enrolled, year in college); (b) discussion of how technology is integrated in classes; and (c) affordances and constraints around technology integration (technology access, technical support).

Observations. I conducted a total of 12 observations. I only observed classes in which technology integration took place. The observations showed me what and how technology was integrated in teaching and granted knowledge of the context in which events occurred (Patton, 1990). A limited number of observations were conducted due to scheduling and unwillingness of the faculty. Glesne (1999) noted that the role of researcher may vary from mostly observer to mostly participant at different points in the research process. Due to my desire to be as unobtrusive as possible and to maintain the nature of a naturalistic study, I asked my participants to implement their teaching agenda in their usual way when they asked me if I wanted them to do something specifically. During the observations, I was an observer. I took notes as detailed as possible to capture what was taking place in the classrooms. The observation protocol consisted of (a) classroom structure, environment; (b) technology integration activities- evidence of ongoing technology integration; and (c) student assignments and engagement with technology.

Documents and artifacts. Documents and artifacts constituted a significant communication channel in the daily life of the organizations and were active elements of the material culture (Hodder, 2000). Yin (2009) suggested "for case studies, the most important use of documents is to corroborate and augment evidence from other sources" (p. 203). Documents and artifacts were collected related to each program to understand the culture and technology integration and served as secondary sources of data, informing other forms of data collection and analysis in the study. These included course syllabi, lesson plans, assignment descriptions, brochures, websites, student projects, and access to WebCT courses.

Data Analysis

During my data analysis, I used both an holistic and an analytic approach. The holistic approach helped me see my data as a big picture while the analytic approach helped me develop coding categories for my data sources. Data analysis was performed in multiple phases and consisted of "working with data, organizing it, breaking it into manageable units, synthesizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others" (Bogdan & Biklen, 1982, p. 145). The analysis focused on three main tasks: (1) identifying similar and different components of programs; (2) identifying alternate forms of implementation of these components; and (3) determining similarities and differences in outcomes of in each program.

Data analysis occurred in two stages: within-case and cross-case analysis (Merriam, 1998; Miles & Huberman, 1994). While data were collected for three teacher education programs, each program was "treated as a comprehensive case in and of itself" (Merriam, 1998, p. 194) and analyzed to understand the case as a unique, holistic entity (Patton, 2002). Each teacher education program provided the foundation for the cross-case analysis. After each individual case analysis, I identified similarities and differences among the three teacher education programs "to build abstractions across cases" (Merriam, 1998, p. 195).

Interviews. After each interview, the participants' responses were transcribed in their entirety. During my interview and field notes data analysis, I used open and focused coding to link and generate all ideas and concepts and understand their relationship to others. Open coding helped me identify events described in the notes that became the basis of categorization (Emerson, Fretz, & Shaw, 1995). I reviewed the transcriptions line by line to establish emerging concepts. Focused coding engaged me to build up and elaborate analytically interesting themes by connecting data that initially may not have appeared to go together and by delineating subthemes and subtopics that distinguished differences and variations with the broader topic.

First, I identified regularities and patterns in the participants' responses by dividing data into smaller and meaningful parts to classify the data into themes, using a constant comparative approach (Glaser & Strauss, 1967). I worked back and forth between my field notes and interview transcripts to detect relationships among categories. In the process, I tried to relate them to my key issues of interest.

Observations. A coding system was developed by writing down words and phrases to represent the topic and the patterns in the data (Bogdan & Biklen, 1998). After reading my observation field notes, I looked for regularities and patterns to determine if certain words or behaviors were repeated and stood out.

Establishing Trustworthiness

Lincoln and Guba (1985) listed prolonged engagement, persistent observation, triangulation, peer debriefing, negative case analysis, referential adequacy, member checking, and thick description to establish trustworthiness of the data and interpretations and validity and reliability. I tried to take some measures into account in my study.

Prolonged engagement. Lincoln and Guba (1985) defined prolonged engagement as "the investment of sufficient time to achieve certain purposes: learning the "culture", testing for misinformation introduced by distortions either of the self or of the respondents, and building trust" (p. 301). The durations of my visits and the number of observations varied from one program to another. However, during the some of the interviews, discussing in-depth what had occurred during the observations with the participants helped me clarify what was taking place in the classroom in regards to technology integration.

Triangulation. Researchers make use of multiple and different sources, methods, investigators, and theories to provide corroborating evidence (Glesne & Peshkin, 1992; Lincoln & Guba, 1985). Denzin (1978) mentioned four different ways of triangulation in research which are using multiple and different sources, methods, investigators, and theories. I used observations, interviews, and documents and artifacts analysis as multiple methods to collect data to create an in-depth understanding of the research questions. Using different data sources enabled me to include different perspectives and voices to interpret my findings from different angles and the identification of major themes throughout the data analysis process (Yin, 2003).

Peer debriefing. Lincoln and Guba (1985) defined peer debriefing as "a process of exposing oneself to a disinterested peer in a manner paralleling an analytic session and for the purpose of exploring aspects of the inquiry that might otherwise remain only implicit within the inquirer's mind" (p. 308). Peer debriefing provides the researcher with "an opportunity for catharsis, thereby clearing the mind of emotions and feelings that may be clouding good judgment or preventing emergence of sensible next steps" (Lincoln & Guba, 1985, p. 308). During data analysis, I constantly participated in discussions with faculty. These discussions helped me gain different perspectives on what my participants were communicating.

Member checking. Lincoln and Guba (1985) described member-checking process as "whereby data, analytic categories, interpretations, and conclusions are tested with members of those stakeholding groups from whom the data were originally collected" (p. 314). This process considered by Lincoln and Guba (1985) to be "the most critical technique for establishing credibility" (p. 314). Even though I wanted to do member checking with my participants, most of my participants were not willing to participate in the process. Sharing the data with my participants could have helped me correct errors, gather additional information, and clarify any unclear information. I was able to get additional information from some of the participants through emails. During some interviews, I was yet again able to discuss what had taken place during the observations with the participants to understand the participants' intentions "by acting in a certain way or providing certain information" (p. 314).

Thick description. In the process of presenting the study, I tried to provide vicarious experiences for the reader by being as descriptive as possible to enhance the naturalistic generalization of the study (Stake, 1995) and to organize the data "into a coherent developmental account" (Polkinghorne, 1995, p. 15) in order to "capture perspectives accurately" (Bogdan & Biklen, 1982, p. 7).

I used narrative inquiry to tell the story of the teacher education programs, the technology integration, and the affordances and constraints related to technology integration. Denzin (1989) talked about the importance of using "thick description" in writing qualitative research. By this, he meant that the narrative should "presents detail, context, emotion, and the webs of social relationships . . . evoke[ing] emotionality and self-feelings . . . .The voices, feelings, actions, and meanings of interacting individuals are heard" (p. 83). Providing thick description allows the reader to make decisions regarding transferability (Lincoln & Guba, 1985) because the researcher describes the study in detail. I provided rich descriptions of the research framework, research sites, participants, and the methods, and analysis of data collection to draw a clear picture for the readers.

Patton (2002) argued "Writing in the first person, active voice communicates the inquirer's self aware role in the inquiry" (p. 65). He argued "A credible, authoritative, authentic, and trustworthy voice engages the reader through rich description, thoughtful sequencing, appropriate use of quotes, and contextual clarity so that the reader joins the inquirer in the search for meaning" (p. 64). By using the first-person account, I presented the findings by way of empirical assertions, quotes from interviews, and interpretative commentaries framing particular and general descriptions (Erickson, 1986). Where appropriate, I used quotations to capture the "voice" of the participants as well as to enhance the credibility and authenticity of the findings. In some cases, I made some minor stylistic changes in the quotations for readability, otherwise, the quotations included in the chapters appear exactly as they do in the field data. As with all names of the participants, pseudonyms have been used for the teacher education programs and their services.

Chapter 4

Descriptions of the Case Study Programs

To better understand the affordances and constraints around technology integration in three teacher education programs, multiple case studies were undertaken (Stake, 1995). Three research questions guided the study were: (1) What are the contemporary realities of technology and teacher education programs in the three programs? (2) What are the affordances and constraints around technology integration in teacher education programs in the three programs? and (3) What working infrastructure has been established in teacher education programs as potential affordances for technology integration?

The chapter describes the three teacher education programs individually in the following order: (a) State University; (b) Northern University; and (c) Eastern State University. Each case study is organized into three parts to address the affordances and constraints around technology integration. The first part briefly describes the teacher education program. The second part explains the affordances and constraints around technology integration in the program. The last part summarizes technology integration efforts in each teacher education program. The chapter ends with the summary of the affordances and constraints around technology integration across the three education programs.

TEACHER EDUCATION PROGRAM AT STATE UNIVERSITY

The teacher education program, located at a public land-grant research university, is located in a small Midwest town. The program continuously seeks better ways to implement technology integration and presents a strong vision for it. The presence of technology permeates the whole environment: from students' carrying laptops to the state-of-the-art technology and computer labs. The implementation efforts portray both affordances and constraints. However, the program provides a collaborative environment in which faculty, staff, and students work together to overcome the constraints. Affordances include technology requirements for students, administrative support, funding for technology, a technology center, and faculty development. One constraint around technology integration is the lack of articulation of technology in methods courses. Lack of technology in schools, technical problems, and feeling pressured to integrate technology have major effects on individual faculty decisions not to integrate technology. Even though these constraints exist, the program still strives for excellence in maintaining its commitment to technology's role in teaching and learning.

During my four-day visit, I interviewed 11 faculty, one staff member, six teaching assistants, and eight students, and I conducted five classroom observations. This section is organized into three parts to address the affordances and constraints. The first part briefly describes the teacher education program. The second part explains the affordances and constraints around technology integration in the program. The last part summarizes the program.

Teacher Education Program

The teacher education program is housed in the Department of Curriculum and Instruction and offers undergraduate programs in Early Childhood Education (Pre-K-3), Elementary Education (K–6), and most of the pedagogical education for secondary programs.

The degree programs can be completed in four years of undergraduate study. Graduate programs are also offered for students who already have degrees and want to become certified teachers. The department provides all of the professional teaching courses for mathematics education, science education, and most of the courses for other teacher education majors. Admission to the program is competitive. Criteria include a minimum acceptable grade point average and completion of core courses. A student seeking admission to the teacher education program must be accepted by a selection committee for the specific licensure which the students seek. Students complete practicum and student teaching under the direct supervision of a licensed teacher. Practicum courses provide short-term placements in schools, where students observe teaching and learning and/or do short-term teaching. Student teaching courses are longer-term experiences in which students teach full-time and are expected to become increasingly independent in their planning, classroom management, and teaching.

The teacher education program has 25 tenured and tenure-track faculty, 12 joint faculty appointments, and 16 lecturers/non-tenure faculty. The program has 675 undergraduate and 131 graduate students.

Affordances around Technology Integration in the Program

Affordances include technology requirement for students, administrative support, funding for technology, a technology center, and faculty development.

Technology requirements for students

Two years ago, instead of offering one required technology course, the teacher education program redesigned the introductory technology course because students felt the class was irrelevant to what they should be learning to teach their content areas. Currently, the program delivers two required introductory technology courses: one for students in the early childhood and elementary (grades Pre−K−6) programs and one in the secondary (grades 7−12) program. Each student in the program is required to take an introductory technology course, depending on their program. The focus of the classes shifted from learning about technology to learning with technology.

Both classes follow the same format: lectures and lab sessions. The lectures provide the pedagogical overview and are taught by professors in the Instructional Technology Program. The labs provide the venue for student project work and are facilitated by graduate teaching assistants. Even though PCs are still available, these classes are conducted using Apple computers. The program adopted Apple computers because many of the state's schools use those. However, because of students' unfamiliarity with Apple computer usage, time is often lost, especially at the beginning of each semester, as students spend time learning to navigate the new system. Computer labs have state-of-the art computers. However, the teaching assistants have limited administrative permissions on lab computers, e.g., they cannot spontaneously install a single program to show students for demonstration purposes. Working with these kinds of restrictions sometimes inhibits important teachable moments. In both classes, students are expected to explore the technology and work as a group to figure it out. The classes however have different foci and assignments.

Elementary technology class. This class focuses on understanding technology's role in teaching and learning in the Early Childhood and Elementary Education programs (grades Pre−K−6). It examines how technology can influence and facilitate learning and be used to solve instructional problems in classrooms. Class topics include contemporary hardware, software, and pedagogical techniques. Course activities include planning, designing, and production of media and the operation of hardware and software for educational use. The course outcomes are built around general performance standards (see Appendix A).

Assignment descriptions. The class requires 7 assignments: course portfolio, digital media project, technology lesson plan, lab projects, lab assignments, in-class lecture assignments, and exams (see Appendix B). WebCT, the course management system, is used for distribution of readings and assignments, assignment submission, and grade monitoring.

Secondary technology class. The course focuses on the role of instructional technology in grades 7–12. Class topics include 21st century literacies, the use of tool software, interactive multimedia, video editing, the Internet, and ethical and equitable uses of instructional technology. Students use a variety of instructional technologies commonly found in educational settings and think about issues related to teaching, learning, and their content areas. The course outcomes are built around general performance standards (see Appendix C).

Assignment descriptions. Students are graded on three major projects, a series of homework assignments, lecture and lab activity participation, and mid-term and final exams (See Appendix D for descriptions of assignments). *Ning*, a social networking software, is used as the course management system for readings and assignments, conducting on-line discussions, submitting assignments, and checking grades. Megan Sanders, a teaching assistant, reports that *Ning* allows students to see other students' work at different phases, giving them a chance to revise and improve their work.

The introductory technology courses introduce theoretical and pedagogical foundations of instructional technology to students. Overall, faculty state that the technology classes are well developed and provide a good foundation for the rest of the faculty in their teaching. However, one major concern among faculty is that by the time students are in their methods courses, students have forgotten their technology skills. Most faculty suggest moving the technology classes to occur later in students' course sequences so the skills can be applied into the methods courses; however, the level and extent to technology integration in methods courses depends on individual faculty. Because the program is not articulated in a way where students often learn about technology integration in their methods courses, student often do not get the opportunity to transfer what they have learned in the technology courses into their teaching.

Students raise two types of concerns: technical problems and curricula. Students often encounter technical problems as they work on their projects in the computer labs located at the technology center. Because the technology course has been restructured, the amount of support provided by student consultants at the technology center has also changed. While they are encouraged to direct their questions to teaching assistants first, they often turn directly to student consultants.

Curricular-related problems consist of students' lack of understanding of how technology can be integrated into their content areas. For example, Dianne Bishop, an agriculture major student, states,

> It's hard as a future agriculture educator to integrate technology, because we're talking about crops, and we're having the kids plant plants outside in the greenhouse. So, I think it's kind of hard.

Another agriculture major student, Amy Lowry, says, "Because technology is so advanced compared to me, I can't just fix it. I'm from a farm, so I can fix a tractor, but technology is way above me, so if something breaks, that's one difficulty."

Administrative support

Examining the technology in the teacher education program, it is evident that the program projects a strong vision for technology use, which is an integral part of the culture. Morgan Jones, an assistant professor in literacy and instructional technology, states,

> It's [technology] not seen as an outside entity within our teacher education program. It is embraced for the most part. It's not perfect, but I think it's the people that make that. I don't think faculty overuse technology, but when they see a fit, they use it.

One of the affordances of the teacher education program is the shared leadership. The program does not have a strong hierarchy. Leadership for technology is a collaboration of the chair of the teacher education program, the director of the technology center, faculty in the Instructional Technology program, the teaching assistants, and the students.

Because the role of technology in teaching and learning has been valued and encouraged by former and current departmental leadership, it has remained and is still a vital part of the culture. The faculty, especially Morgan Jones and Angelina Gunderson in the Instructional Technology program, have played a critical role in encouraging technology integration in the program. Jones' interest in technology was influenced by working with the technology consultants as a former elementary teacher. She served as the associate director of the technology center before becoming an assistant professor. She directs a number of grants that link K–12 teachers, area education agencies and university faculty and students to support technology use. A former high school mathematics teacher, Angelina Gunderson served as a department chair, founding director of the technology center and the mentoring program, and is now currently a professor in the Instructional Technology program.

