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Judy A. Meyers

December, 2012

PRESERVICE TEACHERS' DEVELOPMENT OF A
VISION FOR TECHNOLOGY INTEGRATION

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

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Abstract

The purpose of this study was to understand how preservice teachers perceive their own vision development of technology integration in the classroom. The study employed qualitative methodology, both descriptive and interpretive (Merriam, 1998). The study was designed as a qualitative case study, examining four 4th-8th grade level preservice teachers for a single semester during their participation in student teaching. Each preservice teacher examined in the study was treated as a single case study, with a cross-comparison of the case studies for the purpose of identifying emerging common themes. Initial sampling was a convenience sample in that the general pool of participants were twenty-three 4-8th grade preservice teachers who were enrolled in student teaching at a major research university, located in a large, southern, metropolitan area. Categories and themes within each case study were analyzed. A cross-comparison of individual case studies was used to identify common themes among the participants in their experiences in student teaching as it involved technology integration.

Findings from the study show that two participants had a vision of teaching with integrated technology that provided a sound foundation on which to continue building the vision, whereas the other two participants had a vision of teaching with integrated technology that was based on misconceptions about technology integration and a narrow view of technology integration. Implications are that care needs to be taken to peel back

preservice teachers' layers of perception and understanding of what it means to integrate technology in the classroom. Otherwise, preservice teachers may mimic what they are taught and repeat what they think their professors want to hear (Davis et al., 2010), hiding deep-seated beliefs and misconceptions that can derail successful technology integration in their future teaching. Other findings from the study are in agreement with current literature in regard to preservice teachers' development of technological-pedagogical-content knowledge (TPACK).

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Chapter 1: Introduction

Societal and governmental pressure to improve the quality of K-12 education has been a running theme for the last two decades (U. S. Department of Education [U. S. DOE], 2002; Lambert, Gong, & Cuper, 2008; North Central Regional Educational Laboratory [NCREL], 2003; Vockley, 2008). A major focus in educational reform has been the acquisition and utilization of digital technology in the schools (Gewertz, 2007; Plomp, Anderson, Law, & Quale, 2003, 2009; Texas Education Agency [TEA], 2002b; U. S. DOE, 2003; U. S. DOE, 2004). Educational and societal leaders with a vision of technology use to facilitate the roles of teachers and to help students develop curriculum-based skills and concepts have pushed for the purchase of hardware and software to be placed in schools. Those with a competitive eye to global economy have stressed the importance of educating today's students in learning to use digital technology (U. S. DOE, 2004). However, even with the purchase of technology and subsequent training of practicing teachers to use it, slow progress has been made in technology integration in the classroom (Cifuentes, Maxwell, & Bulu, 2011; Gao, Choy, Wang, & Wu, 2009; Lim & Chai, 2008; Project Tomorrow, 2008, 2010; Selwyn, 2008; U. S. DOE, 2010; Wachira & Keengwe, 2011). Technology integration can be thought of as the availability, understanding, and appropriate use of technology tools to effortlessly and seamlessly support specific educational tasks in addressing learning goals and objectives (Mize & Gibbons, 2000; Staples, Pugach, & Himes, 2005). Jonassen, Peck, and Wilson (1999) state that, "Meaningful learning will result when technologies engage learners in:

knowledge construction, not reproduction; conversation, not reception; articulation, not repetition; collaboration, not competition; reflection, not prescription” (p.16). Therefore, the meaningful use of technology in learning can be thought of as a student constructing his or her own understanding and development of content knowledge and skills through the use of technology.

The lack of progress in the use of instructional technology can be attributed to several factors, including the practicing teacher’s lack of self-efficacy in using technology tools, lack of understanding of the uses and limitations of specific technology tools in teaching content while addressing pedagogical considerations (Cifuentes et al., 2011; Nelson, Christopher, & Mims, 2009; Scherer, 2011), the inconvenient placement of technology tools in school labs as opposed to the classroom (Convery, 2009; Wachira & Keengwe, 2011), and school policies that interfere with innovative uses of mobile devices and Internet access (Project Tomorrow, 2010).

Basically, teachers have been asked to embrace a new set of teaching tools involving a steep learning curve and necessitating a revamping of classroom management skills, teaching style, and forms of assessment. Despite the fact that more teachers than ever before have received professional training related to digital technology use (Darling-Hammond, Chung Wei, Andree, Richardson, & Orphanos, 2009; Partnership for 21st Century Skills, 2009), and despite the steady increase of school access to computers and digital technology during the last twenty years (National Center for Education Statistics [NCES], 2010a, 2010b), the majority of teachers are not well-prepared to use digital technology in their teaching (U. S. DOE, 2010). For teachers already over-burdened with

responsibilities, including the ongoing pressure to raise student performance on standardized tests, the expectations may seem overwhelming. Although Project Tomorrow (2010) found that a number of teachers are using digital media tools, digital resources, and computer/online games, they are hindered in using technology with students because they often lack access to mobile computers or devices for individual student use, and they lack consistent, reliable Internet access in the classroom. In addition, there are still many teachers who use digital technology sparingly and for low-level purposes, such as presenting lecture notes on PowerPoint slides, having email correspondence among school personnel and with parents, and submitting grades and attendance electronically. Their requirement of student use tends to center on applications for drill activities, conducting basic Internet searches for reports, and completing word-processing tasks (Gao et al., 2009; Wachira & Keengwe, 2011).

A number of difficulties exist in encouraging veteran teachers to integrate technology, and so attention has increasingly turned towards the training of preservice teachers (Angeli, 2005; Lambert & Cuper, 2008). A concern, though, is that preservice teachers' own educational experiences often took place in a teacher-centered learning environment where teachers tend to disseminate knowledge through print-based materials and discussion (Bai & Ertmer, 2008). In contrast, a student-centered learning environment, which involves the use of higher order thinking skills and interactive learning, is considered to be the most powerful learning environment for facilitating student understanding and knowledge of core subject matter (Cifuentes et al., 2011; Denton, 2012; Doering, Hughes, & Huffman, 2003; Partnership for 21st Century

Learning, 2009). A few states such as Oregon, Kentucky, and New York are just beginning to provide access to tools for their teachers that facilitate such a learning environment, online tools like Google Docs which allow students to peer review or to simultaneously contribute to discussions or to collaborate (Clayburn, 2010; Dessoiff, 2010).

Because we live in a media-driven society that greatly depends upon and utilizes technology, students must develop a wide range of skills, including: media literacy; information literacy; and information, communication, and technology (ICT) literacy (Partnership for 21st Century Skills, 2009). These literacies, in turn, help to facilitate student engagement through activities that involve critical thinking, problem-solving, collaboration, and communication. These kinds of activities can be facilitated within the classroom with technology tools such as personal mobile devices which can allow access to cloud computing, involving the use of applications and services that allow data sharing and simultaneous publishing (Denton, 2012). Students learn best when they are actively engaged in the learning process; therefore, the integration of technology is an important component in helping students develop the skills and knowledge needed for the 21st century (International Society for Technology in Education [ISTE], 2008; Partnership for 21st Century Learning, 2009).

In an effort to prepare preservice teachers to integrate technology, teacher education programs typically require a rather rigorous introductory educational technology course that combines pedagogical concepts, knowledge of curriculum

content, and the development of instructional technology skills (Lambert & Gong, 2010; Pope, Hare, & Howard, 2005). Some teacher education programs include technology-fused methodology courses (Pope, Hare, & Howard, 2002), opportunities to observe classroom teachers, and hands-on experiences that require a technology component (Browne, 2009; Lambert & Gong, 2010). Certainly, the more technology skills preservice teachers develop and the more technology they are required to use in their learning, the more self-efficacy they develop for using technology (Anderson & Maninger, 2007), and the more uses they are able to imagine in their future teaching (Doering et al., 2003; Pierson & Cozart, 2004). Multiple observations and hands-on experiences also lead to a better developed understanding of technology integration (Bai & Ertmer, 2008; Pope et al., 2002). However, preservice teachers' experiences with instructional technology are still limited, and like experienced teachers, many enter teacher education programs with deep-seated beliefs about what a classroom should look like, what the roles of the teacher and the students should be, what should be taught, and how students should be taught (Bullock, 2004).

First, as indicated in the Project Tomorrow (2008) survey results of both teachers and students, most preservice teachers have experienced little to no technology integration in their own K-12 learning and so they possess a limited vision of what technology integration looks like in a K-12 classroom setting. Second, most college professors, in particular those who teach core content areas, tend to utilize technology for low-level needs, which include such tasks as posting assignment due dates, providing links to online sources, and providing access to assignment submission portals (Maddux

& Johnson, 2006; Pierson & Cozart, 2004; Project Tomorrow, 2008). Any required technology component in student assignments or projects tend to be superficial. As a result, preservice teachers are often not afforded the opportunity to see technology integration modeled in the content courses or by their cooperating teachers during student teaching (Ertmer & Ottenbreit-Leftwich, 2010; Graham, Tripp, & Wentworth, 2009; Pierson & Cozart, 2004).

Added to the lack of effective technology integration in their required courses, preservice teachers frequently notice a disconnect between the expectations laid out to them in their basic technology and methodology courses and what they later experience during their classroom observations (Pierson & Cozart, 2004). Preservice teachers are often placed with cooperating teachers who use little technology in their own teaching (Chen, 2010; Graham et al., 2009). This causes preservice teachers to wonder what technology and support will be available to them when they enter the classroom as practicing teachers. This contributes to a lack of a vision of technology integration that would allow them, not only to understand and utilize the tools available to them, but also to imagine what other tools might exist or what tools they might develop (Doering et al., 2003; Finley & Hartman, 2004; Pierson & Cozart, 2004). Because of limited experiences with technology in their own learning, deep-seated beliefs about teaching tend to not include technology (Bai & Ertmer, 2008). Furthermore, preservice teachers face many of the same challenges that practicing teachers now face in utilizing technology in the classroom.

Problem Statement

In order to integrate technology effectively to address the diverse learning needs of students, preservice teachers must be able to imagine how technology can be used to address those needs (Doering et al., 2003; Ertmer, 2005). Part of helping preservice teachers to develop this vision of technology integration can be accomplished through an understanding of how their vision of technology integration began, developed, and/or changed through their participation in their teacher education program (An & Shin, 2011; Bai & Ertmer, 2008; Bullock, 2004; Doering et al., 2003; Schrum, Skeelee, & Grant, 2003; Vannatta & Fordham, 2004). In return, such an understanding may offer teacher education programs needed insight on how to help preservice teachers to develop a vision of technology integration, thereby increasing preservice teachers' intentions to use technology in their future teaching. Therefore, a major challenge in teacher education is to assist preservice teachers in developing a vision of effective technology integration in teaching.

Purpose of the Study

Few studies have been done in tracking changes in preservice teachers' attitudes, beliefs, and practices in using technology as they progress from course work through student teaching (Choy, Wong, & Gao, 2009). However, no studies were found concerning preservice teachers' perception of how their vision of teaching with integrated technology began and developed. This study was designed to understand how preservice teachers perceive their own development of a vision of technology integration in the

classroom. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers to develop a vision of teaching with integrated technology, thereby influencing them to use technology effectively and meaningfully in their future teaching.

Definitions of Terms

According to the Texas STaR Chart by Texas Education Agency (TEA, 2002a), technology is defined as computers, netbooks or mini computers, thin clients, interactive tablets, eBooks, Internet mobile devices, portable media players, and interactive white boards.

Also according to Texas STaR Chart, technology integration is defined by TEA (2002a) as teachers and students having “regular access to digital resources and technology tools that are integrated into the curriculum through various instructional settings.” Pierson (2001) further clarifies the definition of technology integration by stating, “A teacher who effectively integrates technology would be able to draw on extensive content knowledge and pedagogical knowledge, in combination with technical knowledge. The intersection of the three knowledge areas, or technological-pedagogical-content knowledge [TPACK], would define effective technology integration” (p. 427). Pierson’s model of technology integration (see Figure 1) demonstrates that effective technology integration is the intersection of the three knowledge areas: content knowledge, pedagogical knowledge, and technological knowledge.

For the purpose of this study, a preservice teacher's vision of technology integration is his or her understanding of the interaction of technological, pedagogical, and content knowledge, the goals the preservice teacher sets for himself or herself and his or her students, and the ability to imagine how technology might be used to achieve those goals (Pierson, 2001).

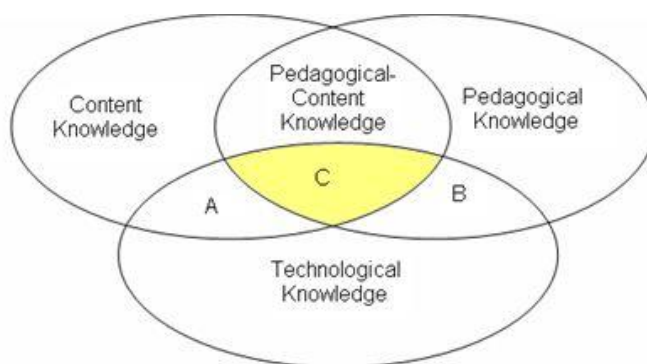


Figure 1. Pierson's model of technology integration. Used with permission.

Research Questions

This study was designed to address the following research questions:

1. What is the preservice teacher's vision of teaching with integrated technology?
2. What factors influence the development of the preservice teacher's vision of teaching with integrated technology?
3. How does the preservice teacher's vision of teaching with integrated technology play out in the classroom during student teaching?
4. How do experiences in student teaching related to technology use influence the preservice teacher's anticipation in using technology as a practicing teacher?

Research Design

This study was designed as a qualitative case study, employing both descriptive and interpretative qualitative methodology. The researcher narrowed the general pool of twenty-three potential participants by emailing to them a questionnaire about experiences and attitudes towards technology use in education prior to and during participation in a teacher education program. Five preservice teachers responded to the questionnaire and were then invited to participate in the interview phase of the study. Four accepted the invitation to be interviewed. Interviews took place during the summer following their semester of student teaching. Participants in the final selection were each asked to provide a lesson plan with a technology component developed by that participant. The case study design was selected because the focus of the study is on an instance of a specific concern or issue, allowing the researcher to develop insight, make discoveries, and to interpret findings, as opposed to testing a hypothesis (Merriam, 1998).

The Importance of a Qualitative Study

Greene (1995) stated that:

To see things or people small, one chooses to see from a detached point of view, to watch behaviours from the perspective of a system, to be concerned with trends and tendencies rather than the intentionality and concreteness of everyday life. To see things or people big, one must resist viewing other human beings as mere objects or chess pieces and view them in their integrity and particularity instead. One must see from the point of view of the participant in the midst of what is happening if one is to be privy to the plans people make, the initiatives they take, the uncertainties they face. When applied to schooling, the vision that sees things big brings us in close contact with details and with particularities that cannot be reduced to statistics or even to the measurable.

The process of learning and learning to teach is complex in that it involves the interaction between and among many people and a wide range of factors over a long period of time. Each preservice teacher is unique in that educational and life experiences vary widely among preservice teachers. They enter teacher education programs at different times in life, and their earlier learning experiences help to formulate visions of teaching and attitudes towards the use of technology in the classroom. Therefore, the development of a vision for teaching with integrated technology in the classroom requires a close examination of a common interest in a complex situation.

The purpose of this study is not to test a hypothesis and to generalize but to examine an instance of a specific concern or issue, allowing the researcher to develop insight, make discoveries, and to interpret findings. Because it is not easy to separate the parts from the whole, a holistic view is needed that allows for diverse view points on a wide range of issues and variables to be discussed (Yin, 2003), some of them not predetermined but emerging from the recursive nature of the qualitative research design (Merriam, 1998). This study was developed as a case study because doing so offers a close examination of one interest in a common though complex situation. Examining and synthesizing diverse viewpoints may lead to gaining a complete picture of an issue, thus contributing to theory building.

The Teacher Education Program

The teacher education program the participants completed was divided into three phases, QUEST 1, QUEST 2, and QUEST 3. Each phase included field experiences for

observing in the classroom and for hands-on teaching experiences, with QUEST 3 being student teaching. Each phase of the program also included a one-semester hour introductory educational technology course designed to address the development of technology knowledge with content and pedagogical considerations for various grade levels within a certification range.

Significance of the Study

One major reason meaningful technology integration has been slow to develop in the classroom is because many experienced teachers have already developed visions of teaching that do not include the use of digital technology (Ertmer & Ottenbreit-Leftwich, 2010). Changing that vision or beliefs about the value of technology to address learning needs is very difficult (Russell, Bebell, O'Dwyer, & O'Connor, 2003). As a result, attention has turned to preparing preservice teachers to use technology in their future teaching (Collier, Weinburgh, & Rivera, 2004; Wright & Wilson, 2005-2006).

Preservice teachers are typically required to take a technology course in teacher education programs, increasing their expertise and confidence level in using technology (Banister & Vannatta, 2006; Swain, 2006). When preservice teachers are afforded opportunities to utilize these technology skills in their methodology courses and through field observations and/or experiences with authentic, learner-centered activities, they are allowed to construct their own understanding of technology integration. Such experiences improve their perceived self-efficacy in using technology, (Chen, 2004) which in turn facilitates the development of a vision for technology integration (Pierson & Cozart,

2004). These kinds of opportunities influence preservice teachers' intentions to use technology in their future teaching (Anderson & Maninger, 2007; Smarkola, 2008).

However, preservice teachers often come away with questions and concerns based on a disconnect between what they learn in their teacher education program and what they experience in their field observations (Chen, 2010; Pierson & Cozart, 2004; Sutton, 2011). They encounter unexpected barriers to using technology during their field experiences. As a result, they wonder what technology will be available in their schools and what kind of support and encouragement they will have in utilizing available technology as practicing teachers.

This study was designed to understand how preservice teachers perceive their own development of a vision of teaching with integrated technology in the classroom. The participants in this study are not considered to be typical types of preservice teachers. One participant is 42 years old and experienced no digital technology in her education prior to entering the teacher education program. Another participant grew up without a television or a computer in her home. Examining the experiences in student teaching of participants with such diverse backgrounds makes the emerging of common themes in integrating technology during student teaching even more significant than if all four participants had common backgrounds because it is an indication of issues student teachers commonly experience in utilizing technology in the classroom. In turn, these experiences can impact a preservice teacher's development of a vision for teaching with integrated technology, thereby influencing their intentions to use technology in their

future teaching. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers to develop a vision of technology integration, thereby influencing them to use technology effectively and meaningfully in their future teaching.

Overview of Chapters

This dissertation consists of five chapters. Chapter One introduces the problem statement and the purpose of the study, provides definitions of terms to be used in the study, introduces the main research questions, and states the significance of the study. Chapter Two presents findings from the literature that is relevant to the study. The literature review consists of the following major topics: expectations for today's teachers; recognized barriers to technology integration; expectations for tomorrow's teachers; the historical perspective of teacher education and technology training; adoption theory; and helping preservice teachers develop a vision of technology integration. Chapter Three restates the purpose of the study and the research questions, discusses the research design, describes the researcher and the participants in the study, and explains the sampling procedures, data collection process, data analysis process, and management of data. Chapter Three also discusses issues of trustworthiness and validity, as well as limitations of the study. Chapter Four restates the purpose of the study. It explains the organization of the chapter and reports the findings of the research. Finally, Chapter Five restates the research questions, discusses the findings of the study and links to the literature review, and provides implications for teacher education programs.

Chapter II: Literature Review

This study was designed to understand how preservice teachers perceive their own development of a vision of teaching with integrated technology in the classroom. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers to develop a vision of technology integration, thereby influencing them to use technology effectively and meaningfully in their future teaching.

Chapter Two presents findings from the literature relevant to the study. The literature review consists of the following major topics: expectations for today's teachers; recognized barriers to technology integration; expectations for tomorrow's teachers; the historical perspective of teacher education and technology training; adoption theory; and helping preservice teachers to develop a vision of technology integration.

Expectations for Today's Teachers

Increasingly, state and national standards have required that teachers use computer technologies to support teaching and learning (TEA, 2002b; U. S. DOE, 2004). The passage and implementation of the IDEA Amendments of 1999 and NCLB in 2002 created a focus on the growing presence of students with special needs in the regular classroom (U. S. DOE, 2000), emphasizing the urgency for teachers to develop a multitude of literacies, including technological literacy. Technology can address the diversified needs of all learners, facilitating a student-centered learning environment (Pasco & Adcock, 2007). Therefore, high-quality teaching equates to teachers possessing

not only knowledge of their content area and pedagogy, but also technological knowledge, using these different kinds of knowledge interactively to support differentiated teaching (Means, Padilla, DeBarger, & Bakia, 2009; Office of Educational Technology [OET], 2004; Patrick, 2008). Mehlinger and Powers (2002) state that “not to know what technology is available to assist children educationally, and not to use it thoughtfully, is evidence of instructional malpractice” (p. 26). Trained teachers make a difference in the success or failure to properly integrate technology into the classroom curriculum (Bird & Rosaen, 2005; Grabe & Grabe, 2004).

In addition to the concern for addressing the diversified learning needs of all learners was the overall concern with the quality of public education resulting in both the societal and governmental cry for public educational reform (U. S. DOE, 2002). Added to that was the increased awareness of the growth and use of digital technology in business and in personal life. Governments realized the need for its people to develop technology skills in order to remain competitive in a global economy (U. S. DOE, 2004). The demand to integrate technology into the classroom became two-fold: improve student learning in core subject areas, and prepare students to use technology in the workplace.

The National Center for Education Statistics (NCES, 2000) conducted a study to determine the extent of technology integration into classroom learning. They reported that in 1999, only about one-third of teachers reported feeling prepared enough to use the computer or the Internet in classroom instruction. The report also stated that only about half the teachers with computers and Internet access in the classroom used them for classroom instruction. In the decade following that report, training, hardware, and

software increasingly became available to teachers and students in the classroom (Project Tomorrow, 2010). While Cuban noted in 2001 that teachers had not embraced technology in their regular teaching practices, in the past decade, teachers have come to use technology daily. Technology investment in schools has helped provide classroom access to the Internet, hardware and software, and various peripherals, such as the interactive whiteboard. Many schools require that teachers use email for communication within the school. They also require teachers to submit grades and attendance electronically; furthermore, teachers are assessed on their use of technology in teaching (Culp, Honey, & Mandinach, 2005). Technology has become ubiquitous in everyday lives, with both teachers and students using email, blogging on social sites, conducting Internet searches, and using peripherals such as smart phones for a variety of tasks. However, true technology integration, that is, drawing on extensive content knowledge and pedagogical knowledge in combination with technical knowledge (Koehler & Mishra, 2005; Pierson, 2001), has taken place slowly and sporadically among practicing teachers (Cifuentes et al., 2011; Ertmer & Ottenbreit-Leftwich, 2010; Project Tomorrow, 2008, 2010; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010). Instructional technology is often shared within and among schools (Convery, 2009; Wachira & Keengwe, 2011), and too many teachers have not yet addressed pedagogical considerations for how to use technology appropriately in their teaching, such as employing tools to teach higher order skills as opposed to simply practicing basic skills (Scherer, 2011).

The NCES (2010) reported the following: 97% of teachers had at least one computer in the classroom daily, 54% could bring computers into the classroom, 93% of

computers located daily in the classroom had Internet access, 96% percent of computers brought into the classroom had Internet access, and the ratio of students to classroom computers was 5.3 to 1. NCES further stated that 40% of teachers reported that they or students used classroom computers often during instructional time and 29% of teachers reported that they or students sometimes used classroom computers during instructional time. Teachers reported that they or students used computers in other school locations during instructional time. They used data projectors (LCD's or DLP's) connected to a computer to project images onto a screen, from the computer available as needed (36%) or in the classroom daily (48%), interactive whiteboards (28% and 23% respectively), and digital cameras (64% and 14% respectively). Teachers reported that student use of educational technology differed between low and high poverty concentration of the school, with students sometimes or often using technology during instructional time for word processing tasks (66% and 56%, respectively), for practice drills (61% and 83%, respectively), and to develop and present multimedia presentations (47% and 36 %, respectively). Statistics also showed that the percentage of teachers responded that the following activities prepared them to some degree to use technology effectively for instructional purposes: 61% for professional development activities, 61% for training provided by school technology support staff, and 78% for independent learning.

As encouraging as some of these statistics are, they do not show a clear picture of how teachers and students are using technology beyond low-level uses such as Internet searches and word-processing. Current studies indicate that the largest use of technology in the classroom is to support the traditional teacher-centered activities of transmitting

knowledge to students as opposed to student-centered activities allowing students to develop a deeper understanding of concepts through critical thinking, communication, creativity, and collaboration (Gao et al., 2009; Lim & Chai, 2008; Partnership for 21st Century Learning, 2007; Project Tomorrow, 2008; Selwyn, 2008; Wachira & Keengwe, 2011), although there is a growing trend to use technology to foster a more student-centered learning environment that supports the development of 21st century skills (Project Tomorrow, 2010). Clearly, encouraging teachers to utilize technology in the classroom involves more than providing hardware, software, access to the Internet, and training to use technology. A number of barriers to successful technology integration exist.

Recognized Barriers to Technology Integration

Three key influences comprising 76% of all factors impacting teacher integration of technology are teachers' technology skills, beliefs in the benefits of using technology, and perceptions of barriers to using technology in the classroom (Brush, Glazewski, & Hew, 2008). Barriers are obstacles one must overcome in order to achieve a goal or an outcome (Bromme, Hesse, & Spada, 2005). Teachers, and preservice teachers entering into student teaching, find integrating technology a challenge because of existing barriers to instructional technology use, both external and internal. Teachers are confronted by external barriers, such as lack of resources, inadequate training to use technology tools that relate directly to the curriculum they teach, lack of technical support, and insufficient time for planning and experimenting (Cifuentes et al, 2011; Nelson et al., 2009; Wachira

& Keengwe, 2011). Internal barriers involve beliefs about what should be taught and how, and limited visions of technology integration (Ertmer, 1999).

External barriers. Recent studies have identified that some external barriers to technology integration involve lack of access to technology tools located within the school and/or on the Internet (Ash, 2008). Other external barriers include unreliability of equipment, lack of technical support, and lack of teachers' and preservice teachers' abilities to fix minor technical problems (Choy et al., 2009). Additional external barriers include lack of planning time, lack of school finances, lack of administrative support, and factors involving the school/district environment (Cifuentes et al, 2011; Ertmer, 2005). Furthermore, school and district policies often present barriers to innovative uses of technology for educational purposes within the classroom (Project Tomorrow, 2010).

Lack of technology availability. Although technology has increasingly become more available in schools, lack of hardware and appropriate software still prove to be major barriers to technology integration (Cifuentes et al, 2011; Hew & Brush, 2007; Kress, 2011). For example, Wachira and Keengwe (2011) found that schools often have access to software applications for math drills but do not have access to dynamic software that would allow for exploratory or investigative learning or for data analysis. This is an important consideration since research by Cradler, McNabb, and Freeman (2002) indicates that technology use has been effective in helping students develop their understanding of mathematics content. Furthermore, although many Web 2.0 applications that allow for creativity and collaboration are free through Internet access, school district

filtering systems and policies often prohibit access to such tools (Ash, 2008; Project Tomorrow, 2010).

Even within a school district, technology access is uneven among schools. One school may have four computer labs while another has one, or elementary schools may have four computers in each classroom, whereas high schools may have only two computers per classroom (Wachira & Keengwe, 2011). Inequality exists within the individual school, as well. Schools that choose to place all instructional computers and interactive whiteboards in labs create competition among teachers for limited access to those labs. This hinders integrating technology into instructional activities in a meaningful way for both teachers and students since technology is not readily available, preventing the fluidity of use needed in true technology integration (Zhao, Pugh, Sheldon, & Byers, 2002). Some teachers use technology and others do not, causing a digital divide within the school. Technology-using teachers are more likely to get technical support in a timely fashion, increasing the existing technology inequality among both teachers and their students. Furthermore, teachers who are interested in using technology increase the likelihood of receiving technology through writing technology grants or by some other means (Cifuentes et al, 2011; Wachira & Keengwe, 2011).

NCES (2010) stated that 97% of classrooms have at least one computer, but that the one computer is most often used for teacher activities like email correspondence, and reporting attendance and grades, as opposed to supporting student learning. Furthermore, Wachira and Keengwe (2011) found in their study that not all teachers had a computer in their classrooms and had to share one or two computers with other teachers in the

workroom. Besides lack of classroom computers, other technology tools, such as calculators, were so sparingly available that teachers did not have enough to go around for an entire class, discouraging teachers from using them.