Gunderson describes technology in the program:

> I think a couple of things that we have going for us is that we've been involved in technology and teacher education for about 17 years. The reason that we got involved isn't so much that we had a great vision 20 years ago that this was going to be important. The reason is that we moved to this building. And, at this university when you move to a building, you get a budget for new supplies and equipment. So, we had this equipment budget and micro-computers. . . . We've been in it for a very long time, and that turned out to be a very good deal for us because by the time faculty got computers, and really the entire faculty became involved. That was about 1990. It was a piece of our culture. Students were doing some projects using technology. When the faculty became involved, we took it. We did it very slowly, so there was never an, "OK, everybody's got a computer, now, you have to do this." It was a slow process. We began one-on-one mentoring as our solution to helping faculty become confident with computers. And one of the lessons about that it takes a long time. So now, 18 years of later, most of our faculty expect to use technology and use technology. One important piece to that whole story is that we've never forced anyone to do anything, and that's still the case today. It's always a choice, and it's the faculty saying, "This is the best way to do it," not a department chair saying, "You have to do this." What happened with us as we have more and more faculty using technology, it becomes sort of an unwritten expectation, because all of your colleagues are doing it. But to get to that tipping point and to form that community, it's not something that you do in a year or two. I think a lot of places are trying to do that.

The program has created a caring community in which the spirit of collaboration is most evident. Shared leadership contributes significantly to the collaboration efforts. The faculty in the

Instructional Technology program work closely with other faculty in different content areas to provide assistance in technology integration. Teaching assistants work closely with faculty in designing the technology courses. Students who work at the technology center continuously research current technologies to bring the latest tools to the program. Jones explains:

> For instance, the FLIP camera idea, students are the ones who said, you should have a look at this. This is a great situation for the classrooms. And, that came from them and their research, and from me not keeping up.

Some students have recently submitted a proposal to get a gaming room with *Wii, Guitar Hero,* and *Dance Revolution Mat* to understand how/if there are potential effects on teaching and learning.

The program encourages technology integration by providing faculty with access and support, but faculty integrate technology by choice. Gunderson adds, "There will always be some faculty who choose not to use technology, and our approach to that has been to just leave it alone." She argues that faculty need to be willing to learn how technology can be integrated to impact teaching and learning even though putting together a high-quality course with technology integration takes much time and that the department should provide incentives. However, the program does not provide any incentives to faculty who spend their time learning to use technology. However, during their annual evaluation, faculty are asked to sign the department chair into their WebCT so the chair can see how technology is integrated.

The program is still in transition and aims to find ways that technology can be integrated to make a very engaging and enriching classroom environment that focuses on student learning. In order to understand how prepared students are to integrate technology in their classrooms, Gunderson and Jones aim to track students starting with the introductory courses and follow them through their student teaching and beyond. Jones states, “Our hope is that our graduates will be leaders and change agents for schools in using technology in classrooms.”

Funding for Technology

During one of my observations, Jones passed out a sheet of paper and asked students to write down any kind of technology they would want to have available for use so the technology center could purchase it. It was exciting to wonder how much funding was available for this program and the opportunities it could create. Funding for technology comes primarily from a computing fee and faculty-written grants. The money is first centralized, then, using a formula based on student credit hours and enrollment, part of the money stays at the central university level, and the rest comes to the colleges. The department typically gets about $80,000 per year to spend on technology. Each college has a committee of students and faculty—where faculty cannot outnumber students—to decide how to spend the money.

Numerous faculty-written grants to government, research, commerce, and industrial agencies also contribute to bringing funding to the program. Some of the ongoing projects during the study include a digital storytelling project in a high school geometry classroom, a 7th grade language arts project to measure student comprehension and understanding using a digital think−out-loud strategy, and a project to measure students’ knowledge development of technological pedagogical content knowledge. In addition, faculty and student written proposals have brought equipment to use in learning and teaching. For example, two faculty have purchased a projector and clickers to use in their science methods courses and a SmartBoard to use in their mathematics methods course and research.

Even though funding is not an issue for most of the faculty, access to hardware is still a problem for some, especially for lecturers. For example, Brittany Voss and Jeremy Moody are both lecturers and teach methods courses in foundations and social studies. They have been unable to get new laptops from the program. Moody brings his own laptop to class. Because of limited time between the end of one class and the beginning of the next, setting up the laptop takes up valuable time he prefers to spend interacting with his students. Another obstacle is that he does not have speakers for his computer in his office. On the day of the interview, he received a *youtube* video on teaching tolerance, which was the topic of his lecture that day. However, he was unable to show it in class because he did not have speakers in his office to preview it before teaching.

Technology Center

The Technology Center plays a crucial role in the program by providing technology access, technical support, and instructional support and encourages technology integration in the program through research, development, and service. The Center maintains a substantial state-of-the art library of equipment that can be checked out on a limited basis by faculty, staff, and students (see Appendix E for a complete list of the resources). It houses 107 computer workstations equipped with contemporary software and other resources. The Center is composed of different spaces designed for different purposes: whole-class instruction, collaborative group work, individual projects, and usability testing. The Center is equipped, as is the entire College of Education building, with access to the wireless network.

The Center staff is committed to making technology resources easily accessible and available to the members of the teacher education program. The availability of technology enables faculty and students to design projects that allow them to integrate technology both on- and off-campus. Like faculty, students can also check out equipment to use in their practica, allowing them to undertake the same kinds of projects demonstrated in their university courses.

Responding to technology access in the program, all participants (faculty, teaching assistants, and students) find themselves in a technology-rich environment. Faculty indicate that the center has provided them with great technology resources whenever they need and describe the resources as “wonderful,” “great,” and “plenty.” With up-to-date resources participants consider themselves “lucky” and “spoiled” to be able to acquire and use any kind of technology needed in their teaching and learning. Teaching assistants and students also describe the resources as “wonderful,” “up-to-date,” “different technology-savy types of equipment,” and “of different variety.” On one hand, faculty indicate that funding is always available to get the technology they need. On the other hand, Claire Bounds, the coordinator of the technology center, provides a different perspective and points out that money is an issue. Keeping the center up-to-date requires much money, “We are a center that should have the latest technology, but there’s not enough money for that.”

Technical support on the campus and college level is available; however, the members of the teacher education program heavily rely on college-level support. The Center provides a variety of technical support and is open from 8 a.m. to 4:30 p.m. Monday through Friday. It staffs 12 student technical consultants at the Help Desk and two full-time staff who support faculty, staff, and students. After 4:30 p.m., the student technical consultants are the only ones to provide technical support. These consultants are College of Education students who have strong interest in technology, and most of them are pursuing a minor in Technology. The consultants find working at the center beneficial because they can always research emerging technologies and experience how technology is integrated in instruction. When these students are in class, faculty rely on them for assistance with technical problems and for bringing ideas on how to integrate technology in instruction. Even though there are benefits to employing these students at the Center, hiring these consultants makes it difficult to create a stable Center because they graduate and new consultants are hired.

The overall impressions of the technology support are positive. Faculty participants speak highly of the technical support, describing it as “unbelievable,” “wonderful,” “great,” and “fantastic.” Some participants integrate technology in their teaching because the technology support is available. On one hand, one faculty member expressed reservations about the availability of help, especially after 4:30 p.m. when only technical consultants provide support. On the other hand, at least four faculty commented on receiving the same quality support from the technical consultants after 4:30 p.m. Teaching assistants describe the support in the following ways: “We have a pretty nice tech support,” “There’s tons of support,” and “I’ve become really spoiled with the access and the support.” They rely heavily on the student consultants for issues related to technology classes. Technical consultants ensure that any needed technology is in working order prior to the beginning of each class.

Student participants also value the amount of technical support available to them. They comment on helpful and knowledgeable staff. Jennifer McLeary, who has been working at the center for four years and is a senior in English education, says that their first priority is to create an open environment where students are able to feel comfortable asking questions. She points out that,

> [The full-time center staff] always told us every day, every year, the students are number one. If a student has a question, it doesn't matter what you're doing, stop it, and go help them. If you don't know the answer to the question, find someone who does.

The Center is a community of faculty, staff, graduate, and undergraduate students working collaboratively to discover different and effective ways to integrate technology in instruction. It is a community where everybody's voice is heard, every person is respected, and decisions are made collaboratively. As soon as I entered the technology center, located in the basement of the teacher education program, I was amazed by the resources that were available and by the friendly and welcoming staff members. The more time I spent at the technology center interacting with the staff and the technical consultants, the more I realized the center was more than just a physical space. It was impossible not to see the warmth and helpfulness of the staff and that it was a great place to work, learn, and grow.

Faculty Development

In the beginning, faculty development was offered in the form of workshops; however, these workshops did not attract much enrollment. According to Bounds, who developed these workshops, reasons such as lack of time to learn, use, and keep up with technology and different faculty technology backgrounds, skills, and needs with technology all contributed to the failure of the workshops. As a result of the unproductive workshops and the increasing technology access in faculty offices, the faculty-mentoring program was established. The program plays a vital role in helping faculty learn and integrate technology in their teaching. The mentoring program, says Jones, has

> Probably been one of the key issues that has gotten us to integrate throughout the program. Because they're [faculty] always thinking about technology and how technology might be integrated in their classes, or in their professional life, the program allows faculty to see different ways to integrate technology.

The program was established as part of a graduate-level course, designed by Gunderson and is offered every fall. The field experience of the course requires graduate students to mentor interested faculty for an hour per week on a variety of topics. Faculty participate in the program by choice. The program has attracted faculty with varied technical expertise, teaching experience, and subjects. When the program first started, the mentors worked on basic projects such as how to use email or PowerPoint. Throughout the years, however, the projects have become more sophisticated. Some recent projects include a digital storytelling assignment to construct and identify ideas about identity and a database to track graduate students' careers after they graduate.

Participants speak very highly of the mentoring program and find it useful. Time, however, is a big limitation for some faculty's participation. Of 11 faculty interviewed, six participated in the mentoring program. Of the six, one participated three times and one twice. Another limitation is that the program is not offered to adjunct faculty. This creates a problem because the program employs adjunct faculty to teach methods courses. One reason why the mentoring program is not available for the adjunct faculty is that the program does not want to require them to do more than what they are paid for. However, two adjunct faculty, who were interviewed for the study, participated in the mentoring program because the students in their classes asked them to integrate technology.

Constraints around Technology Integration in the Program

Lack of Technology Integration in Methods Courses

One recurring reported concern is the lack of articulation of technology integration throughout the program. Gunderson said,

> We still have programs that are still lagging behind, and that's not fair, it's not fair to the teachers we're preparing. But, ultimately, it's not fair to the students that they'll have in their classrooms, because these kids will have grown up with technology and expect technology.

Many faculty agree that technology integration should occur among all courses, should be woven into the entire program, and should start when the students enter the teacher education program. Most faculty agree that the introductory technology courses introduce students to a variety of technologies and students have a sound experience with technologies and skills. Most of the time technology is not incorporated into methods courses; as a result, students' are not exposed to technology. Each interviewed faculty listed a variety of technologies they use on a regular, if not daily, basis. The amount of technology integration in the methods courses varies with individual faculty. Student participants agree that they experience somewhat limited exposure to technology integration in their methods courses. Emily Shovelin, a sophomore in elementary education and educational computing minor, notes

> Like a lot of my other education courses say when I'm writing the lesson plans say, "Oh, don't worry about the tech type things. You'll add that later." So when I go to classes and we expected to mix the tech lessons, it's kind of hard to mix the two together.

Of eight students interviewed, four had not taken many methods courses. However, the methods courses taken so far have not been technology oriented.

Technology in the methods courses. This section presents a fairly broad, though not complete, picture of how 11 faculty integrate technology in their methods courses. At the elementary level, one teaches methods courses in mathematics, one in literacy, one in science, and one in literacy and instructional technology. At the secondary level, one faculty member teaches in foundations and social studies, and one in science. Two faculty teach across the three programs.

Elementary education program. *Mathematics***.** Donna Perez and Ty Ludwig teach methods courses in mathematics. Perez uses (a) laptops to research and access journals on the

Internet; (b) multimedia stations to show videos, present PowerPoint lectures, and student presentations; (c) WebCT to post course information and conduct discussions; (d) SmartBoards to demonstrate how to teach basic operations; and (e) discipline-specific software such as Lego-Digital Designer and Discourse.

Unlike Perez, Ludwig does not integrate much technology. Her technology use includes (a) WebCT to conduct discussions where students in their grade-levels answer weekly questions; (b) PowerPoint student presentations; (c) video clips of children thinking and solving problems; and (d) virtual manipulatives to provide hands-on experience.

Literacy. Laurie Jeffs and Morgan Jones teach methods courses in literacy. Jeffs uses (a) WebCT to communicate with her students and conduct discussions during their four-week practicum in the middle of the semester; (b) PalmPilots for students to take notes, brainstorm ideas, draw objects, and write poetry; and (c) digital cameras for students to create digital stories.

In her reading methodology course, Jones' students create a digital story project and an e-portfolio that allows them to express themselves in a variety of ways and learn through visual, auditory, and print media. In addition, she coordinates the undergraduate educational computer minor program and teaches the introductory elementary technology course.

Science. Kendra Coyle does not integrate much technology in her teaching because she does not want technology to get in the way of her students' thinking. Her technology use consists of (a) videos to analyze teaching; (b) discipline-specific software, Starry Night, to model the solar system; and (c) multimedia stations to present information. Coyle reports that she spent six months working on a clicker-based activity to use with the SmartBoards, but she could not use it because the clickers never arrived.

Secondary education program. *Science.* Chris Rimsa uses "laboratory-ware equipment" such as heart monitors to measure heart rate and sound level meters for sound. He makes his students aware of effective technologies that help learners understand fundamental ideas. He still keeps an overhead projector in his classroom because he believes that, at times, it is a much better tool to use than an ELMO.

Social studies. Brittany Voss uses (a) the Internet to access the primary sources such as pictures, old photos, old ads, and old newspapers; (b) a multimedia station to show videos on YouTube and listen to music; and (c) email to communicate with students and for assignment submissions.

Early childhood, elementary, and secondary education programs. Ivan Reina and Jeremy Moody teach classes in all three programs. In his mathematics classes, Ivan Reina emphasizes the importance of understanding the mathematical ideas first and then focusing on technology if appropriate. His technology use consists of (a) his own website to post course information; (b) a listserv to communicate with students and conduct discussions; (c) laptops to investigate curriculum standards, mathematics lesson plans, and resources on the Internet; (d) Google Documents to gather students' discussions; (e) digital cameras and camcorders to allow students to record kids' thinking about a mathematical concept; (f) discipline-specific applications such as SketchPad, Tinker, and Fathom; (g) discipline-specific tools such as graphic calculators; (h) PowerPoint software program for student presentations; and (i) ELMO to share student work.

Jeremy Moody teaches classes in foundations courses. He uses (a) WebCT to post all course information; (b) videos; (c) PowerPoint lectures; and (d) the Internet to do research.

Reasons why faculty do not integrate technology. Lack of technology in schools, technical problems, and feeling pressured to integrate technology are critical elements in faculty's cited decisions not to integrate technology.

Lack of technology in schools. The teacher education program coordinates 500 placements a semester. Placing students in schools where cooperating teachers model technology integration becomes challenging. Due to the size of the program, not all students experience technology modeling. The prevalent feeling among participants is that most of the placements are not equipped with much technology and in some cases there is a complete lack of access. A few methods-course faculty choose not to use technology in their teaching because of the limited exposure to technology in schools. For example, Ivan Reina, a lecturer in mathematics education who has observed "many horrors of technology use" during his supervision, comments,

> I'm not going to be spending a lot of time with my students for them to learn technology so that the ones that end up going to nicer neighborhoods and schools end up having the tools to deal with those kids.

Ty Ludwig, an associate professor in mathematics education, does not have her students use much technology in her teaching because

> Most of the classrooms they're [students] doing both their field experience in don't have a lot of technology. I have such a short amount of time in that course that I don't want to spend very much time on something that most of them are not going to be able to take advantage of. It would be great if we had more time to do that, and then, they could go into the schools and become advocates for getting more technology in their schools but that's just not the current situation. And I'm just not huge on technology. Obviously, I use my computer all the time. Beyond that, my work is not really about technology. It's

not where my research interests are. The more that I can get them in the classrooms and interacting with kids, it's just more where I'm going to put my time.

More specifically, faculty in mathematics and science do not want a piece of technology to get in the way. Rather, they want students to understand the fundamental ideas and to give them the hands-on experience in their methods courses without focusing on technology as "cool gadgets." Technology use, according to Kendra Coyle, an associate professor in science education, needs to have "an appropriate place and appropriate use." She adds,

> I think that people think that they're being cutting-edge and innovative when in fact, they're perpetuating a very mindless, thoughtless, low-level excuse for science teaching. Frankly, if technology is so wonderful, let's hire an actor and put them in front of kids. We don't need teachers. I'm trying to go after deep fundamental understanding of science content and to do that, we have to get outside, and we have to get dirty.

Technical problems. Encountering technical issues takes time away from their teaching, wasting valuable class time especially when faculty do not have the technical background to fix the problem(s). As a result, they choose not to use technology. Some of the common technical problems faculty encountered include difficulties with multimedia stations, WebCT, and wireless network.