Another concern is that statistics regarding availability of technology in schools do not always indicate how that technology is being used. For example, Kress (2011) conducted a case study of a New York City High School reading teacher's struggles to integrate technology into her teaching. Statistically, her school was completely wired for Internet access in every classroom, with a 5:1 student to computer ratio. However, in reality, the teacher had to take her students to one of three labs available for class use. The computers were old, in disrepair, and had viruses. The school did, however, spend considerable resources on technology, but the expenditures were for surveillance equipment aimed at monitoring teachers and students. In 2010, Kress conducted a case study of Urbana High School, located in Boston, MA. Her findings were very similar to what she found at New York High School in 2004-2005. Obviously, one cannot go by statistical information alone. To have a clear understanding of technology availability, one must actually see what technology is present in schools, the condition of the technology, and how the technology is being utilized.

Unreliability of technology. Wachira and Keengwe (2011) and Kress (2011) found unreliability of technology within the schools as another significant external barrier to effective technology use within the classroom. For example, lab and classroom computers may not be in working order or may be too old to run newer software, or may lack needed plugins (Choy et al., 2009). Even with new equipment, necessary items such

as printer cords or infrastructure like electrical outlets are sometimes missing. Other problems that exist are slow Internet access or failed access. The concern that the technology component of a lesson may fail discourages many teachers from trying to use technology during a lesson.

Lack of technology support and lack of ability to resolve minor issues.

According to Wachira and Keengwe's findings (2011), the unreliability of technology itself brings to surface another concern, and that is the lack of technology support. Schools sometimes have one technology support person, or a district may have a few technology support personnel to be shared among all the district's schools. Because of this, response to teacher request for help in resolving technical issues is slow. Work orders must be submitted and may take days or weeks to be addressed. Even simple issues like forgotten passwords by teachers who do not access computers regularly require time-consuming technical support. In addition, teachers and student teachers may lack the skills to address minor technical glitches, making them hesitant to use technology in their teaching (Choy et al., 2009).

Lack of technology leadership. Research indicates that technology leadership, especially among school administrators, has a bigger effect on teacher success in integrating technology than do investments in technology and infrastructure (Anderson & Dexter, 2005). Administrators who are involved in decisions concerning information communication technologies (ICTs) tend to improve their own technology skills, increasing their chances to model technology use for their faculty members (Parr & Ward, 2011; Stuart, Mills, & Remus, 2009). Ritchie (1996) suggested several variables

that impacted technology integration into the classroom, with lack of administrative support having the largest negative impact. A recent study conducted by Schrum, Galizio, & Ledesma (2011) noted that in many states, administrators are not required to develop instructional technology skills in order to earn their administrative certificates. However, without school administrative support, technology integration in the classroom will have little success (Cifuentes et al., 2011).

A lack of communication and planning within a district leads to a hodgepodge of available technology tools. In Wachira and Keengwe's study (2011), teachers reported that they were allowed very little input into what technology was needed at their schools, resulting in teachers receiving technology not useful to them and not getting the technology tools needed for their content areas. Many teachers also stated in the report that they were not allowed downloading or installing of software, though it was for educational purposes, and that they were expected to apply for any grants that could be used for attending workshops or conferences or for purchasing technology tools.

Along with lack of communication among school and district administrators on what technology to purchase is also a lack of understanding on what to provide in teacher training for technology use. Studies indicate that technology training can positively affect teachers' attitudes about using technology in their teaching (Cifuentes et al., 2011; Kadel, 2005; Lambert et al., 2008). However, in Wachira and Keengwe's study (2011), a key reason cited for lack of technology integration was the focus on training in the generic use of technology rather than training in content-related ways of using technology to address learning needs. For example, one math coach reported observing students

computing long division during a lesson focused on proportions. These students, who already understood long division, should have been using calculators so that their focus was on computing mean and median, rather than routine computational tasks.

Finally, lack of access to social networking and social software, issues of online safety and privacy for teachers and students, concerns with possible copyright infringements, and lack of professional development centering on information communication technologies add to hindrances in teachers' intentions to use technology in the classroom (Cifuentes et al., 2011; Nelson et al., 2009; Project Tomorrow, 2010).

Lack of time. Teachers tend to resist adopting changes to curriculum or instruction (Ponticell, 2003). Learning to use new tools, as well as developing new classroom management skills and problem-solving skills, takes time (OTA, 1995). Because technology is constantly changing, teachers are even more hesitant about adopting technology into their teaching (Straub, 2009). Classroom teachers are overburdened with accountability issues focusing on curriculum benchmarks and preparing students for high-stake tests (Wachira & Keengwe, 2011), state-level standardized tests that can determine if students move on to the next grade level or graduate from high school. This leaves teachers with little time to explore with technology and to plan how to use it in their lessons. As a result, teachers often look at technology as one more thing they have to do, an add-on to a long list of expectations or demands. The issue of unreliable or inadequate technology simply aggravates the time issue in learning to use technology or determine how to incorporate it into a lesson. Teachers in Wachira and Keengwe's study (2011) reported that, "The unpredictable functionality and the

uncertainty of getting timely technical support make it almost not worth the time to learn and use technology” (p. 21). Teachers also reported concerns with classroom management issues, such as students wasting time with off-task behavior in a computer lab or with items like calculators missing at the end of a class period (Cifuentes et al., 2011).

Internal Barriers

Some barriers to technology integration within the classroom are of a more internal nature, relating to teachers’ beliefs centering on technology in the classroom and teachers’ visions of technology integration (Ertmer, 2005; Koehler & Mishra, 2008; Lambert & Gong, 2010). Teachers’ beliefs about the use of instructional technology involve three components: pedagogical beliefs, self-efficacy beliefs, and beliefs about the perceived value of computer technology to facilitate student-learning (Miller et al., 2003). These three components are found to be the major predictors of whether teachers choose to incorporate technology into their teaching (Russell et al., 2003).

Pedagogical beliefs. Pedagogy is the art of teaching. It involves knowing what to teach and how to teach it, which includes lesson plan development, assessment strategies, and classroom management (Schmidt et al., 2009). The majority of today’s teachers use a teacher-centered approach in the classroom, which relies heavily on teacher dissemination of knowledge through lectures and print-based materials (Gao et al., 2009; Lim & Chai, 2008; Selwyn, 2008). Many teachers who profess to believing that technology has value in the classroom tend to use it for low level learning tasks, such as

teaching remedial skills through drill and practice activities, word-processing, emailing, and conducting basic Internet searches rather than to promote understanding of concepts (Ertmer, 2005; Project Tomorrow, 2010). Teachers, who take a constructivist approach to teaching, making the learning environment student-centered, are likely to use technology more often and in more meaningful ways than teachers who have a teacher-centered learning atmosphere (Judson, 2006; Roehrig, Kruse, & Kern, 2007). The higher level use of technology involves student use for problem-based learning (PBL), creativity, collaboration, and communication. Such activities help develop critical thinking skills, sense of motivation, and social skills through group work (Albion, 1999; Project Tomorrow, 2010; Sage, 2000). The implication is that teachers may need to develop student-centered beliefs to encourage a higher level of technology use in the classroom (Albion & Ertmer, 2002; Kagan, 1992), and that traditional, teacher-centered beliefs have a negative impact on technology integration (Hermans, Tondeur, van Braak, & Valcke, 2008).

Teachers' beliefs can be influenced through self-reflection on pedagogical beliefs, through hands-on experiences such as problem-based learning (Derry, Siegel, Stampen, & the STEP team, 2002; Ertmer, 2005), and through inservice training in technology integration, where faculty members share expertise with their peers (Cifuentes et al., 2011; Georgina & Hosford, 2009; Parr & Ward, 2011).

Self-efficacy beliefs. Self-efficacy is one's personal beliefs in what one is able to learn and to accomplish on a designated level (Bandura, 1997). Studies have shown that a major predictor of whether teachers will utilize technology in the classroom is their self-

efficacy beliefs concerning technology (Albion, 1999; Levin & Wadmany, 2008). Self-efficacy beliefs involve perceived ability to use both hardware and software programs. They also involve the perceived ability to make major changes in teaching style, classroom management skills, lesson-plan development skills, and assessment skills pertaining to technology use. Teachers are sometimes hindered in using technology because of how they view their own ability to use technology as opposed to simply understanding their subject matter and what to do to teach it (Ertmer et al., 2003). For example, Wachira and Keengwe (2011) noted through observations and discussions, that teachers appeared to be very anxious about making mistakes while using technology. They lacked confidence in using technology and in problem-solving errors or glitches while utilizing technology. Choy et al. (2009) noted in their study that student teachers seemed to lack ability to plan for and to prevent potential minor technical problems or glitches in utilizing technology in their teaching. Fear of making mistakes both in experimenting and in damaging the technology equipment adds to fear and anxiety in using technology. The unreliability of the technology tools and the lack of timely technology assistance in resolving problems make teachers even more anxious about using technology, all clear indicators of a lack of self-efficacy.

Beliefs about the perceived value of computer technology. A teacher's belief about the value of technology in education is another major indication of whether or not that teacher plans to use technology in the classroom (Ertmer, 2005). Changing from traditional teaching practices, where the teacher is at the center, to a student-centered learning environment takes time, effort, and training, as does learning to use technology

tools. Willingness to make those kinds of changes is dependent on the value teachers place on computer technology to facilitate their roles as teachers and to assist their students in their learning endeavors. Teachers who have positive attitudes and perceptions towards computers are more likely to increase and use their technology skills in instruction than teachers who do not possess a positive view of computers in education (Wang, 2002; Zhao & Frank, 2003).

Lack of knowledge. Teacher knowledge is also a major factor influencing whether teachers integrate technology into their teaching (Hughes, 2005). Shulman (1986) identified three kinds of teacher knowledge, which included: knowledge of the subject matter to be taught, content knowledge (CK); knowledge of teaching methodology and classroom management strategies, pedagogical knowledge (PK); and knowledge on how to teach specific content to specific learners in specific learning situations or environments, pedagogical content knowledge (PCK). Shulman (1987) later added four more categories of teacher knowledge: knowledge of materials used for teaching, including visuals and media, curricular knowledge; knowledge of learner characteristics, learner knowledge; knowledge of educational contexts, or where learning takes place, context knowledge; and knowledge of educational goals and beliefs. Although media is mentioned in curricular knowledge, little emphasis is placed on information communications technology (Fajet, Bello, Leftwich, Mesler, & Shaver, 2005). As a result, teachers may assume they are doing a good job of teaching even if their students never use technology, especially when the school environment in which they teach has not adopted a definition of good teaching that includes the effective use of

technology (Ertmer & Ottenbreit-Leftwich, 2010). However, to not use technology in teaching today is no longer acceptable. According to the U. S. DOE (2003) “Technology is now considered by most educators and parents to be an integral part of providing a high-quality education” (p. 3). The definition of good teaching needs to be revised to include the effective use of technology tools to address student learning needs (Ertmer & Ottenbreit-Leftwich, 2010).

To integrate technology, teachers must add another knowledge category, technological knowledge, to interact with the ones identified by Shulman (1986, 1987). Technology integration is the interaction of technological knowledge, pedagogical knowledge, and content knowledge (TPCK, TPACK, AACTE, 2008; Pierson, 2001). Teachers most often know the content they are to teach, but interfering with effective technology integration is their lack of knowledge in using technology, knowing what technology is available in the schools, and their lack of pedagogical knowledge in using technology effectively to teach content (Wachira & Keengwe, 2011). In effect, teachers need to understand what specific technology tools to use to address the specific content being taught, and how to use those tools to help students understand difficult concepts more easily, resulting in meaningful learner outcomes (Angeli & Valanies, 2009). Adding to this, as teachers involve their students in the development of higher order thinking skills, teachers become more involved in interdisciplinary teaching, which requires that they increase their content knowledge base as well (Ertmer & Ottenbreit-Leftwich, 2010).

Teachers with strong TPACK facilitate a student-centered learning environment that fosters activities that engage students (Nelson et al., 2009) as opposed to allowing

students to be passive learners. They look at technology, and instead of focusing on how to use a tool, they focus on why they want to use that specific tool (Gooding, 2008). They realize that students must become active learners in order to interact on different levels with their teachers, peers, field experts, and content, thereby developing a deeper understanding of concepts through seeking information, collecting data, collaborating with others, constructing knowledge, and evaluating their own products (Nelson, 2008).

Despite the abundance of free access to Web 2.0 applications online, the majority of today's classroom teachers who utilize technology to facilitate student learning do so in low level ways. According to the Speak Up 2007 national survey (Project Tomorrow, 2008), 51% of teachers reported that the main use of technology to facilitate student learning consisted of word-processing, basic Internet searches, and software for drill and practice. Students in grades 6-12 surveyed confirmed that their use of technology focused mostly on word-processing, conducting Internet searches, and checking assignments and grades online. In their report, Wachira and Keengwe (2011) stated that two-thirds of the teachers interviewed in their study admitted that they did not know how to use widely available applications, such as spreadsheets and PowerPoint. Teachers also admitted to not knowing how to effectively integrate technology into daily classroom activities. Clearly, most practicing teachers today are not TPACK proficient. However, during the past decade, the interest in using TPACK as a framework for understanding the kinds of knowledge teachers need to successfully integrate technology in teaching has continued to grow (Angeli & Valanides, 2009; Koehler & Mishra, 2008; Mishra & Koehler, 2006),

and tools for gauging teacher growth in this area are in the process of being developed (Lux, Bangert, & Whittier, 2011; Shin et al., 2009).

Teachers' lack of visions of technology integration. A final barrier to technology integration for the classroom teacher involves simply understanding what is meant by technology integration and being able to envision a technology-integrated classroom (Albion & Ertmer, 2002). This means having a vision of teaching that includes teaching with technology. Hammerness et al. (2005) state that the development of a vision for teaching is facilitated by the community in which teachers teach, and is “a set of understandings about teaching, learning, and children: dispositions about how to use this knowledge: practices that allow them to act on their intentions and beliefs; and tools that support their efforts” (p. 385). They further define vision as the teachers’ “need to have a sense of where they are going and how they are going to get students there” (p. 385). In other words, the determination of teachers’ goals for their students directs what is taught, how and when it is taught, what tools are used, and how student learning will be assessed. The ability to imagine what teaching and learning looks like when the teacher’s goals have been realized is at the heart of having a vision (Hammerness, 1999). Therefore, a vision of teaching can influence how teachers teach and what they teach. These visions can change or be modified over time with rethinking goals for student learning and tools used in helping students achieve those goals.

Teachers’ visions are partially developed and shaped by their past experiences in learning and in teaching (Hammerness, 1999). Reflections on these past experiences lead to beliefs about teaching. Richardson (1996) noted that “beliefs are thought to drive

actions; however, experiences and reflection on action may lead to changes in and/or additions to beliefs” (p. 104). Beliefs are formed through how teachers perceive their past experiences, especially experiences in their own learning and through their teacher education training (Pajares, 1992). Fang (1996) states, “. . . teacher’s beliefs are shaped by many factors. Among them are the influences of discipline subculture, the quality of preservice experience in the classroom, and the opportunity for reflection on the preservice experience” (p. 50). Pajares (1992) finds that an individual’s beliefs are “the best indicators of decisions individuals make throughout their lives” (p. 307).

Most classroom teachers’ visions of teaching do not include technology use because they have little to no experience in using technology in their own learning (Cifuentes et al., 2011). With the abundance of technology tools and the focus on educational reform, which includes the use of information communication technologies, today’s teachers are constantly being challenged to use technology tools that are new to them as teachers and with which they have no experience in their own learning (Jacobsen, Clifford, & Friesen, 2002). If teachers have been educated in a traditional classroom setting throughout their educational experiences, then where do they go to view examples of successful technology integration (Niess, 2011)?

Teachers can develop a vision of technology integration through a long process of self-reflection concerning teaching practices and attitudes, training in the use of technology, by observing examples of technology integration, and by accepting opportunities to experience and test ideas in a supportive environment. However, providing such opportunities for the majority of practicing teachers within a short period

of time, even over a few years, is not possible logistically (Albion & Ertmer, 2002).

Furthermore, teachers' beliefs and practices are difficult to change (Ertmer, 2005). As a result, attention has increasingly turned to teacher education programs to prepare preservice teachers to integrate technology into the classroom.

Expectations for Tomorrow's Teachers

With a focus on students developing 21st century skills and promoting higher order thinking skills, teachers of tomorrow are expected to enter the classroom prepared to utilize technology to address individual student learning needs in developing content-related knowledge and skills, concepts, and problem-solving strategies. Teacher education programs are required to provide the training necessary for preservice teachers to develop technology skills through an introductory educational technology course (U. S. DOE, 2003).

Historical perspective of teacher education and technology training. Offering technology courses in teacher education programs is not new. The earliest technology courses, during the 1920s and 1930s, focused on visual instruction and film collections (Saettler, 1990). These courses evolved through the decades to include projectors and other visual aids, the history of using visuals, the psychology of using visual aids, and the use of audio (Starnes, 1937). With the launching of the first satellite, Sputnik, by Russia in 1957, came the U. S. National Defense Education Act (NDEA) in 1958. As a result, a major emphasis in teacher education was an introductory technology course. Eventually,

the technology component of teacher education programs was referred to as educational media instruction (DeKieffer & DeKieffer, 1970).

The arrival of the personal computer in the late 1970s began two decades known as the Information Age, and with it came changed expectations of how educators were to use technology in the classroom (Saettler, 1990). Prior to the 1990s, many teacher education programs were slow to incorporate personal computers into their introductory technology courses. As personal computers became ubiquitous in society, schools were pressured to provide technology to teachers and their students. At first, teacher education programs responded by incorporating computer training into the original technology courses, balancing the skills between the old technology and the new. However, with the arrival of the Internet in the mid-1990s, more pressure was placed on preservice teachers to develop a new set of technology skills to take with them into the classroom, with the major focus placed on using computers and the Internet (Betrus & Molenda, 2002). In 2002, the mandates of No Child Left Behind (NCLB) increased the pressure to incorporate technology into teaching by requiring teacher education students to take an introductory, computer-based technology course (U. S. DOE, 2003).

Assumptions about today's preservice teachers. Because computers have been in the K-12 school setting for the last two decades, the majority of today's preservice teachers are young enough to have grown up with this technology in their schools and homes. For that reason, there is an assumption that the younger generation preparing to enter the teaching profession is more likely to embrace technology and effectively integrate it into their teaching and student-learning (Russell et al., 2003).

It is true that schools have increasingly made hardware and software available to teachers and their students, provided training for teachers, and increased expectations for teachers to use technology to facilitate their roles as teachers and to assist students in their learning (ISTE, 2008; NCES, 2010a). It is also true that many of today's preservice teachers own digital devices such as cell phones, digital cameras, and computers. However, prior to participation in teacher education programs, preservice teachers' experiences with electronic devices is often limited to personal uses for entertainment, casual communication, basic Internet searches, and basic word-processing (Ertmer et al., 2011; Project Tomorrow, 2010). Furthermore, a majority of today's preservice teachers had high school teachers and college professors who did little more with technology than communicate through email, make phone calls, submit attendance and grades electronically, show video, and use an overhead projector (Maddux & Johnson, 2006; Project Tomorrow, 2008). Not only do preservice teachers lack role models in how to integrate technology, hindering their ability to develop a vision of technology integration, but they also often enter teacher education programs without an understanding or appreciation of how technology can facilitate student learning (Ertmer et al., 2011; Project Tomorrow, 2010).

Adoption theory. According to the adoption theory for technology integration, for practicing teachers to thoroughly embrace the concept of technology integration in the classroom, they must progress through five stages (Geoghegan, 1994; Rogers, 1995): first, learning about technology; second, believing in the value of technology; third, deciding to utilize technology in their teaching; fourth, using technology in their

teaching; and fifth, reaffirming or rejecting the original decision to utilize technology in their teaching based on their experiences in having done so. Teacher education programs are designed to address the first three stages of the adoption theory in influencing preservice teachers' decisions to use technology in their future teaching, but the last two stages involving the actual usage and reaffirmation to continue using technology in the classroom take place over a long period of time by the individual as a practicing teacher.

Learning about technology. It is through their teacher education courses, primarily their introductory educational technology course, that preservice teachers receive training on how to use technology for educational purposes (Banister & Vannatta, 2006). The subject matter of the introductory educational technology course in some teacher education programs is aligned with National Educational Technology Standards for Students (International Society for Technology in Education [ISTE], 2007) and Teachers (ISTE, 2008; Browne, 2009; Lambert & Gong, 2010). Preservice teachers are commonly introduced to various software packages, computers, peripherals, and educational websites (Garcia & Rose, 2007). They read, reflect, and participate in various forms of online communication such as newsletters, podcasts, blogs, mail merge memos, non-linear multimedia, wikis, and video-conferencing (Browne, 2009; Lambert & Gong, 2010). The course often requires that preservice teachers utilize applications for spreadsheet analysis, database creation and queries, and geospatial technologies in critical thinking and problem-solving, and desktop publishing, video creation, and Website creation in the development of technology-enhanced lessons (TELEs) for their specific content grade levels (Browne, 2009; Doering et al., 2003; Lambert & Gong, 2010).

Several studies indicate that when preservice teachers gain experience in using computer technology, their confidence and attitudes towards using technology increase, and so do their intentions to use technology in their future teaching (Anderson, Groulx, & Maninger, 2011; Anderson & Maninger, 2007; Chen, 2004; Dexter & Riedel, 2003; Paraskeva, Bouta, & Papagianna, 2008; Smarkola, 2008). Therefore, an increase in technology skills can lead to believing in the value of educational technology and the decision to use it in teaching.

Believing in the value of technology. To achieve technology integration, teachers' beliefs about the value of technology must be addressed (Anderson et al., 2011; Russell, O'Dwyer, Bebell, & Miranda, 2004; Sugar, 2002). Like practicing teachers, preservice teachers need to learn how technology can effectively be used to address the diverse and varying needs of students. When preservice teachers view technology use by their university instructors and when they are required to use technology in their own learning and through lesson-plan development in field experiences, they are afforded opportunities to view various aspects of technology, possibly increasing their perceptions of technology usefulness in education, which can positively impact preservice teachers' intentions to use technology in their future teaching (Al-Ruz & Khasawneh, 2011; Anderson et al., 2011; Banister & Vannatta, 2006; O'Bannon & Judge, 2004; Schrum et al., 2003).

Through field experiences, preservice teachers are given opportunities to explore issues and problems in a K-12 setting. They are able to utilize a problem-based learning approach to examine different perspectives. They are often encouraged to reflect on their

beliefs while developing or extending on their knowledge and in developing skills in problem-solving, which involves critical thinking skills, decision-making skills, and in working collaboratively with others (Albion, 1999). To this end, preservice teachers are placed in the field to observe practicing teachers' strategies for teaching content, managing classrooms, and using technology (Fleming, Motamedi, & May, 2007; Lambert & Gong, 2010). In addition, preservice teachers are afforded opportunities for developing and delivering lessons that are aimed at solving instructional problems and/or making their own teaching more productive, as well as requiring their students to use technology to help construct understanding of concepts taught (Doering et al., 2003; Lambert & Gong, 2010).

Deciding to use technology. Through experiences with technology during course work, observing technology modeled by university instructors, and the opportunity for authentic learning during field experiences, preservice teachers begin to understand how to achieve technology integration in addressing student learning needs, leading to the decision to use technology in their future teaching (Karagiorgi, 2005). For example, in his study of science student teachers and technology integration, Efe (2011) found high correlations between student teachers' experience with educational technology, their intentions to use technology in teaching, to have their students use it in learning, and their beliefs about the value of technology in learning science. Al-Ruz and Khasawneh (2011) found in their study of preservice teachers and technology integration that the higher the level of modeling of technology in the teacher education courses, the higher the level of

technology proficiency and perceived self-efficacy, the higher the likelihood that preservice teachers will use technology in their future teaching.

These kinds of activities and experiences certainly help preservice teachers learn about technology, to become more comfortable in using it, and to reflect on what their beliefs are concerning the benefits of technology. Such activities and reflections make it more likely that preservice teachers will use technology in their teaching (Anderson et al., 2011; Fleming et al., 2007), satisfying the first three stages of the adoption theory—learning about technology, believing in the value of technology, and deciding to use technology. However, findings from studies indicate that student-centered learning approaches for preservice teachers may need to be implemented over a long period of time in teacher education programs in order to have a significant impact on preservice teachers' beliefs about student-centered learning and technology integration (Bai & Ertmer, 2008; Park & Ertmer, 2008).

Preservice Teachers' Intentions to use Technology Versus Actual Usage

Preservice teachers often indicate their intention to use technology in their future teaching, but when they enter student teaching, these intentions often do not translate into action. Choy et al. (2009) found in their study of student teachers' intentions and actions in integrating technology that although most of the participants in the study had the ability and confidence to integrate technology and professed to having a positive attitude about the benefits of technology, they felt discouraged in trying to use technology in teaching because of a lack of technology resources available to them in the classroom.

They did not perceive having any internal barriers, and the external barriers regarding the lack of technology resources had to do with minor challenges such as lack of specific software, needed plug-ins, and slow Internet access. Although these were minor issues, the preservice teachers did not appear to be equipped to handle these issues, indicating that their technology skills were not sufficient to deal with minor glitches or that they lacked strategies in addressing such obstacles as lack of specific software.

In Whitacre's study (2011), preservice teachers indicated that they felt that their technology skills were proficient and that they were able to teach others how to use technology. However, the results of the study showed that these preservice teachers did not use technology or used it very little in their field placement and student teaching. They reported that reasons for little integrating of technology during field placement and student teaching included logistical problems in arranging to use technology, such as scheduling computer lab time, not being held accountable in their evaluation for incorporating technology into their lesson plans, and having a cooperating teacher who did not use technology.

Preparing preservice teachers to integrate technology is complex. Many factors can derail their intentions to use technology once they enter the classroom, despite positive attitudes and intentions (Lim, Chai, & Churchill, 2010). Technology is always changing, and there is interplay of various kinds of knowledge that preservice teachers are only beginning to understand and develop. Unlike practicing teachers, preservice teachers lack a deep understanding of content knowledge and pedagogical considerations (Niess, 2011). In addition, the teaching environment, such as the attitude of the

cooperating teacher towards technology integration, can play a role. Availability of technology and support in using it are major factors in whether a student teacher chooses to use technology (Al-Ruz & Khasawneh, 2011; Vannatta & Fordham, 2004).

The Need for Modeling Technology Integration

Beliefs about the value of technology in education may be changed by providing preservice teachers with various visions of what teaching with technology looks like and with opportunities to experience different approaches in supportive contexts (Albion & Ermer, 2002; Pierson, 2004). The real hope for future teachers to successfully integrate technology into the classroom is dependent, therefore, not only on the skills they develop in teacher education programs, but also the vision they have of a student-centered learning environment, where students are allowed to develop skills and understanding of concepts and to participate in problem-based learning with the use of digital technology (Fleming et al., 2007). The integration of technology into methods courses is an important component of such preparation (Collier et al., 2004; Pierson, 2004; Pope et al., 2002; Wright & Wilson, 2005-2006), as is the opportunity to observe classroom teachers effectively utilizing technology to address student learning needs in specific content-related instruction and in the context of the classroom. Seeing practical examples of content-specific technology use can help preservice teachers envision what their own ideal classrooms might look like.

In addition to providing technology-related field experiences, faculty can incorporate multimedia case studies, such as those found in the NETS Digital Video

Library (Stirling, Williams, & Padgett, 2004). Derry et al. (2002) found that video case studies depicting the practices and beliefs of exemplary technology-using teachers in technology-enriched learning environments can potentially influence preservice teachers' beliefs and attitudes toward technology integration. Videos of real teaching allow preservice teachers to view best practices involving constructivist teaching methods and invite the preservice teachers to discuss what they view in a meaningful way, whereas it is often difficult to arrange field experiences that demonstrate ideal situations.

Guidance in lesson-plan development that incorporates the use of technology is also very helpful (Pierson, 2004). For example, Pierson's Technology Planning Target model (see Figure 2) provides a visual for lesson plan development with a technology component. The process of lesson development begins in the center of the target with identifying the goal or objective of the lesson and determining why technology is needed to achieve that goal or objective. Working outward in the target next is the determination of who uses the technology, student or teacher, and for what purpose. Questions to address from there include: what is the learning structure (large group, small group, or individual student); where is the technology to be used; what is the placement for technology use in the lesson sequence; and how is the technology tool to be developed?