Multimedia stations. Nearly all classrooms in the teacher education program are equipped with multimedia stations. These stations are used to show videos, access the Internet, WebCT, and presentations. While these stations enhance instruction, technical problems are unavoidable. At least six faculty cite incidents when the projectors did not communicate with the computers or project videos which resulted in losing teaching time. Another problem related to the multimedia stations is showing videos. Three faculty participants, Jeremy Moody, Ty Ludwig, and Ginger

Freidman report that they often had problems with showing videos. When the problem occurs, they often cannot fix it so they end up changing their teaching agenda because they do not want to waste teaching time dealing with the technical problem.

WebCT. WebCT is used as the course management system. The graphical organization of the WebCT is one of the most common problems that is voiced by the faculty, teaching assistants, and students. The information on WebCT is not organized for easy navigation, and sometimes locating materials is difficult. However, students comment that, while WebCT is tricky to navigate initially, it becomes easier to use after taking a few courses. Another problem with the WebCT is access. At least four faculty recall times when the system was down. Because access creates problems, participants find WebCT unreliable.

Wireless network. Wireless network access is available in all campus green space, covering more than 50 acres, most campus buildings, public areas of residence halls, and many on-campus residence hall rooms. During Spring 2009, all on-campus residence halls were scheduled to have wireless service. Setting up a guest account is extremely easy and free of charge. Once I signed up, I had access to use the wireless connection for seven days without having to register on a daily basis. However, because of thick walls in the college building, wireless connection is not fast enough. Users frequently encounter problems such as drops and weak, inconsistent signals.

Feeling pressured. Some faculty participants argue that technology is sometimes pushed on them. According to Chris Rimsa, an associate professor in science education, for example, distance learning has been pushed on faculty even though most faculty are not interested in it because of concerns that distance learning will reduce the need for faculty, as well as concerns that, students will not work as hard as they would in face-to-face instruction.

Because Rimsa teaches science methods courses, he argues that his material cannot be taught through distance learning. Faculty also sense pressure to use new technologies as soon as they are available. They agree that just because something is cutting-edge does not mean that it is valuable. Coyle comments,

> This crazy department is investing so much money to stick it [SmartBoards] on our walls. It's on the wall, and nobody knows how to use it. It's the stupidest thing I've ever seen. I can't figure out why we waste money to be innovative when I look at this stuff. Well, what? What is it solving for us that we could not before? Or are we doing this in the name of the staying cutting-edge?

Summary

The commitment to integrate technology in the program is evident. Technology integration is a part of the program's culture because of the dedication of the former and current department heads. Affordances include technology requirements for students, administrative support, funding for technology, technology center, and faculty development. One constraint around technology integration is the lack of technology integration in methods courses. Lack of technology in schools, technical problems, and feeling pressured to integrate technology have a major effect on faculty's decisions not to integrate technology. Even though these constraints exist, the program portrays a strong vision for technology integration.

The program provides a strong administrative support for technology integration. Leadership for technology is shared and a collaboration of the members of the teacher education program. The availability of funding, access to technology, technology support, and faculty development create an environment in which technology integration is encouraged.

Funding for technology comes primarily from a computing fee and faculty-written grants. The funding allows for a substantial amount of state-of-the art equipment. Faculty also write grants and proposals to obtain equipment to use in their instruction. The Technology Center provides reliable, consistent technical support and state-of-the-art equipment. Faculty, teaching assistants, and students praise the availability of support and the personnel. Two faculty explicitly report that they integrate technology in their teaching because the center provides high quality technical support which encourages technology integration in their instruction. The Center maintains a substantial state-of-the art library of equipment that can be checked out on a limited basis. Technology access enables faculty, teaching assistants, and students to design projects to use both on and off campus, leading to variation in what they are able to use in their instruction. Even though the coordinator of the technology center cites funding as an obstacle, faculty argue that lack of technology has never been an issue. All participants (faculty, teaching assistants, and students) find themselves in a state-of-the-art technology environment. Adequate access to equipment is combined with reliable, appropriate technical support. Findings reveal that a few adjunct faculty do not have up-date access to equipment to use in their instruction. Yet, they still integrate technology in their teaching to some extent.

Appropriate professional development encourages and supports faculty's efforts to integrate technology. Depending on faculty's interests and skills, the mentoring program allows faculty to work one-on-one with a mentor to learn and integrate technology in their teaching. It also presents graduate students opportunities to secure assistantships or work on publications with their mentees. Faculty speak highly of the program; however, they report lack of time as an obstacle. One limitation of the program is that it is not offered to adjunct faculty. This creates a concern because adjunct faculty teach some of the methods courses.

Even though aforementioned affordances help create an environment in which technology integration is encouraged, there is still lack of technology integration in methods courses. The required technology courses, which are usually taken during the sophomore year, are well-designed to help students integrate technology in their teaching. However, students take these classes early in their program. As a result, students often forget how to apply their technology skills across methods courses. The predominant suggestion among faculty is to move the technology courses later in the course sequence, enabling students to apply their newly-developed knowledge in the methods courses.

Nevertheless, the majority of the faculty commented on lack of technology integration in methods courses, because the extent of use depends on individual faculty. Students complete a variety of assignments designed to help them integrate technology teaching in Pre−K−12 grades; however, they have a hard time understanding how technology can be integrated in their content area. In addition, some students are concerned with their technology skills. Faculty express reservations about not integrating technology such as lack of technology in schools, technical problems, and feeling pressured. Commenting on lack of technology in schools, a few faculty state that they choose to focus more on teaching their content area instead of technology integration. However, these faculty still use (a) WebCT to conduct discussions; (b) PowerPoint lecture presentations; (c) virtual manipulatives to provide hands-on experiences; (d) instructional video clips; (e) listservs to communicate with students; (f) digital cameras/camcorders to record kids' activities; and (g) discipline-specific applications and tools.

In addition, technical problems often result in lost class time, and lack of troubleshooting skills discourage faculty from integrating technology. Of the 11 faculty interviewed, one stated that the technology faculty have inordinate power and decision making, and there is pressure to use new technology when available. Because the rest of the participants did not mention these concerns, it is difficult to interpret and decide if these are legitimate complaints that need to be addressed.

TEACHER EDUCATION PROGRAM AT NORTHERN UNIVERSITY

This teacher education program is at a state-supported university of approximately 13,000 students in a rural Midwest city. The program places a strong emphasis on excellence in preparing students to become reflective, responsible decision makers in a global and diverse world. However, it does not appear to have much in the way of technology integration. The presence of technology does not permeate the whole environment. The program lacks the resources and the vision to create an environment in which technology is available and its integration promoted. The implementation efforts portray both affordances and constraints. One affordance around technology integration is the technology requirements for students. Constraints around technology integration center around administrative support, funding for technology, lack of technology in methods courses, technology center, and faculty development. Reasons such as lack of technology in schools, teaching styles, and technical problems influence faculty members' decisions not to integrate technology in their instruction.

During my four-day visit, I talked to 17 faculty and 8 students and conducted 4 classroom observations. This description is organized in three parts. The first part briefly describes the teacher education program. The second part explains the affordances and constraints around technology integration in the program. The last part is a summary of technology integration in the program.

Teacher Education Program

Wendy Manning, a professor in elementary education, describes the teacher education program,

> In general, we are very conservative even though our reputation is that we're very liberal. We're [a] very conservative institution. Change comes very slowly. It's a culture that is

impervious to new ideas even though at times we often tout ourselves as being on the cutting-edge of new ideas. We're very tradition-bound. The university in some respects is technologically behind.

The program emphasizes preparation and continuing professional development of early childhood, elementary, and secondary students. Degree programs can be completed in four years of undergraduate study. Graduate programs are also offered for students who already have a degree and want to become certified teachers.

Students must successfully complete the 32–33 hour professional education sequence to receive a teaching license. The sequence consists of four levels, with four decision points marking a student's progress toward a teaching license. The decision points include foundation courses, field experiences, methods courses, and student teaching requirements. Students complete 95 hours of field experience before they student teach. Approximately 40–50 teacher education faculty provide instruction in the preparation of students. They are nationally and internationally recognized in their fields.

Affordances around Technology Integration in the Program

One affordance around technology integration is the technology requirement for students.

Technology Requirements for Students

The program offers a basic, required one-semester technology course that focuses on the selection and uses of various educational technologies to support meaningful learning and teaching. These courses are designed for students in the elementary (grades Pre–K–8) and secondary (grades 5–12) programs. The elementary students take a three-hour technology course. The secondary students take a two-hour course because there is no room in the curriculum for a three-hour course. These courses are team taught by three instructors who have a background in instructional technology. The technology course is intended to be taken during the sophomore year. However, due to the size of the university and the lack of a fixed sequence of courses, the course is attended by juniors, seniors and, in some cases, students in their student teaching semester. Both classes use the same format: lectures and labs. Weekly lectures are followed by a two-hour lab. Assignments are introduced in lectures, while labs focus on skill building to complete class projects and are designed to get students started on most assignments.

The lab sections of the technology courses are held in the Apple computer labs. One problem related to the computer labs is the administrative permissions for students and instructors. Because instructors and students do not have administrative permission, they cannot install any applications on the computers. In order for students to use any computer in the lab, they need to log in with a username and password. However, their documents do not follow them from one machine to another because students do not have roaming accounts. The technology course instructors do not have control of the computer lab where they teach. Since the instructors do not have access to the administrative password, updating and downloading software programs and fixing minor problems becomes problematic and time-consuming. As a result, technical problems that could be fixed on the spot get delayed because instructors have to wait for others to come and fix them. Another related problem is the scheduling of the computer labs. Because the technology course instructors have the priority to use these labs, some faculty struggle with reserving the labs.

Course activities include planning, designing and production of media, and the operation of hardware and software for educational use. Course instructors try to use free, easy-to-use online tools so that students can then have free access in their respective schools. Even though there are two separate courses for each level, both have the same requirements and assignments in order to create a consistent curriculum, with the exception of the digital portfolio assignment in the elementary program. Course outcomes are built around State Learning Standards (see Appendix F).

Assignment descriptions for elementary and secondary programs. There are 11 assignments for the elementary students and 10 assignments for the secondary students, with an extra credit option for both levels. Assignments consist of quizzes, a thematic unit description, an inspiration diagram, a WebQuest organizer, WebQuest, spreadsheets, a video project storyboard, a video project, a PowerPoint, and a final presentation (see Appendix G for assignment descriptions for both levels).

The prevailing feeling about the technology courses among faculty is that the students are well prepared to integrate technology in their teaching. However, those accomplishments are not often developed further in the methods courses. Therefore, students do not see technology integration as much as they should. A few faculty discuss the need to redesign the curriculum for the technology classes to start a dialogue among the faculty on what the curriculum should include. Most students report concerns related to the course curricula. Students find some of the course activities or assignments not applicable to their content areas; as a result, they do not understand the need to keep those assignments in the curriculum. Melissa Coppin, a junior in early childhood program, explains that, like most of her classmates, she has been using PowerPoint software since second grade so she does not need to learn how to use it. Julie Leffler, a senior in early childhood program, comments that the WebQuest and Excel projects do not align with her teaching philosophy:

> With the Excel project, you could get yes or no answers, no open-ended questions with the technology that we learn. You're either right or wrong, always. So, it doesn't leave very much room for much creativity, unless it was something like a generic program.

Constraints around Technology Integration in the Program

Constraints around technology integration center around administrative support, funding for technology, lack of technology in methods courses, technology center, and faculty development.

Administrative Support

Even though the university and the department head support technology integration, faculty are not encouraged to integrate technology in their teaching. Most faculty argue that making technology a part of the tenure and promotion process would encourage them to integrate technology. Wes Pisha, an associate professor in the Instructional Technology program, argues that when the department promotes faculty, their professional performance evaluation should be based on their skill in integrating technology. Pisha notes,

> Grassroots is nice, but some of it needs to be top-down saying, you have to have this capability. You have to identify the skills that are required. You have to identify what types of outcomes you're going to have. This talks about articulating curriculum which contains technology, which can be achieved through technology. And this is hard to do at the university level, although our department is doing a lot for that. It's something like, trying to make change at a university is a lot like moving a graveyard, and often the inhabitants are the same.

Katelynn Gaines, the department head, contends that technology integration cannot be imposed top-down, arguing that a shared leadership is essential; however, the department lacks this kind of leadership.

Funding for Technology

Technology is funded through a mandatory student activity fee. The money can only be spent on technology that is directly beneficial to students, such as computer labs, generic software purchases, and updating classrooms. However, the faculty contended there is a lack of money. Larry Kapstein, a technology course instructor, states that available funds are only sufficient to maintain the multi-media rooms. The maintenance of these rooms at a cost of roughly $60,000 consumes most of the budget. The department head claims,

> The idea of upgrading a classroom is to build a multimedia station, which of course becomes a presentation station. And we are a department that prides itself on being constructivist-based, which means presentation stations don't meet our needs. And so, that's the technician's ideas of what teachers need. And, obviously people are thrilled that they can put their PowerPoints up there. But it promotes a teaching style in a department which prides itself in hands-on education.

There is also lack of grant opportunities for technology funding because the department setting does not foster aggressive grant-seekers.

Lack of Technology Integration in Methods Courses

One persistent reported concern is the lack of articulation of technology integration in methods courses. The majority of faculty mention that methods instructors need to integrate more technology as part of what they teach. Even though students get a strong basis in the technology courses, the skills and knowledge they learn are not often developed further in the methods courses. Gaines states, “I don’t think [technology integration] is carried through. It’s not well articulated, and this campus is working on articulating the entire teacher education program, because we are big.” One way to overcome this obstacle according to Kapstein, a technology course instructor, is that methods faculty align their work with the National Technology Standards, which will help integrate technology into the system in such a way that it becomes second nature.

Students do not feel that the program prepares them to teach with technology because they do not see much technology integration in the methods courses. In some cases, exposure to technology in the methods courses does not go beyond PowerPoint presentations, ELMO, and WebCT, and most assignments do not require integration of technology. In response to questions about whether technology integration takes place in the methods courses, Mary Wendelson, a sophomore in elementary education, answers, “No, not particularly. Usually it’s ‘Can someone help me turn this thing on?’”

The majority of student interviewed for the study are pursuing a minor in technology. Working towards a minor in technology helps student become more comfortable integrating technology and understand how they can integrate it in their teaching. They argue that lack of familiarity, not being comfortable, and uncertainty of how to integrate it within the classrooms are some reasons why faculty do not integrate technology in their teaching.

Technology integration in the methods courses. Although information presented in this section does not reflect the whole picture of technology integration in the teacher education program, the interviewed participants share significant aspects of how they integrate technology in their teaching.

Early Childhood Education Program. Four faculty from the Early Childhood Education Program were interviewed. Two of the four teach classes in guidance and instruction, one in Early Childhood Curriculum, and one in Teaching License Preparation.

Guidance and instruction class. Carmen Butto and Erin Crew co-teach the class. Carmen Butto uses WebCT to post class information, online quizzes, weekly readings, grades, and informational videos. Erin Crew uses WebCT to post articles and reference materials. She communicates with her students' listserv to (a) email class materials; (b) conduct online discussions; and (c) use PowerPoint presentations for lectures and class notes.

Early childhood curriculum class. Angela Donovan uses the multi-media stations to show videos and access the web. She uses the ELMO and the computer-on-wheels carts on a daily basis. In one assignment, students use a computer to create a map of a classroom that they have observed. In addition, students create a curriculum unit with lesson plans, using either Inspiration or another web approach to design the learning centers. Students also create a collection of 4–6 activities for young children, along with standards and possible questions that they would ask the children.

Preparation for teaching license class. Kristy Clark uses the Boardmaker software program to create assignments that allow students to experience a regular classroom with a child with Autism. However, she uses a trial version of the software, and free access will expire at the end of the semester.

Elementary Education Program. Of five faculty, two teach literacy courses, and the others teach social studies, science, and curriculum studies, respectively.

Literacy. Jenna Sheehan regularly uses WebCT in all her classes to post her course syllabi, PowerPoint lectures, course assignments, and discussions. These projects are often hands-on, interactive games. For example, in her Early Childhood Literacy course, students create a word-processed book with ClipArt or Internet images for the students they tutor. In her Methods of Teaching Literacy in the Intermediate Grades class, students create two ERIC documents. The first one focuses on creating cartoons using images on science content such as volcanoes, fossils, glaciers, earthquakes, caves and crystals. The other document focuses on differentiated instruction activities for a children's book.