Providing examples of what technology integration looks like builds towards a preservice teacher's vision of technology integration, which includes determining student learning goals and what tools to use, including technology tools, for helping students to achieve those goals (Pierson, 2004). But building that vision of technology integration goes much further than lesson-planning that includes a technology component (Ferratt,

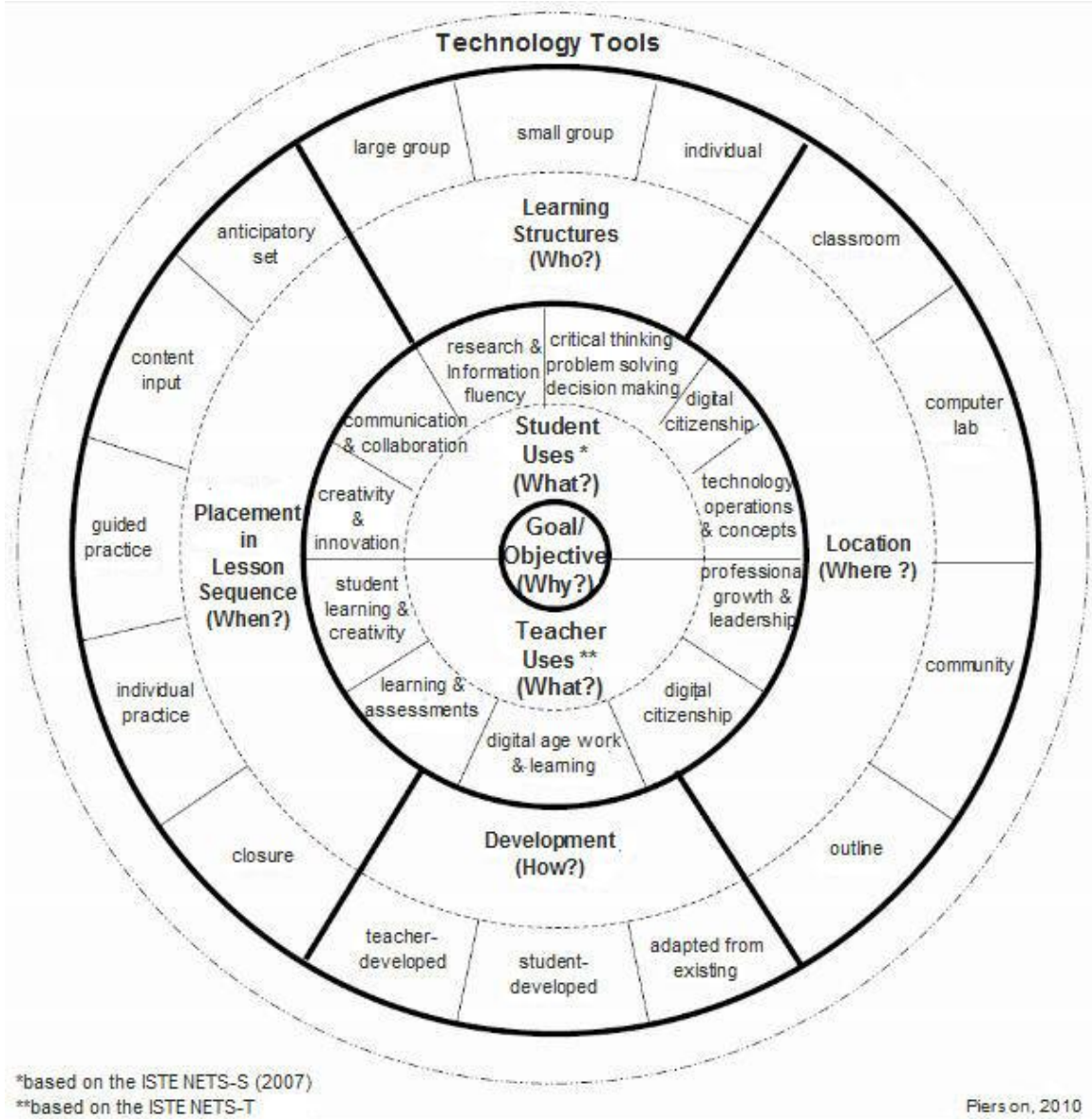


Figure 2. Pierson's Technology Planning Target model. Used with permission.

2009). The preservice teacher begins imagining what the ideal classroom would look like, what kinds and levels of interaction would take place among and between students, the teacher, the community, and course content. It includes what the roles of students and the teacher would be, how the learning environment would be set up, and what kinds of tools

might be available. Building a vision of technology integration asks many of the same questions posed in Pierson's Technology Planning Target model (see Figure 2).

However, instead of looking at a specific learning objective at the center of a specific lesson plan, the vision focuses on: what overall goals the teacher has set for himself/herself; what kinds of skills the teacher wants the students to develop over a period of time and why technology is needed for achieving those goals or developing those kinds of skills; what the possible uses of technology tools are and the purposes for using them; how the teacher and the students might use the technology tools; what the learning environment might look like; and how these technology tools might be developed (see Figure 3).

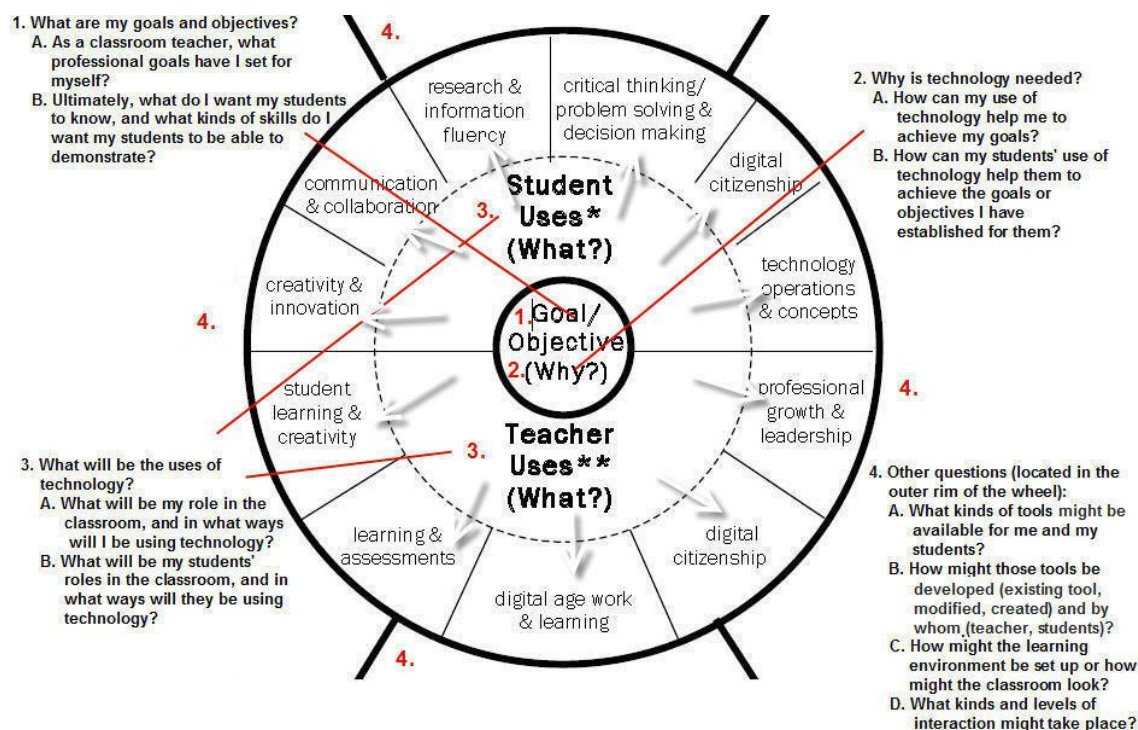


Figure 3. Model for vision of technology integration.

Tracking Preservice Teachers' Changes in Attitudes, Beliefs, and Practices

Preservice teachers enter teacher education programs with different experiences as well as different kinds and levels of knowledge (Bai & Ertmer, 2008). Some of these experiences serve preservice teachers well as they develop their beliefs and attitudes through participation in a teacher education program while the beliefs and attitudes of other preservice teachers remain unaffected. In addition, some of the visions of teaching that teacher educators foster may be in conflict with the practices of most teachers (Veenman, 1984), such as expectations in what technology will be available in the classroom and expectations of using that technology on a daily basis (Chen, 2010). As a result, some preservice teachers may not be ready to accept visions of a classroom set up for technology integration when they discover a disconnect between expectations fostered in their education courses with the reality of entering the classroom (Calderhead, 1991; Calderhead & Robson, 1991; Chen, 2010).

Part of helping preservice teachers to develop a vision of technology integration lies in guiding them to consider how their vision began, developed, and/or changed through their participation in their teacher education program (Bai & Ertmer, 2008; Doering et al., 2003; Pajares, 1992; Schrum et al., 2003; Vannatta & Fordham, 2004). It also involves helping preservice teachers develop attainable goals and to realize that those goals may be achieved in incremental steps over a long period of time. In addition, preservice teachers may need to have guidance in matching their personal visions of teaching with the visions of schools to which they apply to teach (Hammerness, 1999).

Studies have been conducted on preservice teachers' intentions to use technology, but few studies have been done in tracking changes in preservice teachers' attitudes, beliefs, and practices in using technology as they progress from course work through student teaching (Choy et al., 2009). Cullen (2006) asked preservice teachers to draw, write an explanation, and orally present their vision of an ideal classroom. Lux et al. (2010) developed an instrument that can be used for formative and summative evaluation of preservice teachers' TPACK development, including assessing their attitude towards technology use and their ability to identify examples of technology integration. However, the instrument neither asks the preservice teacher to explain his or her understanding of what technology integration means nor how that understanding began and developed. The study by Davis, Hartshorne, and Ring (2010) focused on preservice teachers' conceptions of innovation and technology's role in those conceptions. They found that preservice teachers come into teaching with deep-seated beliefs about teaching. Preservice teachers' had differing philosophies of teaching which included views of their own non-technology learning experiences they felt worked, views that students should be exposed to technology for the sake of technology because of the perceived importance in 21st century learning, and views that technology could foster innovation in teaching and learning. Even though a group of preservice teachers were identified in the study who not only looked at what technology was available to them and their future students, but also imagined what technology might be available to help students achieve objectives, the study did not focus on asking preservice teachers to explain their understanding of what technology integration is and from where their understanding first originated. Although

the study by Davis et al. (2010) comes close with the examining of preservice teachers' conceptions of innovation with technology use, no studies were found that focused specifically on the preservice teacher's perception of his or her development of a vision of teaching with integrated technology. Such a study may shed light on how teacher education programs can further assist preservice teachers in developing a vision of technology integration, thereby influencing preservice teachers' use of technology in their future teaching.

This study was designed to understand how preservice teachers perceive their own development of a vision of teaching with integrated technology in the classroom. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers to develop a vision of technology integration, thereby influencing them to use technology effectively and meaningfully in their future teaching.

Summary of Chapter II

Chapter Two presents findings from the literature that is relevant to the study. The literature review consists of the following major topics: expectations for today's teachers; recognized barriers to technology integration; expectations for tomorrow's teachers; the historical perspective of teacher education and technology training; adoption theory; and helping preservice teachers to develop a vision of technology integration. Chapter Three restates the purpose of the study and the research questions, discusses the research design, describes the researcher and the participants in the study, and explains the

sampling procedures, data collection process, management of data, and the data analysis process. Chapter Three also discusses issues of trustworthiness, threats to validity, and limitations of the study.

Chapter III: Methodology

This study was designed to understand how preservice teachers perceive their own development of a vision of technology integration in the classroom. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers develop a vision of teaching with integrated technology, thereby influencing them to use technology effectively and meaningfully in their future teaching.

This chapter states the research questions, discusses the importance of using a qualitative study in this instance, and describes the research design, the researcher, the participants, data collection procedures, management of data, and data analysis procedures, as well as issues of trustworthiness, threats to validity, and limitations of the study.

Research Questions

This study was designed to address the following research questions:

1. What is the preservice teacher's vision of teaching with integrated technology?
2. What factors influence the development of the preservice teacher's vision of teaching with integrated technology?
3. How does the preservice teacher's vision of teaching with integrated technology play out in the classroom during student teaching?

4. How do experiences in student teaching related to technology use influence the preservice teacher's anticipation in using technology as a practicing teacher?

Research Design

The study employed qualitative methodology, both descriptive and interpretive (Merriam, 1998). The study was designed as a qualitative case study, examining four 4th-8th grade level preservice teachers for a single semester during their participation in student teaching. Each preservice teacher examined in the study was treated as a single case study, with a cross-comparison of the case studies for the purpose of identifying emerging common themes. The case study design was selected because the focus of the study is on an instance of a specific concern or issue, allowing the researcher to develop insight, make discoveries, and to interpret findings, as opposed to testing a hypothesis.

Importance of a Qualitative Study

Teachers' beliefs concerning what is important to teach, how to teach, and how to manage a classroom begin to form in their early educational experiences (Kennedy, 1997). Knowledge and insight gained in teacher education programs and in the first years of teaching have a major influence on teachers' belief about what should be taught, how, and why, including about the importance of learning with technology (Bai & Ertmer, 2008; Fulton & Torney-Purta, 2000). Influencing preservice teachers to embrace instructional technology is a complex issue with many components.

One major component in helping preservice teachers develop a vision of technology integration is to understand what kinds of experiences and beliefs preservice teachers have upon entering an introductory technology education course and whether their experiences alter their beliefs about the value of technology, as well as their intention to use technology in their future teaching (Bai & Ertmer, 2008). A qualitative study allows the researcher to think in the widest terms possible, allowing the inquiry to be interpretive and inductive in nature, as opposed to measuring outcomes of a more concrete nature (Glaser & Strauss, 1967; Harper, 1992; Merriam, 1998; Stake, 1995). This study allowed me to examine, through responses to a questionnaire, analysis of lesson plans developed by the participants, and through interviews, the influences of an introductory educational technology course, as well as methodology and content courses, on the participants' uses of technology in student teaching. Such an approach allowed me to understand the experiences of the participants in the study rather than trying to predict what the participants' experiences will be in the future.

Researcher

I am a doctoral student who taught a required introductory educational technology course for 4-8th grade preservice teachers as part of my graduate assistant responsibilities. Although I did not teach the participants in this study, I have worked closely as a graduate assistant within the teacher education program in which the participants in this study were enrolled. I am a retired public school teacher of 31 years. I taught high school English as well as classes in desktop publishing and web mastering. I also served three years as the head of the English department in one high school and three years as the

head of the technology applications department in another high school. In addition to teaching and department head responsibilities, I was the campus web master during my last three years of teaching. I have served on numerous school and district committees throughout my teaching career, including technology committees, and I have participated in a number of training programs focusing on the integration of technology in education. I have a special interest in technology integration in the classroom in that I believe strongly in the potential benefits of using instructional technology to facilitate student understanding and knowledge of core content material.

Participants

Initial sampling was a convenience sample in that the general pool of potential participants consisted of twenty-three 4-8th grade preservice teachers who participated in student teaching through a teacher education program at the University of Houston during the spring, 2012 semester. The general pool of potential participants progressed through the same teacher education program and had the same instructors for their introductory technology education and methodology courses. Email addresses of the general pool of potential participants were acquired from the Associate Dean of the teacher education program through which the participants progressed. A questionnaire (Appendix A) was emailed to the general pool of participants. The pool of participants was narrowed down to the five participants who responded to the questionnaire. An invitation (Appendix B) to participate in the study was emailed to all five participants. Further narrowing of the pool of participants from five to four was based on the number of participants who responded to the invitation, made an appointment for an interview, carried through with

the interview, and confirmed data records. A consent form (Appendix C) was attached to the invitation email, with a request that it be returned to me at the time of the interview. I had extra copies of the consent form in the event that the participant lost the original or forgot to bring it to the interview. The consent form was collected prior to the beginning of the interview. While the identity of the course participants was protected at all times, responses to the questionnaire were used to help provide a portrait of each participant in the study as it pertained to experiences and attitudes towards using technology prior to entering the teacher education program and during participation in the teacher education program.

Only 4-8th grade preservice teachers were included in the study for validity purposes, since different grade-level teacher education programs may vary to some degree in course content and expectations in using technology in teaching. Preservice teachers for grades four through eight were selected for the study because students in grades four through eight are old enough to use technology somewhat independently for purposes of communication, productivity, creativity, and problem-based learning.

The final sample of participants was to be narrowed to between four and eight participants for logistical considerations, since this is a qualitative study with time-intensive data collection methods. Although each participant was treated as an individual case study, a cross-comparison of case studies was made to determine if any common themes among the experiences of the participants emerged, which may help to influence teacher education programs in how they prepare preservice teachers to integrate technology in their teaching. Too few participants might not have yielded enough data to

recognize emerging themes, whereas too many participants might have offered too much data to effectively analyze in a qualitative study of this size. Determination of the final sample was to be done by me with use of judgment concerning which participants' responded to the questionnaire, when compared among the potential participants, best demonstrated a variety of experiences and attitudes towards the use of instructional technology. I created categories on a spreadsheet concerning experiences and attitudes so that I would have a visual to aid me in selecting potential participants.

Data Collection for the Initial Sampling

Preservice teachers enter teacher education programs with varied experiences as students and in their use of technology. These prior experiences help to formulate the preservice teacher's initial vision of what a classroom looks like, as well as how students learn, and the role of the teacher (Bullock, 2004). The purpose of using responses to a questionnaire (Appendix A) emailed to potential participants identified in the initial sample was to examine the participants' experiences, knowledge, and attitudes concerning instructional technology integration prior to and during their participation in a teacher education program and towards the end of their student teaching. This was done in an effort to identify potential participants for the study with varying experiences and attitudes in utilizing technology for learning and teaching purposes. Examining each participant as a case study and then cross-comparing the case studies may lead to a better understanding of how preservice teachers perceive their own development of a vision of technology integration in the classroom.

Data Analysis for the Initial Sampling

Analysis of the questionnaire was to lead to a purposeful sampling (Merriam, 1998) of preservice teachers who were enrolled in student teaching in the spring, 2012 semester. Initially, I read through the responses to the questionnaire to select potential participants to interview concerning their experiences with technology use in their K-12 education, to identify possible changes in their views of instructional technology during their participation in a teacher education program, and to understand their experiences in using technology during student teaching. In an attempt to have a balanced view of technology integration among the participants, the responses to the questionnaire were to be used to select potential participants with varying experiences and attitudes towards instructional technology. For example, a potential participant may not have had any experience with technology as a K-12 student other than viewing videos and slides presented on overhead projectors, while another potential participant may have experienced learning with video-conferencing and student-development of multi-media products. A potential participant may have become more enthused about technology integration as a result of his or her participation in a teacher education program, while another potential participant's views may not have changed during the course of his or her participation in a teacher education program. One participant may think favorably about technology use in the classroom while another may not. One participant may already have experience using technology in the classroom for teaching purposes prior to participation in a teacher education program, while another one may not. I had planned to use responses to the questionnaire to group potential participants according to one of four

basic categories, and then select two potential participants in each category who appear, in my judgment, to best fit that category. The four categories are based on participants who:

- appear to have had experience with using technology as a K-12 student prior to entering the teacher education program; or
- appear to have had little to no experience with using technology as a K-12 student prior to entering the teacher education program; or
- appear not to have changed views concerning the value of technology in the classroom during participation in a teacher education program; or
- appear to have changed views on the value of technology in the classroom during participation in a teacher education course.

However, since only four potential participants accepted the invitation to be interviewed, my final sampling includes only those four preservice teachers.

Data Collection for the Final Sampling

Data collection for the final sampling included responses to a questionnaire, interviews, and a lesson plan developed by each participant.

Questionnaire. I developed a questionnaire (Appendix A) to email to potential participants initially for the purpose of narrowing the pool of participants to a final sampling. The questionnaire was developed by me with consultation of content area experts. The questionnaire consists of five questions. Participants were asked about:

1. Their experiences in using technology in their own K-12 educational experiences;
2. The kinds of teaching experiences, if any, they had prior to entering the teacher education program;
3. Their opinions about the importance of technology in the classroom;
4. Whether or not their opinion about the importance of technology had changed since entering the teacher education program; and
5. About how they envision their ideal classroom.

I intentionally did not mention technology when asking the participants to describe their ideal classroom. I expected their vision of teaching with integrated technology to become apparent in the main study. In addition, I wanted to see if the participants' initial description of their ideal classrooms included technology tools as a possible indication of whether the participants were, to quote Doering et al. (2003), "thinking with technology." Responses to the questionnaire were also used to help provide a portrait of each participant in the final sampling as it pertained to experiences and attitudes towards using technology prior to entering a teacher education program and during participation in a teacher education program.

Interviews. Data collection for the final sampling was in the form of an interview (Appendix D). Each participant was asked to provide a lesson plan she developed that included a technology component developed by the participant. Interviews were

conducted face-to-face on the university campus in which the participants were enrolled for the teacher education program. Participants were given a \$50 Visa Gift Card for their participation, awarded after completion of the questionnaire, the interview, and emailed confirmation of data records. Participants were responsible for their own parking expenses at the university. Times for interviews varied according to the convenience of the participants and me. The scheduling of the interviews allowed me time to transcribe and analyze each interview before beginning the next interview.

The interview protocol (Appendix D) was developed from a review of relevant literature, drawing from Bullock (2004) and Choy et al. (2009). I also consulted Merriam (1998) for insight on how to structure the interview protocol and to determine the kinds of questions to ask, as well as to gain insight as to what constitutes good interview questions. In addition, I consulted content area experts in providing feedback on the quality of the questions asked and how they related to the stated research questions. The interview protocol consisted of basic questions at the beginning of the interview. The responses to the questions provided identified the subject area and grade level taught during student teaching and helped to ease the participant into the interview. Questions that followed:

- Were aimed at more open-ended questions to allow the participants to define and interpret terms in their own way and to share experiences in student teaching as they pertained to technology integration.
- Three questions focused on a lesson plan with a technology component developed by the participant.

- Eleven probing questions were used as I sensed that the participant had more to offer in response to one of the initial questions.

Each interview lasted approximately 45 minutes. Interviews were audio-recorded. My reflections and comments were recorded in field notes immediately after each interview. A Microsoft Word document with the number-lined feature was utilized to transcribe the interviews. An Excel spreadsheet with commentary features was utilized to create categories and to list emerging themes within categories, with excerpts copied and pasted from the transcribed interviews for support, as well as my reflections.

A transcript of the interviews and my interpretive comments were emailed to each participant to check for accuracy. The participants responded back to me through email confirming the accuracy of the transcription and offering comments to help ensure an accurate account of our interview. Minor corrections were made in reference to names of websites or software applications mentioned in the interviews. Otherwise, there were no discrepancies between my transcription and interpretation and that of the participants. The review of the transcript and interpretive comments took no more than thirty minutes of the participants' time.

Lesson plans. Each participant was asked to provide a copy of a lesson plan with a technology component the participant developed. The lesson plan was discussed during the interview in reference to questions focusing on an example of how the participant used technology with students during student teaching, whether the developed lesson plan was used, and if not, why, and if so, the outcome of the lesson. The copy of the lesson

plan provided by each participant was archived with other data for the study. The copy of the lesson plan was identified with each participant's pseudonym.

Data Analysis for the Final Sampling

Analysis of the participants' responses to the questionnaire was used in an effort to demonstrate the varied experiences and attitudes of the study's participants to identify common themes among the participants in their experiences in student teaching as it involved technology integration. Selecting participants with as wide a range possible in experiences in using technology in their own K-12 education is important because such experiences can influence their early development of a vision of teaching (Bai & Ertmer, 2008), which may or may not include technology integration. Selecting participants with varying attitudes towards the importance of using technology in teaching is important because those attitudes towards the importance of instructional technology may influence the preservice teacher's decisions on whether or not to use technology during student teaching. For example, preservice teachers who believe that the use of technology in teaching is important may be more likely to problem-solve when faced with barriers to using technology as opposed to preservice teachers who feel that the use of technology in teaching is not important. Discovering common themes among preservice teachers during student teaching may have more significance if experiences and attitudes towards instructional technology vary prior to participation in student teaching.

Analysis of lesson plans provided by the participants interviewed was also conducted. Analysis of the development of the lesson plan was completed with the use of Pierson's (2010) Technology Planning Target model (see Figure 2).

Further data analysis involved the participants' interviews concerning technology use during student teaching to identify emerging themes (Merriam, 1998). Categories of common experiences and emerging themes were charted using Excel spreadsheet. Themes within each case study were analyzed as well as common themes that emerged among the case studies.

Management of Data

The participants selected for interviews are referred to by pseudonyms. Case studies are presented in the order that the participants were interviewed. Pseudonyms were assigned in alphabetical order using the letters m, n, o, and p, according to the order in which participants were interviewed. Care was taken to ensure that none of the pseudonyms matched any name on the list of initial potential participants. The first participant interviewed is referred to as Molly, the second as Nancy, the third as Olivia, and the fourth as Penny. The alphabetical listing of names according to the order interviewed was designed to help me in avoiding errors in identity during analysis and discussion of case studies. Pseudonyms linking participants to their identification will be destroyed once the dissertation has been completed. Data will be kept on a data CD for three years after completion of the dissertation in order to satisfy university requirements for completed studies. The data CD will be stored in the dissertation chair's office.

Trustworthiness

Trustworthiness, that is, the credibility, transferability, dependability, and confirm-ability of the findings of this study (Lincoln & Guba, 1985; Yin, 2003), was achieved through two primary methods. First, triangulation of responses to a questionnaire, a lesson plan with a technology component developed by the participant, and responses to the interview questions allowed comparison and contrast of participant responses. Second, follow-up emails were sent to the participants of the study, asking for confirmation of the accuracy of their interview transcripts and my interpretations of their responses to interview questions. Confirmation of these data records was received from each participant.

Issues of Validity/Limitations

Data analysis in qualitative research is a recursive process in which the collection of data and the analysis of data are ongoing, affecting what is collected based on analysis, and vice-versa (Merriam, 1998). I collected initial data from responses to a questionnaire and used the data to analyze participants in the final sampling. Each interview began with some basic questions; however, I used personal judgment on where to probe for deeper understanding of the issues as they emerged throughout the interview.

Further limitations of the study involve the inability to generalize results in a qualitative study (Lincoln & Guba, 1985). Each preservice teacher's experiences in education are unique, involving many factors. However, a cross-comparison of these case

studies may lead to emerging themes and a contribution to theory building that may influence teacher education.

Summary of Chapter III

Chapter Three restates the purpose of the study and the research questions, discusses the research design, describes the researcher and the participants in the study, and explains the sampling procedures, data collection process, management of data, and the data analysis process. Chapter Three also discusses issues of trustworthiness, threats to validity, and limitations of the study.

Chapter Four restates the purpose of the study. It also explains the organization of the chapter and reports the findings of the research. Chapter Four restates the research questions. Next, the chapter presents each participant as an individual case study, relating the thoughts and experiences of the participant as they pertain to the stated research questions. After all individual case studies have been presented, a cross-comparison of the individual case studies is made in relationship to the stated research questions to determine common themes that emerged in two or more individual case studies.

Chapter IV: Findings

This study was designed to understand how preservice teachers perceive their own development of a vision of teaching with integrated technology in the classroom. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers to develop a vision of technology integration, thereby influencing them to use technology effectively and meaningfully in their future teaching.

Chapter Four restates the research questions. The chapter presents each participant as an individual case study, relating the thoughts and experiences of the participant as they pertain to the stated research questions. After all individual case studies have been presented, a cross-comparison of the individual case studies is made in relationship to the stated research questions to determine common themes that emerged in two or more individual case studies.

Qualitative studies often provide direct quotes from participants for illustrative purposes. Direct quotes in this study come from written responses to the questionnaire items and from oral responses during the interview. Omissions within a quote, indicated by the use of an ellipsis, were done only when the omitted words, phrases, or sentences did not relate to the point the quote is illustrating. Dashes within a verbal quote indicate a pause in thought or expression or a break-off of a thought or expression. Bracketed words or phrases were added to help clarify the quote for the reader.