Ashley Gould, uses WebCT for PowerPoint presentations and videos. She uses the presentations as a tool to have interactive class discussions. The videos are examples of in-service or students' teaching in the classroom. In her Methods of Teaching Early Literature class, she models the use of digital cameras to take photos of students' learning. In her Remedial Reading class, students video or audio-record interviews they conduct with the students they tutor.

Social studies. Unlike most faculty in his department, Wendy Manning creates her own class website to post course-related materials, uses listserv to communicate with her students, and provides feedback via emails on lesson plans. In his Elementary Social Studies class, students learn how to use online resources in their teaching. Manning feels comfortable enough with technology to explore different programs. Inspiration is among the programs he plans to explore next. In addition to teaching undergraduate courses, he teaches an online master's degree course.

Science. In her science methods courses, Brook Sims shows videos on science experiments, conducts online discussions via listserv, and emails her class materials. Unlike most of her colleagues, she does not use PowerPoint presentations because she believes a methods course should teach students how they are going to work with children in a situation through hands-on experience. She points out, “If I model teaching that way [using PowerPoint], they will teach that way.” However, she uses PowerPoint at national/international conferences.

Curriculum and classroom management class. Tricia Frantz uses the multimedia stations to access websites and videos, and email to communicate with her students, WebCT to conduct class discussions, Podcasts to access information on class topics, and PowerPoint presentations for lectures. She uses games to capture students’ attention and is a creative way to teach a concept. She prides herself on using PowerPoint frequently in her teaching and states, “I have colleagues who still do not do that.” She also uses videos in her teaching. In her Elementary Curriculum class, students develop an integrated unit that includes technology.

Secondary Education Program. Two faculty were interviewed. They teach courses in literacy and instructional technology.

Literacy. Chad Foust takes full advantage of the technologies available in the classrooms such as the multimedia station to access websites. Although his students are not required to integrate technology in their lesson plans, students use the technology systems that are available in the classroom for their presentations. He is not a frequent user of technology in his teaching; however, he has played a vital role in the creation of the Literacy Social Networking. This virtual community brings faculty and students in the literacy program in order to engage around literacy practice, teaching, weekly book talks, and children’s literature.

Instructional technology classes. Andy Nardoni refers to his classes as “a technology fair.” He regularly demonstrates different kinds of technologies in his classes and creates authentic technology-focused projects. For example, students create promotional PowerPoint storyboards with embedded videos, audio clips, and images; promotional videos about majors on campus; and instructional videos such as hand washing for kids in K–4.

Reasons why faculty do not integrate technology. The lack of technology in schools, teaching styles, and technical problems influence faculty's decisions not to integrate technology in their instruction.

Lack of technology in schools. The lack of access to technology in the schools is a crucial factor for some faculty in deciding not to integrate technology in their instruction. Technology access in field placements is dependent upon which schools students complete their field placements because most take place in rural areas. The majority of schools have a lack of technology, and the available technology is often outdated due to lack of funding. As a result, these schools do not usually have what it takes to integrate technology. For example, Tricia Frantz's elementary education students write about their practicum experience where they spend a week in the schools. Reading about her students' practicum experiences reveals that most teachers do not integrate technology because they are limited by what is available to them.

Teaching styles. Faculty do not want to change their teaching style because, as Ashley Gould, an instructor in elementary education, indicates,

> Faculty were comfortable with how [their teaching] went. They had their routine. They knew how it went. It was very easy for them and [technology] was a big disruption to them, to their routine.

The average age of the faculty is in the 50s, so most faculty did not grow up with technology. The majority of the faculty are within 2–5 years of retirement and are tenured, so they do not see the point in learning about and integrating technology in their teaching. Margo Anderson, a technology course instructor, points out that most faculty have the "I am going to retire so what is the point of change" attitude. Another faculty member, Margie James, suggests that, “As far as some folks integrating technology—you just wait for their retirement party, because it’s never going to happen.”

In addition, since not all of the college classrooms have multimedia stations, faculty do not see the need to learn and think about those technologies in their teaching.

Technical problems. Technical problems come in different forms. Because faculty have different experiences with technology and posses different technology skills, the kinds of technical problems they encounter vary. Some faculty depend upon their students when they encounter technical problems during their classes. Technical problems related to WebCT, multimedia stations, wireless network, and email, are discussed in detail.

WebCT. The university adopted WebCT as the course management system. The majority of faculty use it to administer their courses. One particular problem is access, especially for students who commute from farms and outlying areas that do not have high-speed Internet connections. WebCT takes a long time to load with modems. Another access–related issue is the login duration. Participants point out that users have a certain amount of time to be on the system. If they are inactive for a period of time, the system kicks them out. Melissa Coppin, a student says,

> You could be in the middle of researching something for a paper that you’re doing. It’ll time out and if you get one try on it, it won’t let you go back into it. So, you’ve kind of gotta learn to type it all outside, print it off, or you know, copy and paste it. So sometimes you won’t get the credit because it timed out or sometimes it’s down and you have an assignment that you waited last minute to do and you can’t get in.

Lastly, five faculty mention the graphical organization of the WebCT and how difficult, time-consuming, and laborious setting up can be.

Multimedia stations. A majority of the classrooms have multimedia stations. These are used to show videos, to access websites, and to play CDs. One common problem is the audio. For example, Tricia Frantz struggles with showing videos if the audio does not work. Even though she has asked for help all year long, the problem is not yet fixed. Clark occasionally brings "the old-fashioned boom-box" to share songs with her students because the CD player on the computer often fails to work. Another problem is the different configurations of the stations throughout the teacher education classrooms. Faculty indicate that teaching in a different room sometimes gets frustrating because they have to remember all the configurations of the system.

Wireless network. Wireless service is available at every academic building on campus with plans to expand it to residence halls in the coming years. Setting up a guest account is tedious but free of charge. In order to obtain access the wireless network, a current member of the university is required to request a username and password. Guest wireless account provides access to the Internet at designated buildings for a limited time. One problem related to the wireless is the weak signals and slow connections. This creates problems for faculty and students if they want to access the Internet.

Email. Email is used in a variety of ways in the teacher education program. Besides communicating with students, some faculty have students turn in their assignments via email. Participants indicate that email system goes down most of the time which delays sending and receiving assignments.

Technology Center

The Technology Center, located in the teacher education program, provides technology access and technical support to the members of the teacher education program. The Center provides a wide-ranging library of education-specific resources, including textbooks, activities, lesson plans, teaching and resource units, audiovisual materials, and curricula. It also maintains an inventory of equipment on a check-out basis such as laptops, digital cameras, and LCD projectors (see Appendix H for a complete list of the available resources). The majority of faculty indicate that the resources are available; however, some note that at times resources are insufficient.

The Center provides technology support to the members of the teacher education program. Faculty describe the technical support in the following ways: "responsive team," "strong support," "They respond as best as they can," "The support that is available through the department is really good," and "We have all this support from our technology people who are always encouraging us to do things." Providing in-house technology support in a big institution is crucial; however, because the technology center staff is overworked, some technical problems can go weeks before being resolved. Anderson is the "go-to guy" in the program on whom nearly all faculty depend for support.

One technical support-related issue is the lack of a help-line. Having a help–line would be helpful in terms of dealing with immediate technical issues because many faculty believe that requiring them to make appointments is ineffective. However, some faculty also argue that dealing with technical issues via phone is not useful.

Another issue is related to the technical support personnel. Most faculty report that when they go to the technology center for help whether or not they receive the support they need is affected by "who happens to be there," "what kinds of problems they have," and "the time they teach." For example, Sheehan, an associate professor in elementary education, no longer uses the gradebook application of WebCT. The technical support personnel were unable to fix a problem she was having with the submission of an assignment, and suggested that she redo the whole course from scratch.

Another technology support-related concern is the hours technical support is available. A number of faculty teach night classes when technology support is not available. As a result, if they encounter any technical problems, they either try to fix the problem, ask students for help, or change their teaching plan. As a result, some faculty choose not to integrate technology in their teaching because they know that technical support is not available.

Lastly, some faculty rely on their colleagues for technical support; however, not all faculty are open to peer-coaching and appreciates having to constantly being asked for technical support by their colleagues. Margie James, who teaches in Instructional Technology department, says, “I have a doctorate. I don’t do janitorial work. I find that frustrating. Some people see faculty in our division as that support person. Anderson is paid to provide support. I’m not paid [to] provide support.” Even though the department head agrees that peer–coaching is crucial for “internal accessibility,” such faculty attitudes could impact other faculty’s willingness to integrate technology if essential support is not available.

Faculty Development

The teacher education program offers faculty development in the workshop format. These workshops introduce new technologies and help faculty understand how these technologies can be integrated into instruction. Faculty refer to the workshops as “endless opportunities to go and extend yourself and learn about it.” Some find the workshop topics good and useful, heightening the awareness of what is available.

Yet workshops have always had a weak turn-out rate. Anderson, who is in charge of the workshops, had a course-release to redesign the workshops. He polled faculty about topics of interest and needs. Even though efforts were made to accommodate faculty's schedules and technology needs, the attendance rate still did not change. Some workshops had no one in attendance. Surprisingly, the workshop topics rated the highest got the least attendance. There are many reasons why faculty do not attend these workshops. According to the department head, they are not well attended because faculty have many demands on them, such as teaching three courses, attending meetings, mentoring graduate students, participating in committee work, and supervising students.

However, faculty provide important insights as to why they do not attend these workshops. One reason is the amount of information the workshops cover. Faculty report the flow of information is overwhelming and beyond their technology skills. Another reason is that these workshops are not well planned, user-friendly, and oriented directly to the needs of the faculty. One recurring theme among the faculty is that a one-class workshop does not help them to sharpen their skills or prepare them sufficiently to integrate what has been taught. A few faculty highlight the need to have a mentor available to offer immediate help so that they receive exact type of support they need.

Some faculty find it difficult to stay current without committing enormous amounts of time to technology in addition to their other responsibilities. Most faculty argue that the time committed to learning about technology is a distraction from their primary focus. As a result, finding time to learn about technologies has not been a priority for most of the faculty.

Summary

Attempts to integrate technology in the teacher education program have been evolving for a long time. One affordance around technology integration is the technology requirements for students. Constraints around technology integration center around administrative support, funding for technology, lack of technology in methods courses, technology center, and faculty development. Reasons such as lack of technology in schools, teaching styles, and technical problems influence faculty's decision not to integrate technology in their instruction.

The majority of faculty are aware of the value of technology in teaching and learning. Departmental leadership does not create an encouraging environment in which technology integration is promoted. Faculty are expected to come to technology integration on their own, if they are willing. The department head is aware that in order for technology integration to take place, collaboration is necessary.

Technology integration in the program takes place through a required technology course, and by individual faculty in their instruction. The program offers a required one-semester technology course in the elementary and secondary programs, which presents different obstacles. While most faculty agree that students are well prepared to use technology in their teaching, most students find some of the course activities and assignments unrelated to their content area and, as a result, they are unsure of how to integrate technology in their teaching. Because of a lack of clear requirements to integrate technology in methods courses, the majority of the faculty are concerned about the lack of technology integration in those classes.

Lack of technology integration in methods courses is a common concern shared by faculty and students. The prevailing concern among faculty revolves around the lack of student exposure about how technology can be used in their teaching. Faculty report that they do not integrate technology due to lack of technology in schools, teaching styles, and technical problems. The extent to which technologies are used, and how those technologies are used, depend upon on the faculty, their technology skills, and content areas.

Workshops are a common way to offer faculty development. It is evident that the workshop format does not meet the needs of the faculty. Even though the department conducted a needs assessment to understand faculty's specific technology needs, the workshops are not popular among faculty. Faculty report that they do not attend the workshops because of lack of time, and often times these workshops are not well-prepared, not user-friendly, and not geared towards to the needs of faculty.

Funding is a major concern in the program. Technology is funded through a mandatory student activity fee. Because of lack of grant opportunities, additional funding is not brought into the department. Most funding is spent on purchasing and upgrading multimedia stations in classrooms. Even though most faculty have been vocal about requesting multimedia classrooms in their teaching, there is a general consensus among faculty that these kinds of classrooms encourage old-fashioned, non-constructivist teaching methodology.

The efforts to integrate technology in this teacher education program portray both affordances and constraints. The program continuously seeks better ways to implement technology integration. The need for established technology vision, situated faculty development, adequate funding, and improved access are still unresolved issues.

TEACHER EDUCATION PROGRAM AT EASTERN STATE UNIVERSITY

Eastern State University is located in a small Midwest town. The university is recognized as a doctoral/research-intensive institution by the Carnegie Foundation and enrolls about 20,000 students per year. The teacher education program is one of the biggest programs in the Midwest. Faculty, staff, students, and community come together to foster a successful teaching and learning environment through the immersive learning initiative. The integration of technology plays a vital part of this environment and is embedded into the university's culture. The campus-wide encouragement and support creates an environment in which technology integration is welcomed. The teacher education program is no exception to this commitment.

The program has addressed the issue of preparing students to effectively and seamlessly integrate technology across content areas through laptop and digital portfolio requirements. It is in the forefront of exploring innovative ways to integrate technology so that technology integration becomes part of students' teaching practice. The program continuously seeks better ways to implement technology integration. Affordances around technology integration are technology requirements for students, administrative support, funding for technology, technology center, and faculty development. One constraint around technology integration centers around lack of technology in methods courses. Factors such as lack of technology in schools, faculty technology skills, faculty's age, faculty resentment, lack of incentives, and technical problems affect faculty's decision not to integrate technology in their teaching.

During my three-day visit, I interviewed 11 faculty, 2 staff, and 8 students and conducted 3 observations. The description of program is organized in three sections. The first section provides a description of the teacher education program. The second section describes the affordances and constraints on technology integration in the program. The last section provides a summary on the program.

Teacher Education Program

The teacher education program at Eastern State University offers majors in early childhood, elementary, and secondary education. Criteria include earned grades of C or better in 100‒and 200‒level professional education courses, minimum of 45 credit hours with an overall grade-point average of at least 2.5, completion of content requirements specified by the student's licensure area, and satisfactory completion of the second-level portfolio review. Students are required to successfully complete four decision points to receive a teaching license. The decision points include portfolio review, foundation courses, field experiences, methods courses, and student teaching requirements. Each program has a different set of requirements, and each decision point has certain requirements that must be met to be eligible to stay in the program, graduate, and secure licensure.

Affordances around Technology Integration in the Program

Affordances around technology integration are technology requirements for students, administrative support, funding for technology, technology center, and faculty development.

Technology Requirements for Students

There are two technology requirements for the students: laptop and digital portfolio. Starting in 2002, the teacher education program has started to require every student to purchase an Apple laptop. This initiative provides students with ubiquitous access to computing in their courses, at home, and in the field placements. Ubiquitous computing gives faculty and students the freedom to experiment with technology in instruction and to explore how it affects teaching and learning without the boundaries of a stationary lab. Faculty argue that the laptop initiative has impacted how students and faculty view technology. According to Becky Olerman, the support manager for digital portfolio, the initiative enables students to master some basic skills so that they can experiment with what technology can offer them in instruction. In addition, because of the program, some faculty have started to ask questions such as “What can I do?” or “How can I rewrite this lesson so it integrates technology?” as well as to realize that they need to integrate technology in their teaching. The program offers technical support to students with their laptops. The technology center assists them with initial setup and any technical problems students encounter. The Office of Scholarships and Financial Aid also provides financial aid to eligible students to purchase the laptop.

One concern about the laptop initiative is the Apple-specific software. When students get a PC, the software is not compatible. Ben Crowley, an assistant professor in secondary education, argues, “We should maybe be more open to choices and a variety of different applications that students might use to do the same kinds of things.”

Another technology requirement for the student is to construct a digital, web-based portfolio to represent their competence with teaching and learning. Students begin their program in Decision 1, which constitutes the same components of the introductory courses across the programs. In these introductory courses, students address the digital portfolio requirements and how to construct it. All licensure areas made agreement to have consistent curricula across the programs so that if a student changes his major, the introduction courses do not need to be retaken. For example, if a student starts out as a music major, takes the introductory music course, and then switches to a different major, the student is not required to retake the introduction course.

The program has a laboratory specifically designed to provide any kind of support for students related to the construction of their portfolios. The program also provides web-based handouts and tutorials for faculty and students. Instead of using portfolio packages, the program requires students to “create their portfolios and train faculty to infuse those skills into traditional coursework so that students would see technology integrate as a normal part of their teacher education curriculum,” Rhonda Peters, associate dean, explains.

Of four students interviewed, two describe a lack of digital portfolio support during their student teaching. Because they did their student teaching at schools not in the area, they could not get to campus for help. Lisa Rodgers, a senior in elementary education, reports,

> We kind of had to do it on our own, and figure out everything out, and ask our supervising teacher how to do it, because we didn’t know how to do it. Like, there were still some things we don’t know how to do, like putting certain types of files online. So, that was the biggest problem for me.