Research Questions

This study was designed to address the following research questions:

1. What is the preservice teacher's vision of teaching with technology integration?
2. What factors influence the development of the preservice teacher's vision of teaching with integrated technology?
3. How does the preservice teacher's vision of teaching with integrated technology play out in the classroom during student teaching?
4. How do experiences in student teaching related to technology use influence the preservice teacher's anticipation in using technology as a practicing teacher?

Case Study 1: Molly

Molly is a 42-year-old recent college graduate who completed student teaching for sixth grade science. Prior to entering the teacher education program, she had been a dance instructor for twelve years and a physical fitness instructor for the Navy for three out of the six and a half years she served. In reference to the questionnaire item concerning her experience with technology in her K-12 education, she had responded:

Back when I was a . . . student, technology was actual film projectors and overhead projectors. There were also these purple ink copy machines because Xerox hadn't made its way into schools budgets yet. My high school taught a typing class where we used actual typewriters.

Molly had no experience with digital technology in her own learning prior to entering the teacher education program.

Molly's field experiences. When I asked Molly what technology tools were available to her in the classroom for her student teaching assignment, she replied:

There's a screen you can project a PowerPoint onto. Through the district, you could show videos, but you could not stream them live.

Streaming video involves viewing part of a video while the next part is being downloaded. The buffer allows for smooth, continuous viewing and eliminates the need for storage space since it is not downloaded onto the computer. Not having the option to use video-streaming partially interfered with Molly's implementation of a lesson plan during her student teaching. She described her lesson, saying:

It was part of the simple machines unit. And it had to do with leverage . . . with 1st class, 2nd class, and 3rd class levers—and getting the work advantage, and the power advantage—you know, making work more efficient.

She continued, describing the video she had planned to use:

It was . . . from Cirque du Soleil. And it had a teeter board, like a seesaw, which is like a 1st class lever, and acrobats. So, a lot of physics involved. But you had to observe it, and you would stop every now and then and make predictions and explain why the little guy is afraid of being on the opposite side of the big guy.

Molly had planned to use a computer at the back of the class usually reserved for learning-disabled students. The video on the computer would have served as one of four work stations through which the students progressed during the lesson. She knew of file converter programs like Zamzar that would have allowed her to download the desired

video as a .wmv file but did not know how to access the program. A third concern in using the video was the attitude of her cooperating teacher.

For whatever reason . . . my cooperating teacher decided to just leave it [the video] because even though it was on the smaller [computer] screen in the back, it would have still been a kind of distraction.

Besides being unable to problem-solve downloading the video for viewing, she was influenced by her cooperating teacher to not use it in a small group setting. Molly felt that showing the video to the whole class at one time was not an option. As a result, she implemented the lesson plan without the technology component.

The comment on the lack of video-streaming capabilities caused Molly to reflect on the differences between her experiences with technology during student teaching and the field experiences she had during the second phase of the teacher education program, referring to the second phase as QUEST 2 and student teaching as QUEST 3. She commented, “Previously, where I had done my QUEST 2, you could stream from the Internet.”

Molly noted other differences between the two schools:

And then in QUEST 3, they didn’t have the Smart Boards, but they had the clickers, and that was operational. But my cooperating teacher told me that he had actually gotten that himself by writing a grant. That wasn’t something provided by the district.

A Smart Board is an interactive board with sensory mechanisms that track the movement of input devices such as an electronic pen or an individual’s fingers, allowing students to interact on a board large enough for the class to view. The classroom clicker system is used with PowerPoint and allows students to respond to multiple-choice questions

anonymously within the classroom. However, because the clickers can be assigned to specific students, the system can privately provide the teacher with feedback on individual student responses. The system can be used to quiz students on pre and post knowledge, to take an opinion poll, and to facilitate educational games. The cooperating teacher was able to secure a classroom clicker system through grant writing. In reference to her experiences with technology availability in her QUEST 2 assignment, Molly noted:

They had it [a classroom clicker response system] where I did my QUEST 2, but for the entire semester, for whatever reason, that software was not downloaded, uploaded, or whatever. It was just sitting there in the classroom. We couldn't use it . . .

She continued:

. . . . I have only seen [the Smart Board] used twice . . . my entire time I was at UH and I was never trained on it. They had that, but just like the clicker system, you couldn't use it.

Molly felt frustrated because these electronic devices remained in the QUEST 2

classroom unused for the entire semester. She remarked:

I don't know what the problem was specifically. I asked about it and we were told we just couldn't use it yet. So, I don't know what the hold-up was, like if there was just one tech person going around to every school and they just hadn't gotten to theirs yet, but it was frustrating.

She assumed that the software for the devices had not been installed, that perhaps the IT person was being spread too thinly.

Molly used the clicker system to test student knowledge during review of materials to see what content needed to be reinforced.

I was able to put together a PowerPoint that we could load into the clicker system, and we had immediate feedback with everybody. The majority of the class got

the questions right—because you can tell right then whose got it, even though we did it anonymously because they have their assigned clickers. But if 70% of the class missed the question, then I would know this is something we need to go over again.

She was able to see if the class as a whole understood the material. In addition, she knew how the students performed individually. She added:

. . . . and the 4th period cooperating teacher [for] those students who have learning disabilities, she was like, “Thank you so much. That is like pure gold. I know exactly what they need.”

The feedback on individual students let the teacher’s aide know which of the learning-disabled students needed further assistance. An added benefit was that those students came to realize that other students had difficulty understanding some of the material, as well. This made them feel better about themselves in reference to their learning differences.

Molly was also pleased that the school had a computer lab available. She commented:

First of all, there were enough computers for everybody. No one had to share a computer, which was great. All the students had their own login through the district that they can get access to. They can save it on that computer or save it to their own removables. And it was clean, and everything worked . . . They all had up-to-date; I think it was still 2007 Microsoft Office . . . it was well-lit . . . clean . . . didn’t smell. Everything worked.

Molly was impressed with the school computer lab, which she and her students utilized.

She made no mention of a computer lab at her assigned school for QUEST 2.

Besides the kinds of technology available in the two schools, Molly noted differences in student expectations. For example, during her student teaching, the

students were allowed to choose how to present information on a couple of their research projects.

. . . . some of them did make home videos, edited them, and brought them in and played them on the screen for everybody to see. . . Some of them did write the paper, and some of them did PowerPoints, and some of them, you know, built projects. . . . The ones who wrote by hand were doing posters. And even a lot of those were typed and printed.

For another assignment, all of the students used digital cameras.

When we did speed, velocity, and acceleration, he [the cooperating teacher] had them to build cars that were powered by rubber band. And he checked out the cameras from the library, and they had to take pictures of every step of the way of their design, of their building of the car, their running experiment . . . they had to graph all their information. . . And . . . put their pictures in with their graphs and their writing.

The students snapped pictures to document the steps they took in designing and testing their cars.

In contrast to student teaching, Molly commented on her QUEST 2 experiences:

. . . . the district where I was before that, was in a completely different part of town--different demographics, different district. And using technology with them would have been much more difficult. . . I suspect that the majority of them don't have access to technology at home, and their literacy rate was so much lower than what it was where I did my student teaching.. . using technology with them would have been much more difficult.

Molly felt discouraged from attempting technology use with the students she encountered during QUEST 2 because she perceived them to be lacking in literacy skills. She further commented, “. . . I would say none of them had any access to the Internet other than what they might be able to get on their parents' iPhone.” She depended on students having

technology support from home to complete technology-based projects and did not think these students would have it.

In addition, Molly felt that these students might use technology to bully each other.

I speak enough Spanish to understand . . . and I know they're insulting each other. And they don't do it in English. And so they know they are not supposed to in school. And so I can imagine they would use technology as an extension of their culture in that neighborhood.

She had observed the students' rough treatment of each other and their apparent acceptance of that treatment. She felt that these students would use technology in a negative way, as an extension of their abusive-like neighborhood culture. Added to this concern was that the school had expressed low expectations for these students in completing daily work. Molly remarked:

Using technology in that school wasn't even an option. . . I mean, they didn't even assign homework on paper . . . they didn't have to read their textbooks; they didn't have to write anything and bring anything back unless it was something they didn't finish in school. There was a worksheet that they could take home, write on it, and bring it back.

Molly had stated that using technology in the less affluent school was not possible; however, she did use technology with those students. She recalled:

I was trying to demonstrate how you go down . . . the group, each period is a more intensive reaction, so if this chemical reacts with water, then the next chemical a step down will also react with water, but much more violently. And then the next one down will also react with water but will be even more of a reaction. So, I had a video that demonstrated that all the way down, including a chemical that they would never get to see, even in college, but they got to see it in the video.

She showed a video that demonstrated a chemical reaction that could not be observed in a school setting, even in a college lab.

During student teaching, Molly learned the importance of providing guidance for her students in conducting Internet searches. She recalled:

. . . . they had a space project, and everybody had a different planet or moon or something in the solar system that they had to research, and we pulled a bunch of books out of the library for them to use, and we had them in the room, and we reserved the computer lab. And I told them, “NASA.gov. Go get on that one website and look up what you need to know.”

When a couple of students came back with comments that “It rains diamonds on Saturn,” she asked where they had gotten that information. Students told her they had used Ask.com. She explained that when she told them not to use Wikipedia.com, she meant all sites like Wikipedia, such as Ask.com and Answers.com. Molly and her cooperating teacher were careful to give the students a list of appropriate websites to use for the next research project.

When I asked Molly about her observation of technology use by her cooperating teacher, she reported being surprised at his use of PowerPoint presentations for two reasons:

His PowerPoints were all very wordy. It was funny because he would give me a PowerPoint and I would edit it. And I would add a picture—a different picture to every slide.

Molly modified each presentation before using it with her students, saying:

I had to do this because my evaluating professor comes in to evaluate me and she sees me showing a PowerPoint with the exact same picture on all 20 slides--that’s it. I’m done.

Her cooperating teacher liked what Molly did in using different images. Molly remarked:

And there was one assignment that I gave them that was in a PowerPoint that he actually posted to the school website so that . . . the parents could look at it and help the students with it.

The cooperating teacher thought that the different images on each slide made the PowerPoint presentation more interesting and engaging for the students. He stated, though, that he purposely placed a lot of text on each slide in order to teach his sixth grade students how to take notes. Molly commented:

He knew that it was too wordy. . . He would break it up once in a while and put in short videos. . . He was trying to teach them how to take notes. He kept trying to tell them, “Don’t write down every word. Write down the main idea, and move on.”

Molly said that the cooperating teacher quickly transitioned from one slide to the next during his lecture so that the students would not have enough time to write down all the notes he had on the slides, trying to encourage them to listen for main ideas.

Molly’s attitude towards the use of technology. Molly stated, “It [technology] is important if the kids are learning to use it and the assignments are relevant to learning content.” However, she does not think that technology is essential in education.

. . . but it is not all important. And I say that because for at least a thousand years, schools have not had technology. Mankind has managed to move forward. It’s a huge help at times. I think that if you rely on it too much . . . a lot of the electronic grading needs to go away.

When I asked for clarification on what she meant by electronic grading, Molly replied, “I mean the multiple-choice. There is too much multiple-choice.” She was referring to

multiple choice tests that are graded electronically, such as standardized tests. She went on to explain:

I understand the tendency because it is faster. Now that I have had to grade projects and papers, I understand multiple-choice is awesome. You can just put it in, and it grades it for you. That, and you have your grade, but I don't think that allows students to really have any practice in articulating what they know. And I found that to be very frustrating in the classroom, that they can't verbally answer a question at the level that I think they should be able to. They don't have the vocabulary or articulation developed that they should, to me, at age 12 to answer a question without saying A B C or D. "What is your reasoning? What is your logic? How did you come up with that?"

Molly believes that technology allows for too much dependence on objective testing, as opposed to students being involved in hands-on activities that allow for more authentic learning experiences and opportunities to articulate what they have learned. She does believe that online access to student grades is beneficial for parents, commenting:

I think giving parents access to the online grade book is great because some parents will check it every day, and some parents don't ever check it. And that's fine. That's their choice. But I think that's a good thing to keep parents who want to be involved, involved. And I think emails are a great way to reach out to parents, as far as that goes. Thank God for technology. You don't have to call. You don't have to send postcards. You can generally email them and they will respond quickly.

She expressed the opinion that technology provides a convenient means for keeping parents informed of their students' progress, eliminating the need for other forms of contact.

Molly's motivation to use technology during student teaching. When asked what motivated her to use technology during her student teaching, Molly replied:

Well, they responded to it. You know, people, including myself, get tired of listening to the teacher. And there are only so many hands-on activities you can do with that age level that you have the funds to do it with. So, watching a video,

seeing a PowerPoint, or giving them small activities—getting on the Internet and finding information themselves--which is like when we were kids. We would go to the library, and we would have to look it up and . . . find it ourselves. Only now, we've got the whole wide Internet as our library--which is funny because a lot of them go to Ask.com for answers or Wikipedia—and you just can't do that. They don't understand.

Molly feels that the use of technology gives students a break from listening to the teacher and provides a substitute for the lack of availability of hands-on activities.

Molly's plans to use technology in her future teaching. When asked if she plans to use technology in her future teaching, Molly stated that she absolutely would use whatever was available. When I asked her for an example, she said:

Well, almost every lesson comes with a PowerPoint, but they should be minimal, and they should have lots of graphics. I will certainly give them assignments, if I can, to do, if not at home, then in the library, or in the computer lab--making sure they have access, obviously. They will be allowed to create their own PowerPoint presentations. . . Animotos, slide shows, or look information up on the Internet—do research and come back and tell me where you [they] found this information and answer questions.

Molly's planned use for technology in the classroom appears to mimic her uses during student teaching for student projects. She continued:

Of course they are going to be using Word. But they need to know that when they write the first word of a sentence, that they have to make the first letter as a capital. Nobody is going to do that for them. That is such a pet peeve for me, such a miniature thing for me to get hung up on, but it irritated the heck out of me when they would write out a sentence and they would not capitalize the first letter of a sentence. Word does it for them.

Although she expects her students to use word-processing applications, Molly is concerned that the self-correcting features of some applications will interfere with students learning the mechanics of writing.

Research questions regarding Molly's case. I was able to answer the research questions based on information gained from Molly through her response to the questionnaire, the provided lesson plan with a technology component, and responses to the interview questions.