According to Peters, faculty and students present different perspectives on the digital portfolio requirement: some like it, and some do not. Peters argues pushback on the requirement exists. She reports that faculty questions such as “Why do we have to articulate standards to an artifact?” confirm that some faculty are still unclear about what the programs is trying to do. Most students are still confused about why they are required to construct a digital portfolio.

Administrative Support

In the last 10 years, supportive leadership, especially from the President, has helped the university get recognized for technology. Intel listed the university as making the most promising and innovative changes, recognized for virtual world learning and digital media training and support, and ranked as the nation's top wireless campus.

Administrators have placed a priority on technology integration, have contributed to the creation of an environment in which technology is available and its use is promoted, and have played a vital role in encouraging faculty to use technology. As Olerman, the support manager for digital portfolio, says,

> Having an enthusiastic appearances [someone] who is doing it successfully, that is enjoying it and seeing success on the student end makes a difference. If a department overall drag their feet, then the person who is trying to push the envelope tends to be looked down upon.

Administrators take many initiatives to make technology available to faculty and students. Initiatives such as the laptop and digital portfolio requirements create a ubiquitous learning environment in which students are exposed to technology, using technology, and thinking with technology. Peters, the associate dean, states,

> Technology on this campus is one of the sexiest things you can do. Our President is all about it. We have incredible resources here for faculty from video conferencing, to faculty support, to our budget. So, the feeling on campus is that if you're not doing technology, you're a loser. So, the attitude is, people think, I better start doing something along these lines. The truth is, it doesn't really matter what, it's that you are doing *something.*

Funding for Technology

Lack of funding is not a problem in the program. Funding for technology comes from two sources. Each year, the college is given a budget for new technology purchases from the university's general fund and a small amount of money from the student-paid technology fees. These student paid funds can only be used for technology that is directly in the hands of students, like the loaner laptops, projectors, and cameras. Existing budget in each college and in each department provides for the purchase of items. Faculty simply need to justify what they are asking and show how it will be used to support their teaching. These requests then go to technology representatives in each department who, along with the department chair, ranks these requests by importance. From there, funds are distributed until they run out.

Several faculty apply for grants to purchase technology that is necessary for their courses. Some of these grants include the use of Web 2.0 technologies for student teaching portfolios and SmartBoard training in the elementary education.

Technology Center

Located in the teacher education program, the Center provides a variety of support and technology to faculty and students. The mission of the Center is to advance technology infrastructures, teaching practices, and curriculum through research, development, and outreach initiatives throughout the teacher education program.

Three types of support are available. The iCare Center serves students, the director of technology helps faculty, and an assigned staff from University Computing Services provides just-in-time support for faculty. The majority of the faculty I interviewed spoke highly of the technical support at both college and campus levels. "It's great," "People are forthcoming in whatever we need, we can pretty much find or get support," "We're really loaded with help here," and "We actually have a really good support system" are how faculty described the support. Olerman, who provides support to faculty and students, reports,

> People like me don't exist on other campuses. Faculty can walk into my office and ask a question. That on-demand, when-I-want-to-know-it, instantaneous response has helped the faculty now see the benefit to the integration of technology.

Even though the technical support personnel are delegated for different purposes, Peters explains that some faculty still go to iCare Center for help. As a result, faculty are taking resources from students. Mullen says, “It’s the person who runs iCare who wants people to like her and so she’ll do things for them. And, it drives me crazy!” She says that at times she receives phone calls from the iCare Center about how busy they are, but she argues, “You [the person in charge of iCare Center] have got to say ‘no’ to faculty and make them go to a certain person.” While the majority of faculty praise the availability and dependability of technical support, only one faculty member mentioned getting help could be difficult while teaching an 8 a.m. class. In contrast, Londa Page, an associate professor in educational psychology reports,

> If you have trouble in the classroom, there’s a number you can call. Or, when I have problems if the projector won’t work, or if I want to show a video from the library that won’t show up, I just pick up the phone in every classroom and call. It’s fixed in 5 minutes.

The technology center maintains stock of equipment that faculty and students can check out (see Appendix I for the complete list). The center provides a simple reservation system that allows students and faculty to request equipment. Peters commented on the incredible resources faculty and students have and faculty get what they want and need. The majority of the faculty report that the resources available are incredible.

Faculty Development

One of the program’s strategic goals is that 25% of the faculty would become expert-users in technology in three years starting in 2008. Workshops at the campus and college level are available to faculty.

Alex Lauchner, the director of technology, describes the structure of the workshops.

> For our faculty, we try to provide as many opportunities and workshops in two facets. One is just skill building. The new operating systems come out and your students are

> going to come with this particular set of software and you need to know how it works because it will enhance the way you communicate with them, the way you educate them, the way you can use technology to make them a better teacher. So, we kind of evangelize—we do that. As a matter of fact, I just went through a whole week last week everyday for an hour, providing opportunities for our instructors to come in and essentially, be evangelized to take this next big step.

Lauchner works closely with faculty and explains his role, "When they do come up with a great idea, that we have the hardware in place that will support that, or software, or systems, or whatever they need." Olerman provides support to faculty with their technology needs and to students with their digital portfolio questions.

> I actually go in the classrooms and teach for them, or I will sit in their offices and explain to them how software works, or how to do something with the web site; how to integrate what they do in their daily lives into their teaching so that they're using more technology.

The department also brings in people who have been successful at integrating technology in their teaching. Many faculty keep up with technology through attending conferences, following blogs, and talking with their colleagues. Jay Ratliff, an associate professor in elementary education, reports that in the department faculty who teach online courses get together regularly to share "what we feel we do well with technology so I'm getting all of these ways to start different discussion prompts, or to use different things."

Even though the workshops are available, the majority of the faculty do not attend them due to lack of time and because the faculty find them uninformative.

Constraints around Technology Integration in the Program

One constraint around technology integration is the lack of technology integration in the methods courses. Factors such as lack of technology in schools, faculty technology skills, faculty's age, faculty resentment, lack of incentives, and technical problems affect faculty's decision not to integrate technology in their teaching.

Lack of Technology Integration in Methods Courses

The teacher education program strongly believes that students need technology expertise in their learning and teaching. The program does not adopt a single course approach to teaching students about technology integration in instruction. As Mike Warmbier, an associate professor in instructional technology, puts it, "We require our students to have skills and competencies, but we don't teach them." Instead, technology integration occurs through an infusion model in many, but not all, existing courses. Students develop their technology skills and learn about integration through creating a digital portfolio.

Even though adding a required technology course into the curriculum is a vision, it brings many political ramifications. Peters, the associate dean, argues that the currency in higher education is based on the number of courses and students' enrollment, cutting hours of programs to add a technology course is almost impossible because programs such as the secondary education are not internal to the college and students take their content-area courses in other programs or departments. The teacher education program received a PT3 grant to facilitate technology infusion in the methods courses and throughout the teacher education program. Even though Warmbier agrees that the digital portfolio requirement was a "good noble effort," many faculty resisted the idea and only some welcomed it. The need for a required technology course has always been an idea, but “the credit hours were fixed and no one is going to wiggle on any of that,” as Warmbier explains.

When Lauchner, the director of technology, started his job seven years ago, 20–25% of the faculty understood the importance of using technology in instruction. He reports that now 80% understands how it is imperative to use technology for organization, communication, and dissemination. He argues that the majority of faculty use technology in the classroom; however, there are still some with the “I like to lecture” attitude.

The majority of the faculty report that methods instructors need to integrate more technology and model the appropriate integration of technology by showing students what technology integration is supposed to look like in their teaching. However, Paul Eichman, an associate professor of foreign language education, thinks that faculty need to be provided with resources and training that models how technology can be integrated in their teaching. Olerman points out that most faculty concentrate solely on their content area so much that the technology side of things is sometimes just an add-on, or they do not quite know how to integrate technology because they are afraid of doing it.

Warmbier reports that there are enough faculty who are doing interesting things in their classes; however, a large percentage of students still lack the skills and the knowledge to interate technology. He argues “We’re probably not meeting national education standards for teachers that we say we are supposed to do.”

Technology Integration in Methods Courses. Information presented here does not reflect the whole picture of technology integration in the teacher education program; however, eight faculty exemplify how they integrate technology in their instruction.

Elementary Education. Three faculty participants were interviewed about the elementary education program, and teach a variety of courses.

Classroom management instruction class. Jay Ratliff's technology integration consists of (a) BlackBoard to post his course information and assignment submission; (b) discussion board, blogs, and wikis; (c) Podcasts of his lectures for review; and (d) WebQuests.

Child development and adult development classes: Students in Londa Page's class (a) create a webpage using iMovie or PowerPoint to design "Create a Child" project; (b) videos; (c) online exams; and (d) BlackBoard to post class-related materials and PowerPoint lecture presentations.

Education in a Democratic Society. In addition to creating digital portfolios, Holly Sherwood's technology integration consists of BlackBoard and PowerPoint lectures presentations.

Secondary Education Program. Five faculty participants were interviewed. They teach courses in introductory education or methods courses in history and social science, secondary education, foreign language, music education, and educational technology program.

History and social science. In her classes, Margaret Rhodes uses (a) BlackBoard to post her syllabi, assignments, and readings and communicate with her students; (b) online curricular programs and political cartoons to access history and social science materials; (c) films to frame discussions; and (d) ELMO/laptop to present information.

Introduction to secondary education. Students in Ben Crowley's class (a) construct digital portfolios; (b) online learning modules using SurveyMonkey to conduct pre and post assessments; (c) incorporate multimedia into their module.

Introduction to foreign language education. In Paul Eichman's class, students use (a) podcasts to design stories for listening comprehension activities; (b) WebQuests to focus on a cultural element; and (c) iMovie to gather materials that students put into movies for their own classroom; (d) PowerPoint student presentations on language and culture; (e) webpage to create resources on different language skills and cultural elements.

Music education: Eric Brock is the only faculty member interviewed from the music department. The entire music faculty work as a team with a comprehensive curriculum. The technology integration include (a) SmartClassrooms with state-of-the art visual and sound technology; (b) SmartMusic and Finale software programs; and (c) Microsoft Office, Excel, and other productivity, and record-keeping software programs.

Educational technology courses. Mike Warmbier teaches various classes. His classes focus on building skills that will "help them [students] survive the teacher ed program." Students work on authentic and grade-and content-specific projects to use them in their teaching. Some of the projects include virtual trips to a zoo developed for kindergarteners and training materials on how to play basketball and volleyball.

Special Education. One faculty in the special education program who teaches the introductory course was interviewed.

Computer technology and special education. Cheryl Stout's special education class has two components. She uses (a) Microsoft Office (Word, Excel, and PowerPoint) to show how to use these programs; (b) Netscape Composer to create websites; (c) the Internet to explore different kinds of sites, focusing on efficient techniques of searching information; (d) BoardMaker and Pix for Pecs software programs to make adaptations; (e) PowerPoint software program to create clickable storybooks and puzzles; (f) prediction software, alternate keyboards, speech recognition, and different types of switches.

Reasons why faculty do not integrate technology. Factors such as lack of technology in schools, faculty technology skills, faculty's age, faculty resentment, lack of incentives, and technical problems affect faculty's decision not to integrate technology in their teaching.

Lack of technology in schools. The majority of the faculty agree that students in the program are well prepared to integrate technology in their teaching; however, some faculty do not integrate technology because of lack of technology in schools. Margaret Rhodes, an associate professor in history and social science, argues that she teaches her students material that helps them as teachers with their content and organizing their lessons. She does not integrate technology in her classes because she is not confident that teaching about technology will help them.

Paul Eichmann, an assistant professor in foreign language, points out, "There are schools that have technology, and there are schools that don't. And so, it's clearly still an issue." Faculty argue that where students complete their field experiences makes a difference because in small schools, technology lacks. Rhodes, an assistant professor in history and social studies, states that the university advertises itself as being technology-enhanced; however, but schools where students will have jobs have limited technology.

Students question the role of technology integration when some schools do not have the technology. Eichmann points out that sometimes students are hesitant to learn about technology because they will say, "The school district where I want to teach doesn't have this kind of technology or I don't know how to get this technology." Rhodes finds "huge discrepancy really makes it harder to decide where the middle-road is, where one can go in either direction and not feel inadequate anywhere."

Faculty technology skills. Knowledge about how to integrate technology and faculty's comfort level with it can influence faculty's willingness to use technology in their teaching. Eichmann has "real concerns about faculty's comfort levels trying new things because that's really not what they're about." Rhodes explains,

> I think something that concerns me is having an idea and me not knowing enough to get what I want to be done for the technology to do it. Like, I've seen other people do this and I don't have the knowledge to do it and so.

Some faculty indicate that faculty need to be willing to learn and comfortable with using technology in their teaching. Since technology changes quickly, some faculty do not feel comfortable keeping up with the fast pace. Jay Ratliff, an associate professor in elementary education, thinks "It just becomes a stepping point and leaping outside your comfort zone." However, some faculty are not willing to take that stepping point. A certain attitude gets in the way of faculty learning new technology: "I don't know how to do this, you know, I'm not an expert in web editing and so I may not have my students do multimedia or some kind of web project, or allow that to happen," states Eichman. For example, faculty who integrate technology in their teaching and are comfortable with their skills, use the "technology-fail" incidents as teaching moments to model for students that technology will fail at times and that it's important to have a back-up plan.

Faculty's age. Some faculty argue that age is another factor. Olerman argues that technology integration in the college depends on faculty's age and the number of years they have been teaching. If faculty have been teaching for a long time, they tend to use older technologies or videotapes in their classroom. However, Eichman disagrees that age is a factor. He points out, "We have some very senior professors that are very active in using technology and who are cutting-edge. And we have some relatively new professors who you would think would embrace technology, who don't." Eric Brock describes how one of his colleagues, who is in her mid-60s and the least comfortable with her technology skills at the beginning, has become an expert in technology integration. He says,

> She's also someone who is eager to learn what she needed to, to make sure she was delivering quality instruction to the students, and has done a real good job of doing that. And, is really open to learning from the students, too.

Some faculty are convinced that technology gets in the way between their students and themselves.

Faculty resentment. Resentment is another factor. Some faculty have resentment toward the way the leadership has brought technology into the college. According to Crowley, an assistant professor in the secondary program, the portfolio has been part of the problem because "It's coming from up above and telling everyone that you have to do this, but then, everyone else hasn't been part of that conversation." He argues that due to "built-in resistance and resentment," it will be difficult to get those faculty back. Warmbier, who teaches in the instructional technology program, agrees, saying, "faculty are resistant to being told what to do and what to teach."

Lack of incentives. Even though technology integration is encouraged, faculty are not rewarded or recognized for using technology in their instruction. Technology integration is not part of the expectations for tenure line. Ratliff points out "I would say that they would like to be people who are technologically savvy and proficient and to use all of this," but there are no rewards. He adds, “If your research is about teaching with technology then yes, it would be rewarded. If it’s just using technology in your classroom, it’s not.” In addition, Eichman claims that “incentives either financially, or with release times, or with awards or grants, that is going to recognize outstanding teaching with technology” will encourage faculty to think more seriously about using technology in their teaching. Olerman reports that faculty in general have started to realize that technology integration is becoming paramount almost parallel to service, scholarship, and teaching.

Technical problems. Having technical problems influences faculty’s willingness to integrate technology. Most faculty note that encountering and dealing with technical issues steals their time from teaching. When faculty have to deal with technical problems, they try to fix the problem on their own, or get help from the students, or move to the next activity in their teaching agenda. Faculty list two common technical problems with multimedia stations and the network.

Multimedia stations. Having problems with ELMO is common. Most faculty indicate that at times they struggle with the disconnection between ELMO and the computer. As a result, ELMO does not communicate with the computer so faculty cannot use it to project their instructional materials.

Network. Two kinds of problems exist. The first one involves online exams and the Internet speed. Some faculty give all their exams online. At times, students run into problems when the network is down. As a result, the students sometimes have to wait to take their exams. The second problem is related to storage space. Crowley explains that even though all the students have laptops, the hard drives on those laptops are not big enough. He says,

> As we found out as a couple of students started to import all their videos onto one person’s machine, it ate up the hard drive. So they had no space. So, issues of that and

how do we work with large files. As we're trying to implement and use different digital media how can we kind of on a broader scale, in terms of the university, handle that network traffic. Because we can do it wirelessly, like to load it from one person's computer up to a server, but it would take forever. And if we're going to keep it local on one person's computer, or some external hard-drive, just the management of those files.

Summary

The commitment to integrate technology in the program is palpable. The desire to make technology integration part of students' teaching practice is clear. The program portrays a breadth of knowledge about technology and technology's role in education. The campus-wide and departmental encouragement and support create an environment in which technology integration is welcomed but not forced. Affordances around technology integration are technology requirements for students, administrative support, funding for technology, technology center, and faculty development. One constraint around technology integration centers around lack of technology in methods courses. Factors such as lack of access in schools, faculty technology skills, faculty's age, faculty resentment, lack of incentives, and technical problems affect faculty's decision not to integrate technology in their teaching.

Students in the program construct a digital, web-based portfolio to represent their competence with teaching and learning. In addition, students are required to purchase an Apple laptop to use in the teacher education classes. Each student, depending on their content area, takes an introduction course to familiarize themselves with the digital portfolio requirements and the construction process. By adopting the digital portfolio initiative and laptop requirement, the program aims to create a ubiquitous environment that provides students with constant access to technology. The digital portfolio showcases a student's understanding of the state's learning and teaching standards and uses artifacts from various courses to support their understanding of learning to teach.

One major concern among the faculty is the lack of technology integration in methods courses. However, these faculty still use (a) Blackboard to post class information; (b) WebQuest to design lesson plans; (c) iMovie to create projects; (d) videos/films to incorporate lesson plans; (e) the Internet to access content-based materials; (f) webpages to design projects; (g) productivity programs; and (h) content-specific software programs.

Faculty development is available in the forms of workshops and individual help. Workshops on variety topics both at college and campus level are accessible. The program offers technology support on three different levels, focusing on specific needs. However, faculty report that lack of time is a major reason why they do not attend these workshops. While faculty are encouraged to use technology in their teaching with stable, reliable technical support and rich resources, they state that the program does not offer any types of incentives. The majority of the faculty believes that offering incentives such as rewards and reduction of workload may increase the effectiveness of the professional development opportunities. Recently, part of the hiring process has been the inclusion and discussion about technology as an integral part of the teaching requirements within program. As a result, the program aims to bring in faculty who are familiar and comfortable with using technology in their instruction.

The efforts to integrate technology in teacher education program portray both opportunities and obstacles. The use of technology in the program is an evolving process, and the program continuously seeks better ways to implement technology integration. The key components of technology integration in the program include the digital portfolio and laptop requirements, supportive organizational support, adequate funding and resources, and reliable, individualized technical support.

Summary of the Chapter

The case study sites have made extensive attempts to systematically introduce technology integration in their programs. The findings show similarities and differences in terms of affordances and constraints around technology integration in the programs. These similarities and differences are highlighted by the fact that in some cases affordances in one program proved to be constraints in another, and vice versa. In Table 2, I have briefly summarized the affordances and constraints and reasons why there is lack of technology integration in methods courses across the case studies.

Table 2

Summary of Affordances and Constraints around Technology Integration in the Programs

State University (SU)		Northern University (NU)		Eastern State University (ESU)	
Affordances	Constraints	Affordances	Constraints	Affordances	Constraints
-Technology requirements for students Required technology courses -Administrative support -Funding for technology -Technology Center Access to technology Technical support -Faculty Development	-Lack of technology in methods courses Lack of technology access in schools Technical problems Feeling pressured	-Technology requirements for students Required technology courses	-Administrative support -Funding for technology -Lack of technology integration in methods courses Lack of technology in schools Teaching styles Technical problems -Technology Center Access to technology Technical support -Faculty Development	-Technology requirements for students Laptop initiative Digital portfolio -Administrative support -Funding for technology -Technology Center Access to technology Technical support -Faculty Development	-Lack of technology in methods courses Lack of technology access in schools Faculty tech skills Faculty's age Faculty's resentment Lack of incentives Technical problems

Chapter 5

Cross-Case Analysis

This chapter discusses the findings of the case studies and interprets the meaning and significance of the findings. By focusing on three exemplary, award-winning teacher education programs, this study examined (a) the contemporary realities of technology and teacher education; (b) the affordances and constraints around technology integration; and (c) the working infrastructure created in teacher education programs as potential affordances for technology integration.

In this chapter, I present six themes embedded within the three teacher education programs. These themes make up the affordances and constraints around the degree of technology integration in the programs. These affordances and constraints, ranging from organizational to personal, center around: (a) levels of integration; (b) administrative support; (c) funding; (d) technical support; (e) technology access; and (f) faculty development. It is important to examine these affordances and constraints in order to understand why some programs are more successful in their attempts than others and to create a working infrastructure as potential affordances to provide a systematic technology integration in teacher education programs so that students will gain the knowledge and the skills to integrate technology in their teaching and learning.

Affordances and Constraints around Technology Integration across the Cases

The findings showed that three exemplary, award-winning teacher education programs I investigated made extensive attempts to integrate technology into their programs. Even though each program presumably encouraged, promoted, and made conscious commitments, the programs still struggled to build the necessary infrastructure for a systematic, thorough technology use and integration. The one consistent finding across all programs was the lack of technology integration throughout the programs. Each program had its own strengths and weaknesses, which affected the way each program responded to the affordances and constraints. Similarities and differences in terms of affordances and constraints around technology integration existed across the programs. In some cases affordances in one program proved to be constraints in another, and vice versa.

Levels of Technology Integration

Efforts to achieve coherent, systematic technology integration occurred at the preliminary and secondary levels. At the preliminary level, the programs offered a required single-course or digital portfolio requirement and laptop initiative. At the secondary level, integration sporadically took place in methods courses depending on the individual instructor. Despite these efforts at each level, the study found that the programs lacked a systematic technology integration throughout the programs.

Preliminary level of technology integration. The technology requirements for students across the cases included a required introductory technology course or a laptop and a digital portfolio requirement. The programs at State University and Northern University required a one three-hour credit course on technology integration designed for the programs in which the students were enrolled. These courses focused on understanding technology's role in teaching and learning and were designed for specific grade levels. State University offered two required introduction to technology courses: one in the Early Childhood and Elementary Education Programs and another in the Secondary Education Program. The required technology courses at Northern University were designed for students in the elementary (grades Pre–K–8) and secondary (grades 5–12) programs. In these classes, students completed assignments that focused on certain technologies in order to become familiar with them. Faculty in both programs agreed that these courses exposed students to a variety of technologies they could integrate into their teaching. For example, at State University, students in the elementary program designed a digital media project that focused on using multiple forms of media with PreK–6 students. At Northern University, students created a spreadsheet program to track their students' performance to calculate student grades.

One common concern among faculty in both programs was how early or late students took the courses during their program. State University faculty found that students often forgot how to apply what they learned in their methods courses. Northern University faculty occasionally discovered that students did not enroll in the technology courses until their junior or senior year. This was partially due to the program's size and the lack of a fixed sequence of courses. Students in both programs noted that some components of the curricula being studied in the introductory technology courses did not seem to be what they would most likely need in their teaching, and they struggled with understanding how to integrate technology in their teaching.

The teacher education program at Eastern State University differed with respect to its technology requirement. Instead of a mandatory technology course, students were required to purchase a laptop and construct a digital portfolio. The idea behind the laptop requirement was that students would have freedom and access to computing in their courses, at home, and in their field experiences. The digital portfolio requirement allowed students to document their growth, reflect on what they learned, develop their technology skills and learn how to integrate technology. The introductory to education courses served as a means to introduce students to the digital portfolio requirement and how it was constructed.

These introductory courses aimed to introduce students to a variety of technologies for various disciplines. The findings showed that collaboration among faculty could provide students with relevant technology skills and experiences while they were learning their craft (Brush, 1998). Even though the laptop requirement allowed ubiquitous access to technologies at Eastern State, the exposure to technology integration in methods courses depended on individual instructor. This program did not have a required technology course.

The findings from the three case studies suggest the need to design the curriculum of the required technology courses in a way that helped students understand how technology could parallel what they would teach so that these courses could "provide these students with real meaning, context, and enough practice to ensure this learning transfers to their future classrooms" (Lambert, Gong, & Cuper, 2008, p. 407).

Secondary level of technology integration. The leading obstacle to technology integration in the three education programs was the lack of systematic technology integration in methods courses. This was attributed in part to sporadic integration or modeling in methods courses. The level and the extent of technology integration in methods courses varied and depended on the faculty's technology proficiency and belief in the role of technology in teaching and learning. The findings showed that technology use/modeling across the cases occurred in three major ways: (a) as a course administration tool for the faculty; (b) as a learning tool for the students; and (c) as a communication tool for faculty.

***Course administration tools for the faculty*.** These types of use included course management systems and Web 2.0 applications. The teacher education programs at State University and Northern University adopted WebCT, and BlackBoard was used at Eastern State University. These course management systems were most commonly used by faculty to (a) post course documents (syllabi, assignments, articles, PowerPoint lectures, videos); (b) distribute grades to students; (c) give online quizzes; (d) communicate with students; and (e) conduct online discussions. The first three functions helped faculty administer their courses more efficiently instead of improving student learning, with the exception of online discussions. These discussions encouraged interaction among students and created a cooperative learning community; thus might impact student learning.

The Web 2.0 applications included podcasts, googledocs, and blogs/wikis. Faculty used Podcasts to review lectures, googledocs to gather students' discussions, and blogs/wikis to conduct discussions. Podcasts and blogs/wikis aided student learning by allowing students to engage in discussions and reach curriculum goals. Googledocs was used to organize and present information. These tools aided faculty to organize class-related materials. They did not support student learning.

Learning tools for students. Faculty listed a variety of content-specific software programs and hardware they used/modeled in their teaching so that students could learn how to use them in their teaching and explore issues associated with teaching and to reach specific outcomes. The most popular content specific software programs and hardware included in (a) mathematics: Lego-Digital Designer, Discourse, SketchPad, Tinker, Fathom, virtual manipulatives, and graphic calculators; (b) science: Starry Night, laboratory-ware equipment, such as heart monitors to measure heart rate and sound level meters for sound; (c) special education: Boardmaker and Pix for Pecs software programs to make adaptations, prediction software, alternate keyboards, speech recognition, and different types of switches; and (d) music education: SmartMusic, Finale, and record-keeping software programs.

The study also found that faculty used resource-based tools such as WebQuests, on-line curricular programs, and lesson plans to help students explore issues associated with teaching and to reach specific outcomes. These tools allowed students to integrate Internet resources, curriculum content, and research. Other tools faculty listed were the technologies used for publishing and sharing such as webpages to provide links to information. These tools allowed students to create and elaborate their own knowledge instead of instructor holding the knowledge.

Communication tools for faculty. Faculty used listserv, email, and Blackboard to communicate with students about class-related issues, to provide feedback on assignments (lessons plans), and to send class materials (PowerPoint lectures). Even though these tools allowed faculty to administer their courses more efficiently, they did not address student learning.

Faculty across the cases used/modeled a variety of software programs and hardware in their teaching, and they defined technology integration in various ways due to a lack of a clearly articulated definition of what technology integration was and what it should look like. The personal definition of technology integration impacted the way and the extent faculty integrated technology.

The idea of technology integration goes beyond delivering lectures with PowerPoint, or projecting course materials using ELMO, or using course management systems to administer courses. When faculty use technology to administer their courses or to communicate with their students, technology serves only a functional purpose. Technology in these contexts allows for more efficient completion of tasks. These types of uses of technology are not fully authentic, integrated, transformative uses of technology that promotes student learning. Technology integration does not focus on technology itself, rather, it concentrates on transforming one's practice in light of technologies so that one can come to see what they can do that they could not do before.

Factors Affecting Why Faculty Do Not Integrate Technology in Their Teaching

A variety of factors affect whether or not faculty would integrate technology routinely in their instruction. Table 3 summarizes these factors. Across the cases, lack of technology in schools, and technical problems were the three common factors faculty addressed. In the next section, each of these factors are discussed under affordances and constraints around technology integration in the programs.

Table 3

Factors Affecting Why Faculty Do Not Integrate Technology in Their Teaching

State University	**Northern University**	**Eastern State University**
• Lack of technology access in schools • Technical problems • Feeling pressured	• Lack of technology access in schools • Technical problems • Teaching styles	• Lack of technology access in schools • Technical problems • Faculty's age • Faculty's resentment • Lack of incentives • Faculty technology skills

Administrative support

Consistent with previous research, the study also found that administrative support was important for technology integration across the cases (Bull & Cooper, 1997; Falba, 1997; Thompson, Schmidt, & Hadjiyianni, 1995; Topp, Mortensen, & Grandgenett, 1995; Wetzel, 1993) and had an impact on departmental culture/vision, technology's role in teaching and learning, the disconnection between the teacher education programs and K–12, and lack of incentives. Administration support ranged from acceptance to active involvement at State

University and Eastern State University and from awareness to occasional support at Northern University. At State University and Eastern State University, the administrative support included collaborating with faculty, encouraging them, bringing in funding, providing technology access, and support, and faculty development. Northern University, however, differed from State University and Eastern State University in many ways. Even though faculty reported that department chair supported their efforts to integrate technology, technology did not permeate the environment.

Departmental culture/vision. The examination of departmental culture at each teacher education program offered a fuller understanding of technology integration because it showed what the technology vision was and how this vision was carried out. Even though programs differed in what their vision was and how they made their vision a reality, across the cases, technology was seen as a valued component in each program. Another aspect of this vision also included making technology accessible and visible at all times so it became part of the culture. The laptop requirement at Eastern State University aimed to create ubiquitous access to technology in all aspects of the teacher education program. The presence and abundance of technology at State University and Eastern State University was evident. Hallways and classrooms were filled with students carrying laptops, and access to technology was easy and convenient. These two programs created an environment, which was extremely conducive to technology integration. The program at Northern lacked the environment to model technology integration, which was due to lack of funding. Faculty did not ask students to bring laptops to class, and one rarely saw students carrying a laptop.

Across the cases, the vision for technology showed that technology integration was important, supported, and needed to be infused into all aspects of teacher preparation in the best possible ways so it became part of students' teaching and learning. In order to create a vision, the administration's collaborative approach at State University emerged from the members of the program such as the department chair, the director of the technology center, faculty in the Instructional Technology program, the teaching assistants of the technology courses, and the students. However, faculty across the cases could not build a joint goal and understanding of what technology integration was without a clear vision. There were pockets of technology use and integration in methods courses, but the extent and level of technology integration in those classes varied at the individual level based on faculty's technology proficiency, knowledge, and belief in the role of technology in teaching and learning within and across the programs. The programs lacked a clear, articulated definition and examples of what technology integration was, how it should look, and what should occur in faculty course(s).

In relation to the departmental culture and vision, the study found that faculty attitudes were proved to be a decisive factor. The majority of the faculty across the cases agreed that they were not pressured to integrate technology in their instruction. They were expected to come to it on their own, if they were willing. Yet, a few faculty were concerned about power issues. For example, State University faculty stated that departmental leadership pushed them towards distance learning and new technologies when they were available. At Eastern State University, a few faculty did not like the way the leadership established the digital portfolio requirement without their input. The findings showed administrators needed to involve faculty in the implementation process to create a vision for technology integration in order to avoid resistance and resentment from faculty. Because each faculty member had been affected either positively or negatively by the departmental culture in which they were part of, they varied in their attitudes toward technology and the extent and the level they chose to integrate technology in their instruction.

The findings showed that a few faculty at Eastern State University and Northern University saw technology as an obstacle between their students and themselves, and they were not eager to change their teaching styles because they were comfortable with the way they had been teaching. One theme gleaned only from the four faculty at State University was the need for faculty and students to be somewhat critical consumers of technology. These faculty taught mathematics and science methods courses and viewed technology as an obstacle that got in the way of their students' thinking. The notion underlying these findings was that faculty input was essential to prevent resistance and resentment and to develop a vision. The findings suggested that the technology vision needed to mesh with the teaching styles and pedagogy of the faculty. Teaching style is important because it consists of many components such as ". . . what each educator holds: beliefs, values, attitudes, working philosophy, skills, and personality" (Heimlich & Norland, 2002, p. 19).

Views of technology's role in teaching and learning. Another finding was the administrators' view on technology and its role in teaching and learning. At each teacher education program, the administrators/leaders had backgrounds in instructional technology, were interested in technology and teacher education programs, and had a history of technology integration in their instruction. These key technology players included the former and current department heads at State University, the associate dean at Eastern State University, the department head at Northern University and faculty in the instructional technology department in the programs. These key players took a more active role in the development and implementation of the department's technology vision. They were aware of the range of faculty technology needs and what needed to be done.

Having deans, department heads, and faculty who valued technology integration in teaching and learning was crucial in making technology part of teacher education culture. This kind of commitment from the administration definitely set an optimistic tone to encourage faculty to integrate technology in their teaching. For example, the last three State University department heads valued the role of technology integration in teaching and learning, and their vision remained in the program. Faculty in the instructional technology program set examples for other faculty who were interested in integrating technology. They worked closely with other faculty in different content areas to promote and provide assistance in technology integration. At Eastern State University, the expectation to integrate technology was embedded into the culture of not only the teacher education program but also the university as a whole.

The teacher education program at Northern University, however, portrayed a different picture. Even though faculty often mentioned the importance of technology's role in teaching and learning, the department lacked a strong vision for technology. And while faculty in the instructional technology program set examples as leaders or users of technology, it was difficult to integrate technology in the program.

Disconnection between teacher education programs and K−12. The study found that teacher education programs and K−12 schools needed to work closely so that students could understand how technology could be integrated and to prevent the discrepancy and avoid the disconnect. Faculty across all cases were quite sensitive to issues of equal access in schools because the amount of technology access in field placements varied and was lacking most of the time. As a result, several faculty did not want to integrate technology in their teaching and did not see the point in spending time on technology when most of the students were not going to benefit from it. Students also felt discouraged knowing that they would go out to schools where technology was unavailable. Accordingly, they did not see a reason to think about technology integration.

The unavailability of technology in schools caused two challenges. The first challenge was that students were unable to transfer the skills they learned in their teacher education program into their field placements. The second challenge occurred when students did not experience their cooperating teachers model technology integration. Each teacher education program came up with different ways to overcome the lack of access problem. For example, the technology instructors at Northern University had students work with free online tools as much as possible. As a result, when students started teaching in schools, these free online tools could enable them to integrate technology in their teaching. The laptop initiative at Eastern State University provided students with ubiquitous access to computing. Students were able to take their laptops to the field placements so that they could use/integrate technology. At State University, students could check out laptops, digital cameras, and other technologies that could be used in field placement classrooms. Even though some students checked out equipment to use in their field placements, due to lack of systematic technology integration in methods courses, students were not familiar with how to integrate technology in their instruction.

Lack of incentives. Several incentives were offered to faculty for technology integration. These included administrative support, funding (including grants), technology support, technology access, and faculty development. Findings across the cases showed that even though the integration of technology into instruction was encouraged, it was not linked to tenure or promotion activity in any of the programs. At State University, when faculty had their annual evaluation, the department chair accessed their class WebCT to see what kinds of technologies were integrated and how they were being used. Having this kind of commitment from the department chair definitely encouraged some faculty to integrate technology into their teaching. Even though methods faculty at Eastern University started to realize the importance of technology integration, they argued that any kind of incentive would help them think more seriously about using technology in their teaching. At Northern University, most methods faculty reported that making technology part of the tenure and promotion process would encourage them to integrate technology.

Funding

The case study sites varied in the level of funding available for technology. Across the cases, the source of funding for technology came from a student computing fee. The funds from these fees could only be used for technology that was directly in the hands of students. In addition, faculty involved in grants or proposals related to technology also contributed to the technology funding. These grants/proposals allowed faculty to come up with different ways to integrate technology and understand what worked and did not work. For example, several faculty at State University and Eastern State University wrote numerous grants and proposals to obtain money to buy equipment to use in their teaching. Access to technology became available because faculty brought in their own funding to make it happen. The participants at State University and Eastern State University shared the common belief that if they needed any kind of technology, funding was always available. However, the teacher education program at Northern University was different. Even though the program received funding from a mandatory student activity fee, lack of funding for technology had been an ongoing issue. The program did not foster a supportive environment for grant opportunities. Yet, a few faculty participants had written proposals to acquire the technologies they needed in their teaching.

The findings suggested the need to focus on where and how to spend money was important. The teacher education program at Northern University invested extensive funding on equipping classrooms with multimedia stations; however, the maintenance of these stations consumed the budget. Only buying hardware and software without any follow-through resulted in inappropriate spending of funding.

Technical support

Each teacher education program offered on-site technical support. The findings showed a positive consensus among interviewed participants on the overall quality of the technical support. Because faculty had different needs and skills with technology, they portrayed different insights on the issues related to technology support.

Across the cases, faculty reported some limitations in terms of technical support. One limitation at State University and Northern University was the technical support personnel. For example, at State University, student consultants at the Center provided support after regular work hours. Even though the majority of the faculty reported that they received the same quality support from them, a few still argued that the quality was not the same compared to the help they received from the full-time staff. Yet, hiring student consultants provided many benefits to the students. In most cases, the students obtained good experience working with the various technical issues faculty encountered and experienced how technology was integrated in instruction. At the same time, the technology coordinator faced the challenge of creating a stable center because consultants graduated and new ones needed to be staffed and trained annually.

Faculty at Northern University commented on the quality of the service they received.

Factors such as "who happens to be there," "what kinds of problems one has," and "the time one teaches" determined the quality of technical support received. For example, a few faculty decided not to use WebCT, because the technical support personnel were unable to fix the problems they encountered. Faculty at this program said that if they taught evening classes, they tended not to integrate technology because the support was not available.

At Eastern State University, even though the technical support personnel were delegated for different purposes, some faculty still went to iCare Help to get the help they needed, even though the center was supposed to provide support only to students. By doing so, faculty were taking resources from students and the priorities were given to the faculty's needs.

Another limitation was the lack of technical support while teaching. Several faculty participants at Northern University and State University struggled with a lack of a help-line or just-in-time technology support especially when they taught. At Eastern State University, although some faculty participants struggled with getting the help they needed during their teaching, one faculty shared how she could pick up a phone in every classroom and call to get help. Faculty did not know where and from whom to seek help and the kinds of available support, which resulted in lack of technology use/integration.

Faculty at State University and Eastern State University viewed technical problems as too time-consuming to deal with during teaching because they did not want to waste any class time. Findings showed that some faculty abandoned their efforts to integrate technology because they did not get the help they needed in a timely manner. Faculty reported that encountering and dealing with technical issues took time away from their teaching and was viewed as a serious barrier for them to be willing to engage with technology. Because some faculty did not have the knowledge, experience, or troubleshooting skills, they sometimes tried to fix the problem on their own, get help, move to the next activity in their teaching agenda, or ask their students for help and abandon their plans to integrate technology. Most of the time they changed their teaching agenda, and some used these incidents as teachable moments to communicate to their students that they always needed to have a back-up plan. However, when faculty relied heavily upon their students for technical problems during teaching, some students felt discouraged as they watched faculty fumble with the technologies.

Technical problems. Faculty across the cases offered examples of various hardware-and software-related technical problems. The problems included multimedia stations, WebCT, wireless access, network, and email. Multimedia station-related problems included videos, audio, disconnect between the projector and the computer, or different configurations of the stations in classrooms. WebCT related problems consisted of graphical organization, access, and set up. The course management system was inflexible and difficult to use. Wireless access, network, and email related problems centered around inconsistent connectivity issues. Incidents such as a server being down or email being not accessible frustrated both faculty and students and resulted a decline in confidence in and motivation for technology integration.

This study found that having simpler and cheaper systems might be beneficial in the long run due to low cost and easy maintenance. Buying expensive hardware and not having a long-term plan for maintenance proved to be an important factor that had harmed funding at Northern University. The classrooms equipped with multimedia stations also caused two problems. First, the maintenance of these stations consumed the budget. Second, faculty used these multimedia classrooms as presentation stations, which promoted a teacher-centered teaching style. Findings showed that technical glitches occurred because of bad design. For example, faculty at State University and Northern University reported that WebCT was difficult to figure out and to set up courses. Three faculty at State University designed their own webpage to post their course materials. The findings revealed that different configurations of the multimedia stations needed to be replaced with simple, consistent ones.

Technology access

The case study sites varied in the level of resources available. Participants at State University and Eastern State University found themselves in a technology-rich environment and were able to receive whatever technology they needed in their teaching. However, the findings showed that technology resources available to faculty did not directly affect the extent to which technology was integrated into instruction.

The teacher education program at Northern University presented a different story. The majority of the participants indicated that technology was available, but at times they encountered lack of adequate, up-to-date technology depending on their program. The findings revealed that the teacher education programs needed more appropriate access to technology so that technology integration became part of instruction.

Faculty development

Faculty development consisted of workshops at Northern University and Eastern State University and a mentoring program at State University. At Eastern State University, faculty were encouraged to come together to share experiences and exchange ideas to improve technology integration in their teaching.

The one-shot workshops at both campus and college levels aimed to strengthen faculty development at Northern University and Eastern State University. These workshops introduced faculty to new technologies, helped them with their technology skills, and encouraged technology integration in their teaching. However, faculty members reported various limitations of the current faculty development. They found these workshops disorganized, inefficiently structured, not user-friendly, not geared towards their needs or curriculum, and no follow-up was provided.

Despite the faculty development opportunities, many faculty did not know how to integrate technology to enhance their instruction. Faculty's technology skills and comfort zones with technology affected their decisions about technology integration. A few faculty reported lack of confidence in the their ability to integrate technology; as a result, they did not feel comfortable preparing technology-rich lessons. Although age seemed to play a factor in faculty's technology skills, there were two different perspectives on it. On one hand, the average age of the faculty at Northern University was in the 50s; as a result, most faculty argued that because they did not grow up with technology, they found it difficult to advance their technology skills. On the other hand, the common consensus at Eastern State University was that the technology integration and what kinds of technologies were used depended on the faculty instead of their age. While there were older faculty who still printed their emails, handwrote a response and gave it back to their graduate students to type up, there were also relatively new professors who did not embrace technology and some older faculty who were active technology users in their teaching.

In order to find a solution to replace the ineffective faculty development, State University created a mentoring program to help faculty build their technology skills and encourage technology integration. This collaborative program allowed faculty to work one-on-one on projects with mentors, who were graduate students in the program. It provided faculty with an individual focus because they were able to work at their own pace and on their own learning curve (Chuang & Schmidt, 2007). As a result, the teacher program aimed to increase faculty technology integration by focusing directly on the specific needs of the faculty so that the training was relevant and directly linked to their curriculum (Burns & Dimock, 2007). Faculty who participated in the program reported that their confidence and skills in using a variety of technologies improved. The program also created opportunities for graduate students such as obtaining research assistantships or working on publications with their mentees. In addition, working with graduate students helped faculty to keep up with technology.

One of the shortcomings of the mentoring program was that it was not available to adjunct faculty. Since adjunct faculty in the department taught methods courses, this created a problem. Because adjunct faculty did not receive the support they needed, they chose not to integrate technology in their teaching. The findings showed that if the goal was to impact teaching and learning, then on-going professional development needed to be available to all members of the teacher education program.

Faculty at Northern University and Eastern State University reported lack of time as a reason not to attend the faculty development. The findings showed that these faculty did not prioritize technology integration in their teaching and preferred to focus more on their disciplines instead of on the technology. These faculty did not view technology integration as the highest needs for their students and had different agendas. Technology integration in their teaching meant that they needed to change the way they taught, rethought their curricular objectives because of the technology and the new learning environments technology creates.

The underlying theme of findings was that faculty development that failed to address faculty's specific needs will not be effective. The need for differentiated programs to respond to faculty's needs and skills was evident. A mentoring program would be one way to provide faculty development; however, it needs to be available to every faculty.

Chapter 6

Conclusion and Recommendations

This chapter highlights conclusions, implications, and future research. Technology integration has been widely discussed in the past several decades as teacher education programs have been trying to find effective ways to integrate technology in teaching and learning. By focusing on three education programs, this study examined (a) the contemporary realities of technology and teacher education programs in the three programs; (b) the affordances and constraints around technology integration in teacher education programs in the three programs; and (c) the working infrastructure created in teacher education programs as potential affordances for technology integration. I first present a summary. Following the summary is a discussion of future research on technology and teacher education programs.

Summary of the Study

The contemporary realities of technology and teacher education programs. The purpose of this study was to understand the contemporary realities of technology and teacher education programs to understand what was actually taking place. By providing a critical look, the study examined the gap between what people were saying they were doing and what they were actually doing with technology integration. As Katic (2008) stated, "Preparing. . . . preservice teachers to use technology in ways that transform learning practices is no easy task and one that falls on the shoulders of current teacher educators everywhere, regardless of content area discipline and technological proficiency" (p. 157). The study found that technology integration in the programs was an evolving process, and the programs continuously sought better ways to implement a systematic approach to technology integration. Yet, the programs still struggled to build the necessary infrastructure. The leading obstacle to technology integration in the three education programs was the lack of technology integration into the programs as a whole, particularly in the methods courses and in field placements.

Attempts to create a systematic, consistent technology integration occurred at two levels. At the preliminary level, technology training was introduced through a single-course or a digital portfolio requirement and laptop initiative. These attempts were important and served as first steps to introduce technology integration. Because the technology courses at State University and Northern University were disconnected from methods courses (Mims et al., 2006; Moursund & Bielefeldt, 1999), the knowledge and skills students gained at the preliminary level eventually phased out (Bielefeldt, 2001). Students were not provided with opportunities to design and observe authentic technology integration in their methods courses and field placements. Despite the ubiquitous access to technology at Eastern State University, students did not observe a systematic, consistent integration in their methods courses.

At the secondary level, technology integration occurred sporadically in methods courses, depending on the individual faculty. The extent and level of technology integration varied at the individual level within and across the programs and courses. The current study and the literature indicated the importance of modeling of technology integration in methods courses. If the statement most teachers teach the way they learn (Becker, 2000; Bull & Cooper, 1997; Cuban, 1986; Dunn & Dunn, 1979; Handler, 1993; Niederhauser & Stoddart, 2001; Norum, Grabinger, & Duffield, 1999; Schifter, 1997; Scholz, 1995; Stitt-Gohdes, 2001; Yildirim, 2000) is true, the students' integration of technology will be based on the examples set for them by their methods instructors. The study concluded that existing curriculum and pedagogy needed to be redesigned so that technology is integrated into all facets of a teacher education program. Technology integration throughout the programs occurs when it is part of teaching and learning to enhance content area or multidisciplinary settings. It should be done at all levels and at the same time.

In addition, the review of the literature warranted many advantages to modeling technology integration in field placements (Schrum & Dehoney, 1998; Wetzel & McLean, 1997) as they provide “opportunities to practice a variety of technologies in a more realistic context” (Belson & Larking, 2004, p. 22). Field experiences play an important part in the development of students to grow as teachers and develop ideas of what teaching is, how to do it, their teachers’ identity, and perceptions of teaching (Lortie, 1975). Research has shown that observing cooperating teachers effectively integrate technology in field placements is one of the most important factors that helps students to feel prepared to integrate technology in their own teaching (Hernandez-Ramos, 2005; Kay, 2006; Mims et al., 2006). Bullock (2004) suggested that the teacher education programs be more involved in the selection of cooperating teachers and appropriate school environments that provide adequate access and support. However, this was a challenging task at the three programs due to the large number of placements made and the schools where students were placed. Many faculty participants decided not to model technology use/integration in their teaching due to a perceived lack of technology access in schools. The study found that teacher education programs needed to work closely to prevent the gap between their programs and the schools.

Faculty listed a variety of technologies they used on a regular, if not daily, basis. They defined integration narrowly, which may account for why they believed they integrated technology in their teaching. The study found that a clear, sound definition is crucial to develop clear departmental goals and to build a joint goal and understanding of what technology integration meant and what it should look.

The affordances and constraints around technology integration in teacher education programs. The three programs all made substantial investments and efforts to integrate technology into the programs. Several affordances and constraints, ranging from organizational to personal constraints, contributed to the general failure to integrate technology throughout the teacher education programs. Several similarities and differences in terms of affordances and constraints around technology integration occurred in the programs. In some cases affordances in one program proved to be constraints in another, and vice versa. In particular, levels of integration, administrative support, funding, technical support, technology access, and faculty development influenced the technology integration in the teacher education programs.

A series of reports in the1900s focused attention on the technology and teacher education programs. Since then, teacher education programs have been criticized for not preparing students to teach with technology across the curriculum and technology use and integration has frequently been discussed in the never-ending search to prepare students to effectively integrate technology in their instruction. The literature in this area described numerous affordances and constraints around technology use, which was discussed in Chapter 2. Even though research shows a variety of known obstacles to technology integration, teacher preparation programs are still being challenged to prepare students to effectively integrate technology in their instruction.

The process of creating a working infrastructure in teacher education programs as potential affordances for technology integration. Even in programs that made enormous efforts to provide adequate administrative support, funding, technology access and support, and faculty development, challenges still exist. The mere presence of these elements alone did not drive integration throughout the programs. Does this mean that within the teacher education programs it is naïve to expect full integration? Much can be learned from the three cases presented in this study.

Creating an environment that welcomes, encourages, and promotes technology integration through technology access, faculty development, and technical support creates important affordances, but technology integration goes beyond these elements. The important element of creating a working structure is the combination of various support systems: administrative support, effective faculty development, and technical support.

The first support system is the administrative support, which can either promote or hinder the integration of technology in the programs. Research revealed that most innovations do not succeed because leaders do not learn about the culture of the organization (Olmstead & Ceppos, 2007). Understanding the culture of the program can aid in identifying the pieces for successful technology integration and establishing a technology vision with structured and clearer goals to define what technology integration is, provide faculty with examples of integration and ongoing support. Consistent with the research findings, the study also found that lack of clearly stated goals on the need for and ways of implementing technology (Bailey & Card, 2009; Donnelly, 2010;) caused some faculty resistance and resentment in the programs. Lack of collaboration between the administrators and faculty made the implementation of technology a challenging and slow process (Beastall & Walker, 2006; Donnelly, 2010).

Collaboration between the administrators and faculty is important to start the dialogue to create a vision. Research recognized the need for technological change and collaboration must be evident (Evans & Henrichsen, 2008; Olmstead & Ceppos, 2007). If faculty are part of the conversation to achieve important educational goals and are involved in the development of a vision, most faculty might be more open to learn about, experiment with, design, and deliver instruction with technology and would likely have positive attitudes toward technology integration. The vision should be a product of collaboration among all stakeholders of the programs and involve top-down/bottom-up strategies. Technology integration into curriculum requires curricular goals and objectives to be revised and reconsidered. As a result, faculty input becomes essential and critical in order to build a common vision to prevent resistance and resentment. Also, doing so will "ensure that decisions are appropriate and that faculty feel invested in the process" (Aitken & Shedletsky, 2001, p. 41) because faculty are asked to alter their teaching styles.

The second support system is faculty development. While one-shot workshops at both campus and college level were a common way for faculty development at Northern and Eastern State University, the study found that faculty development should be geared towards the needs of the faculty. The three teacher education programs offered faculty development to their faculty so that faculty can learn new skills, improve practice, and keep current with changes in knowledge and technology. Since faculty possessed different backgrounds, broad levels of technology competency and needs, and learning and teaching style, individualized support, like the mentoring program at State University, provided faculty with an individual focus. This program allowed faculty to design the specifics of their own faculty development by identifying what they needed to do to integrate technology, improve the technology skills of faculty, and encourage technology integration (Polselli, 2002; Vannatta, 2000a).

Even though State University's mentoring program seems to be the most optimal for faculty development framework across the cases, one shortcoming of the program was that it was not available to adjunct faculty. In order to create an environment in which technology integration is consistent and achieved at all levels, faculty development should be offered to all the members. Saylor and Kehrhahn (2003) listed four characteristics of successful faculty development: (a) engaging learners in activities that build upon their current knowledge; (b) providing immediate informative feedback; (c) supporting learners in guided practice, independent practice, and experimentation; and (d) encouraging reflective dialogues among learners. The mentoring program at State University met these four characteristics because it responded to faculty's varying levels of computer experience, learning styles, and needs.

The study revealed that faculty needed time to acquire technology skills and develop new teaching strategies for integrating technology into their instruction. Just providing effective faculty development was not sufficient to encourage technology integration. For example, even though the faculty at State University participated in the mentoring program voluntarily, faculty's lack of time affected their decision not to participate in the program. Faculty across the cases reported that they already had huge demands on them--teaching, meetings, advising, committee work, and in some cases supervising. In some cases, some faculty found that asking them to integrate technology in their instruction was more work added to their other responsibilities. This kind of attitude showed that faculty had different agendas and priorities in their teaching, which caused significant problems in terms of a systematic technology integration in methods courses.

Faculty reported that if technology integration factored in hiring, promotion, and tenure decisions, faculty might be more willing to incorporate technology in their teaching. The three teacher education programs offered a variety of incentives to faculty to encourage them to integrate technology in their teaching. These incentives included administrative support, funding, technology support, technology access, and faculty development. Even though these incentives were important, faculty reported that they needed release time, grants, or other incentives

(Maduakolam & Bell, 2003; Maney, 1999) and needed to know that their efforts were recognized. If technology integration is not a required component of teaching and learning, it will not be a priority for some faculty. Faculty need to see technology as a part of the school culture instead of add-on.

Another support system is providing technical support. When it comes to technology integration, it is inevitable that faculty will encounter technical problems. It is possible, however, to alleviate some of the problems that might be encountered. The study showed that if technical problems arose frequently and were not resolved quickly, faculty abandoned their efforts to integrate technology. Technical problems, especially the ones encountered during class time, had an impact both on faculty and students. Providing just-in-time support, especially for technical problems encountered in the midst of teaching, encourages faculty. The findings showed that technical support needed to be consistent, reliable, and delivered in a friendly, timely manner by skillful people.

Understanding faculty's experiences with the use/integration of technology for instruction and learning may benefit administrators when providing technical support. To make technology part of teaching and learning and to support the integration of technology into teacher education programs requires substantial efforts. Making technology part of the school's culture is a shared effort by all the members of a teacher education program.

The three education programs showed that technology integration was a developing process. These programs all sought better ways to implement technology integration throughout their programs. Some programs succeeded in some areas but failed in others. Even though organizational differences among the teacher education programs existed, lessons can be learned from each program. These are award-winning teacher education programs that were supposedly be doing a good job with technology integration in their programs. Even in these programs, there was a gap between the promise and the realities. If it is happening in these programs, how much worse is it at programs where there is not even any commitment? While one must generalize cautiously from the findings of the study, the primary themes could serve as a way to begin a dialogue about the affordances and constraints in each program and understand what can be learned from each program.

Future Research

Many researchers have discussed the importance of faculty modeling of technology integration in methods courses. Identifying and incorporating best practices, examples of technology integration within teacher preparation programs will help "new teachers better understand what technology integration looks like and how to accomplish technology integration using strong research-based pedagogies, they will continue to use it in schools once they start teaching (Schwarz, Meyer, & Sharma, 2007, p. 243). Students can also learn, observe, and participate in new and existing technologies in their teaching. Teacher education programs need to consider how they can sustain a content-area specific technology integration approach to teacher preparation. One solution could be to identify best practices in educational technologies currently used by K−12 teachers will allow students to be valuable and effective upon hire as new teachers and allow faculty to have purposeful and planned modeling of technology integration. This approach could help transform the culture of teacher education in which technology is seen as changing relationships between students and teachers and between learners and knowledge (NCATE, 1997, p. 14).

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Appendix A

General Performance Standards for Elementary Technology Class at State University

As indicated on the course syllabus, the course outcomes are built around the general performance standards. By the completion of the class, the competent student will demonstrate the categorized outcomes described below.

1. Content/subject matter specialization: The candidate demonstrates an understanding of the central concepts, tools of inquiry, and structure of the discipline(s) the candidate teaches, and creates learning experiences that make these aspects of the subject meaningful for students.
2. Student learning: The candidate understands how students learn and develop, and provides learning opportunities that support intellectual, career, social, and personal development
3. Diverse learners: The candidate demonstrates an understanding of how students differ in their approach to learning and creates instructional opportunities that are equitable and are adaptable to diverse learners.
4. Instructional planning: The candidate plans instruction based upon knowledge of subject matter, students, the community curriculum goals, and state curriculum models.
5. Instructional strategies: The candidate demonstrates an understanding and use of a variety of instructional strategies to encourage students' development of critical and creative thinking, problem-solving, and performance skills.
6. Learning environment/classroom management: The candidate uses an understanding of individual and group motivation and behavior; creates a learning environment that

encourages positive social interaction, active engagement in learning, and self-motivation; and maintains effective classroom management.

7. Communication: The candidate uses knowledge of effective verbal, nonverbal, and media communication techniques, and other forms of symbolic representation, to foster active inquiry, collaboration, and support interaction in the classroom.
8. Assessment: The candidate understands and uses formal and informal assessment strategies to evaluate the continuous intellectual, social, and physical development of the student, and effectively uses both formative and summative assessment of students, including student achievement data, to determine appropriate instruction.
9. Foundations, reflective practice and professional development: The candidate continually evaluates the effects of the candidate's choices and actions on students, parents, and other professionals in the learning community; actively seeks out opportunities to grow professionally; and demonstrates an understanding of teachers as consumers of research and as researchers in the classroom.
10. Collaboration, ethics and relationships: The candidate fosters relationships with parents, school colleagues, and organizations in the larger community to support students' learning and development; demonstrates an understanding of educational law and policy, ethics, and the profession of teaching, including the role of boards of education and education agencies; and demonstrates knowledge and dispositions for cooperation with other educators, especially in collaborative/co-teaching as well as in other educational team situations.
11. Technology: The candidate effectively integrates technology into instruction to support student learning.

Appendix B

Assignment Descriptions for Elementary Technology Class at State University

Below are the descriptions of each assignment for the class.

1. Course Portfolio-Projects and Reflections: A reflective portfolio that is a compilation of work completed in the course throughout the semester.
2. Digital Media Project: A digital media project that focuses on using multiple forms of media with PreK-6 students.
3. Technology Lesson Plan: A lesson plan that integrates technology effectively as it relates to instructional objectives and assessments.
4. Lab Projects and Assignment: A collection of assignments that includes using desktop publishing software, digital photos, digital editing software, podcasts and more.
5. In-class Lecture Assignments: A collection of short assignments to complete in lecture.
6. Exams: One exam given around midterm week and a comprehensive final exam. Short, unannounced quizzes are also given during lectures.

Appendix C

General Performance Standards for Secondary Technology Class at State University

As indicated on the course syllabus, the course outcomes are built around the general performance standards. By the completion of the class, the competent students will:

1. Student learning: The practitioner understands how students learn and develop, and provides learning opportunities that support intellectual, career, social and personal development.
2. Diverse learners: The practitioner understands how students differ in their approaches to learning and creates instructional opportunities that are equitable and are adaptable to diverse learners.
3. Instructional planning: The practitioner plans instruction based upon knowledge of subject manner, students, community, curriculum goals, and state curriculum models.
4. Instructional strategies: The practitioner understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem-solving, and performance skills.
5. Learning environments/classroom management: The practitioner uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.
6. Communication: The practitioner uses knowledge of effective verbal, non-verbal, and media communication techniques, and other forms of symbolic representation, to foster active inquiry, collaboration, and support interaction in the classrooms.
7. Assessment: The practitioner understands and uses formal and informal assessment

strategies to evaluate the continuous intellectual, social, and physical development of the learner.

8. Foundations, reflection and professional development: The practitioner continually evaluates the effects of the practitioner’s choices and actions on students, parents, and other professional in the learning community, and actively seeks out opportunities to grow professionally.
9. Collaboration, ethics, and relationships: The practitioner fosters relationships with parents, school colleagues, and organization in the larger community to support students’ learning and development.
10. Computer technology related to instruction: The practitioner uses computer technology to enhance student learning.

Appendix D

Assignment Descriptions for the Secondary Class at State University

Below are the descriptions of each assignment for the class.

1. Trackstar activity: An activity to create a TrackStar to address a standard from pre-service teacher's content area and help students develop information literacy skills.
2. iMovie video: A video of an interview of an educator to find out their beliefs about how effectively schools are preparing students for life in the 21st century.
3. Mini-lesson: An implementation of a modified version of a technology integrated lesson plan.
4. My favorite class blog: A description and reflection of a particular activity or class that stands out from pre-service teacher's K-12 learning experience, reading five other pre-service teachers' blog, and writing up two or three common themes or ideas that are common among the stories that tell something about good teaching.
5. Media image analysis: An analysis of a photograph using media literacy principles.
6. Marco Torres Video analysis: A critique of student-produced videos as educational practice.
7. Podcast activities: A written response to provided questions on different podcasts related to technology and education.
8. Exams: One exam given around midterm week and a comprehensive, multiple-choice final exam during finals week.

Appendix E

List of Resources at State University

1. Digital video camcorders
2. VHS video camcorders
3. Still digital cameras
4. Macintosh laptop computers
5. PC laptop computers
6. Video projectors
7. Audio cassette recorders
8. Digital audio recorders
9. VCR/television on cart
10. Audio cassette recorders with boundary microphones and also transcribing machines may be checked out for 4 days.
11. A mobile cart with a VCR and monitor are available for check out and use in classrooms within the building.
12. A mobile cart containing 20 Macintosh laptop computers allows students and faculty to take the advantages of wireless communication into their methods classrooms.
13. Mobile kits (IN-TOW) allow students to transport technology into classrooms, both on and off campus. One or more of these kits may be checked out for presentations and student use. A perfect solution for student teachers who want to use technology with their students. These kits include: (a) Three kits each containing five Macintosh laptops; (b) One kit of 5 digital video cameras; (c) One kit of 5 still digital cameras; (d) A presentation kit with a video projector and laptop computer; (e) A kit

containing science probes--Virtual reality equipment; (f) A collection of robotic kits for Toying with Technology projects

Appendix F

State Learning Standards for the Technology Courses at Northern University

As indicated on the course syllabus, the course outcomes for the course are built around the State Learning Standards. By the completion of this class, the competent student will do the following:

1. explore various ways of thinking about media and the messages they convey
2. demonstrate how to use a variety of multimedia tools to enrich learning opportunities
3. identify guiding principles to promote students' safe and ethical use of the Internet
4. apply copyright law, fair use guidelines, and creative commons regulations to the ethical development of electronic multimedia to support learning
5. use the ASSURE model to plan the integration of technology into a unit of instruction
6. write behavioral learning objectives to support instructional goals
7. identify appropriate teaching methods and electronic media to support objective-based lessons
8. design learning experiences that engage students in individual and collaborative learning activities
9. create electronic multimedia to support specific learning objectives
10. apply principles of visual design to the development of electronic multimedia to support learning
11. use graphic organizers to represent topics or concepts in a static or interactive format
12. develop an online collaborative inquiry-based learning activity to support a thematic unit of instruction

13. develop an assessment strategy to evaluate student work within a collaborative inquiry-based learning activity
14. design and develop a digital video to support an objective-based lesson
15. create a web-based resource center to support an objective-based lesson
16. reflectively evaluate how projects align with INTASC+1 standards
17. collaborate with a peer to create an effective multimedia presentation
18. organize and present educational media projects in a portfolio format

Appendix G

Assignment Descriptions for the Technology Classes at Northern University

Below are the assignment descriptions for both levels.

1. Quizzes: Five quizzes through an online system covering assigned readings, watchings, listenings, and doings.
2. Thematic Unit Description: A 3-4 class session on a hypothetical unit
3. Inspiration Diagram: An integration of the software program into teaching of the planned thematic unit by identifying one of the stated objectives from the thematic unit.
4. WebQuest Organizer: An evaluation of three WebQuests websites.
5. WebQuest: A five-page website describing the WebQuest activity.
6. Spreadsheets: A spreadsheet that tracks student performance by constructing a spreadsheet for calculating student grades.
7. Video Project Storyboard: An organization of video project by researching and planning the project and by gathering and planning assets such as video clips, still images, sound effects, music, etc.
8. Video Project: A creation of 1-3 min long video to support learning within the thematic unit.
9. Extra Credit: An essay or a blog.
10. Digital Portfolio: A collection, integration, and reflection of projects developed on a digital portfolio.
11. PowerPoint: A presentation to show use of technology within the thematic unit.

12. Presentation: A report on how technology has been designed to support the thematic unit and to compare their choices to those of a classmate.

Appendix H

List of Resources at Northern University

The Center maintains an inventory of equipment that university student and faculty can check out. The numbers in parenthesis show how many are available.

1. MacBook - laptop computer (4)
2. Dell Latitude D610- laptop computer (2)
3. Dell Latitude D620- laptop computer (2)
4. Mitsubishi LCD projector (1)
5. NEC VT700 LCD projector (2)
6. Dell Multimedia Cart (2)
7. Flip Ultra Camcorder (5)
8. Canon PowerShot A75 - Digital Camera (3)
9. Canon PowerShot A580 - Digital Camera (3)
10. Canon ZR 850 Digital Camcorder (3)
11. USB Flash Drive for Win/Mac (8)
12. FireWire External Hard drive (2)
13. Audiocassette Recorder (5)
14. Digital Cassette Recorder (2)
15. Polycom Conferencing Unit (1)
16. TV-VCR Unit (2)
17. Public Address System (1)
18. Standing metal easel (2)
19. Canon Tripod (photo and video) (3)

Appendix I

List of Resources at Eastern State University

The Center maintains an inventory of equipment that faculty and pre-service teachers can check out.

1. Digital Video Cameras
2. iBook and charger
3. Macbook, adapters, and charger
4. MacBook Pro, adapters, and charger
5. FireWire for Video Camera
6. Firewire 4 to 6 adapter
7. Projectors
8. Mac keyboard
9. Smart Boards
10. Speakers
11. Tripod