Molly's vision of teaching with integrated technology. When Molly was asked on the questionnaire to describe the ideal classroom, she used the descriptive words, "Clean, well lit, spacious, colorful, organized, and safe." Towards the end of the interview, Molly was again asked to describe the ideal classroom. She used the same descriptive words as in the questionnaire response, except that this time she also added that there would be a classroom screen, which she had commented earlier that she considers a standard item in most classrooms today. She also mentioned that she would have some laptop stations at the back of the classroom because she liked how her cooperating teacher in student teaching had his.

Molly had talked about the importance of students constructing understanding through hands-on activities. She stated:

As great as technology is, it is not everything. At some point, they need to build a car out of cardboard and rubber bands, and they need to set up a machine. They need some hands-on mechanical . . . Everyone has a different learning style. Some people are great readers. Some people are very good at articulation, and some people need a mechanical, hands-on building experience to understand leverage. If you don't ever take a pry bar and pull something up off the ground with it—you can talk about the math. You can draw out pictures of the diagram, but when you actually do it, you go, "Okay. I get it. A pry bar gives me more leverage."

She believes that it is important to address different learning styles in providing students with authentic learning experiences. She explained her understanding of technology integration as follows:

So, integrating it into the class means to me that the teachers and the students are both using technology. It doesn't mean, you know, when I was in school, technology was watching an actual film from reel to reel that would snake through the machine. That was technology, but that wasn't necessarily-- I wasn't actually using it. The teacher wasn't using it. It was just being used in the classroom. But integration, to me, means that you are actually using it to create a product.

Molly thinks that technology integration is not taking place unless the teacher or the student is creating a product with its use.

Throughout the interview, uses of technology mentioned by Molly included: utilizing interactive boards and classroom screens with projectors; creating short videos with applications such as Animoto, Windows Movie Maker, or Prezi; creating PowerPoint presentations with images, text, and/or video clips; use of a classroom clicker system; use of cameras to document the stages of a hands-on project; showing a video to allow students to make predictions about outcomes and to understand concepts; the use of the Internet for basic, guided research; use of word-processing applications; development and use of a class website for posting online material; email for communication with parents; and providing an online site where parents could check students' grades.

This is an impressive list of technology tools and uses, especially for a preservice teacher who just completed student teaching. A variety of tools are to be utilized in the classroom for authentic learning experiences, with technology being among those tools.

Molly had emphasized the need for students and the teacher to have a variety of tools from which to select according to their needs. That approach places the focus on the learning objective rather than the use of technology for the sake of using technology. With the emphasis on spaciousness, cleanliness, safety, colorfulness, and work stations, the vision seems to lend itself to being student-centered as opposed to teacher-centered, which makes it potentially a more engaging and powerful learning atmosphere for the students (Cifuentes et al., 2011; Doering et al., 2003; Partnership for 21st Century Learning, 2007).

The lesson plan Molly developed that provided for work stations reflects the kind of learning environment described above. The learning objective was for students to be able to apply the principles of leverage to move a box and to think about other ways the principles of leverage are applied. Students had vocabulary to learn. In addition, students had four work stations to rotate through in a thirty-minute period. Multiple intelligences were to be addressed at different centers through small group work and experiences provided through hands-on manipulatives, a video-taped demonstration, mathematical organization, and written/verbal organization. As a whole class, learning was to be facilitated through graphic organization and oral input. Individual learning would be addressed through a homework assignment.

If we view Molly's vision of technology integration on a surface level, it appears to have a good beginning. Students are using technology to understand concepts through viewing video clips, making predictions, recording steps of a process, researching information, and presenting their understanding through the creation of a digital product.

However, when we listen to Molly's definition of technology integration, we find it to have a narrow focus. She stated that, "... integrating it [technology] into the class means to me that the teachers and the students are both using technology ... But integration, to me, means that you are actually using it to create a product." Molly is aware of several ways that technology can be used to address learning needs and does so, but she does not include those uses when she describes her vision of technology integration. Molly's stated vision of technology integration is technology in the hands of the teacher or students for the purpose of creating a product. Figure 4 illustrates Molly's vision of

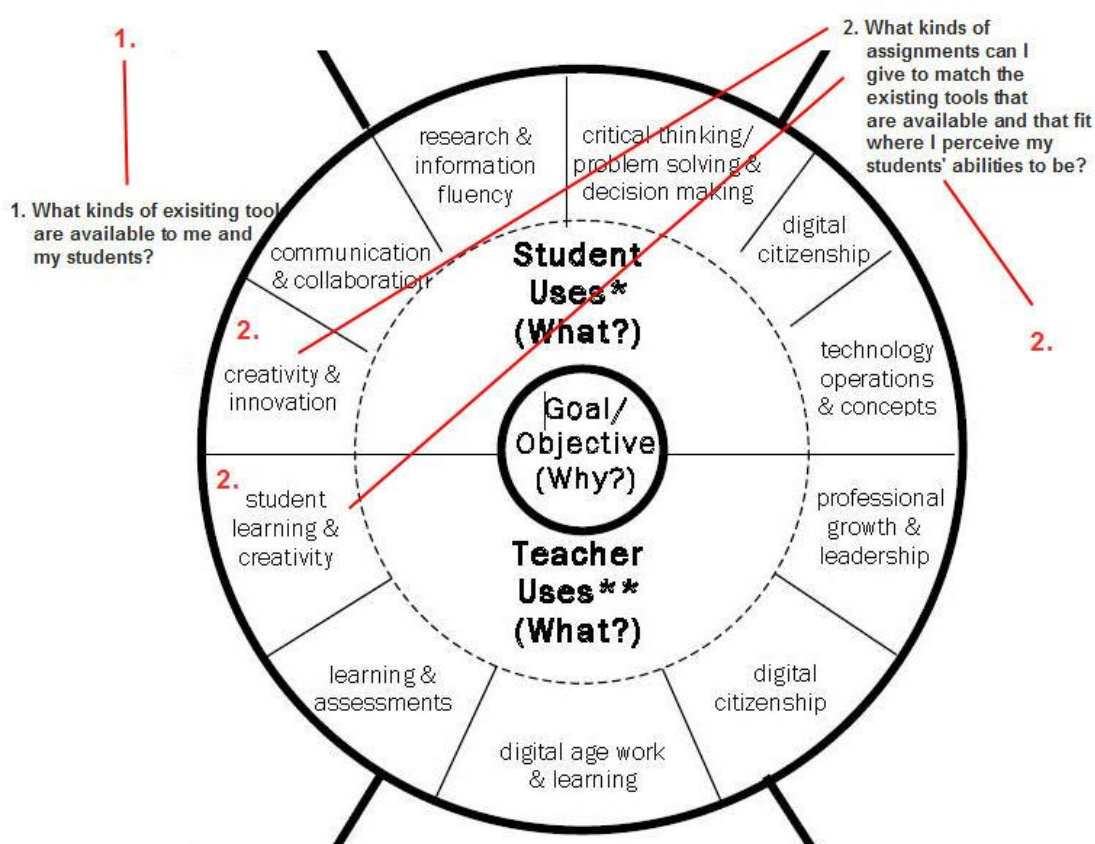


Figure 4. Molly's vision of teaching with integrated technology.

teaching with integrated technology. First, Molly determines what technology is available to her and her students. Second, she decides what kinds of assignments she can develop that match the tools available to her students and their abilities to use those tools.

Factors that influenced the development of Molly's vision. When I asked Molly how she came to understand what technology integration means, she said that it began with her first educational technology course, which took place during QUEST 1.

. . . she [the instructor] had us coming up with ways to make assignments for the students to use it. And that was how we learned to use it, as if we were a student in her class. What assignments we would give them using this technology, using that program. So, that was probably what started it, and of course, the experience itself, being in the school, and [seeing] what technology is available, and what they [students] already know, and where you are with your students as far as their access and their ability.

Molly's vision of teaching with integrated technology is clearly connected with her first experiences in learning to use it educationally. Her comments about being aware of what technology is available in the school, what students already know about technology, where their literacy skills are, and what access they have, such as from home, fits with her attitude towards using technology with the low socio-economic students she encountered during QUEST 2. She stated that using technology with them was not an option because of their low literacy skills, lack of social skills, and lack of technology support from home. Basically, Molly began her vision of technology integration by focusing on what technology was already available, what kinds of assignments would match the available technology, and what she perceived her students' abilities to be.

How Molly's vision played out during student teaching. Molly's vision of technology integration in the classroom was successfully played out during student

teaching when students were allowed to present findings from a research project in any form they chose. Some chose to use technology and expertise from home to create short videos. Some used the computer lab to create PowerPoint presentations, and some utilized the computer for writing a paper. Molly's vision of technology integration successfully played out again when students used cameras to document the various stages of building rubber band cars and running tests for speed, velocity, and acceleration. They mounted the pictures on a poster board along with graphs showing test results. Once more, Molly was successful in technology integration through her modification and creation of PowerPoint presentations to share in the classroom with students and on the class website for students and their parents to access from home. All of these activities fit her vision of technology integration, which is that technology should be in the hands of the students or the teacher to use for the creation of a product.

How experiences in student teaching influence Molly's intentions. Molly's experiences in student teaching clearly influence her plans to use technology in her future teaching. She intends to utilize PowerPoint presentations, and she plans to give her students assignments to complete with technology, if not from home, then with the use of the school computer lab or library computers. They will be given assignments to create PowerPoint presentations, Animoto video presentations, and slide shows. They will be allowed to use the Internet for research and will be expected to explain from where they got their information. Students will also be encouraged to use word-processing applications such as Word for writing papers. These examples echo Molly's experiences with technology integration during her student teaching.

Case Study 2: Nancy

Nancy is a twenty-nine year old who recently graduated with teaching credentials in math for grades four through eight. During student teaching, she was assigned to 7th grade math pre-AP, which included Gifted and Talented (GT) students. She had no previous teaching experience prior to entering the teacher education program. In response to the questionnaire item concerning her experience with technology in her K-12 education, Nancy responded:

When I went to school, we had just received computers in the library and teachers were designated to teach students typing skills. We were also just introduced to the Internet, which at that time had been made accessible by most in the U. S. Technology was not a component in the classroom unless you specifically took a course in technology/computer science.

During the interview, she added, “When I was in the fourth grade, that’s when they first came out, like, introduced the schools to computers, and so there was the Oregon Trail.” Although she remembers playing Oregon Trail, she says that educational uses of the computer were restricted to learning the key board and for technology courses.

Nancy’s field experiences. During the interview, I asked Nancy what technology tools were available to her and her students in the classroom. She replied,

She [the teacher] had a Smart Board in there, but she never used it. She had an overhead projector she used . . . to work problems. . . [and] a pull-down screen for using with the overhead projector.

She commented that her cooperating teacher’s only use of technology was the overhead projector. Nancy had limited experiences with the Smart Board gained through her math methodology class. She recalled:

We used it [the Smart Board] to put our PowerPoint slides if we wanted to do a presentation. I think they [the methodology math professors] used the Smart Board pad where they write on it, and they would record the lessons and put it up on their website.

Nancy was impressed with the Smart Board pad used by her professors.

In reference to her experiences during student teaching, Nancy continued, “At first, I wasn’t really familiar with the Smart Board.” She began using it with her students as soon as she started taking over her cooperating teacher’s classes. Initially, she only wrote on it. However, her students began assisting her. Nancy commented:

They [students] had other teachers from sixth grade . . . who would let them go up and work the Smart Board. So, when I started working it, they would actually come up and help me.

An additional source for her in learning to use the Smart Board was another teacher who co-taught with Nancy’s cooperating teacher. She explained:

The first year teacher, basically, had a bunch of Smart Board slides, and she used the Smart Board every time she taught. And so I was able to kind of get some ideas from her, and she would send me some slides, you know, like some templates to use for some of my lessons. And she . . . told me about Smart Exchange.

The co-teacher introduced Nancy to the www.exchange.smarttech.com site and sent slides to her, as well.

Nancy added:

If you wanted to give the kids something to work on, you could put it up on the Smart Board and they could use it, like write on it. So, she taught me how to scan it in as a .pdf and copy it, and paste it onto a Smart Board slide. I had no idea that we could ever do that.

Although the cooperating teacher did not utilize the classroom's Smart Board, Nancy learned to use it through her own initiative and support from others.

In addition to the Smart Board, Nancy had access to library computers and a computer lab. She also noted:

If you wanted to do computers [in the classroom], you would have to . . . get the notebooks from the library, which most teachers generally didn't like doing because they were never . . . updated. There always were problems with them.

Teachers at her school chose not to check out the notebooks. Instead, there was competition among teachers to use the lab. Nancy commented, "If you want to use it, you have to book it at least a month in advance." As a result, she chose not to do so.

Another tool Nancy used in the classroom was the showing of a video clip. She recalled:

The topic was over making predictions. . . So, [to what] I initially introduced them was a video from NASA. . . basically, they were able to look at different individuals and professors and mathematicians—people that work with statistics who are able to make predictions on, say, at the baseball leagues, the national basketball association, NFL. To predict certain teams' outcome based on past statistics.

Nancy continued:

We talked about how it [predictions] is used in the real world. And then, basically—I kind of made a modification to the lesson that I used with my GT students. . . the regular pre AP students working with partners . . . used construction paper and . . . created their own real-world scenario.

Following the viewing of the video clip and discussion, students built an imaginary business, recorded statistical information for the imaginary business, and created

questions and problems to be resolved that centered on making predictions about needs, costs, and inventory. Nancy continued:

The modification I had for this lesson, for the GT students, where they had to go online—they were given a pass to the library for a certain number of class periods. They would research their own statistics, and they would make predictions based on the research they had gathered . . . They created a presentation for their classmates.

Nancy added:

We have advisory periods, and so since I was the extra teacher in the classroom, I was able to work with them during advisory and help them. One kid created his own website based on global warming. And another student did Microsoft Excel. So she used a spreadsheet to create and view her own statistics, so she needed help in entering in her own formulas. And I had a student do PowerPoint.

Because she was an extra teacher during the advisory period, she was able to help the GT students one-on-one in the library during their use of the computer for their projects.

Despite the fact that computers were not made available to most students during class time, Nancy was aware that her students researched on their own outside of class.

She encouraged her students to share what they found. She commented:

They [sites students suggested] were okay. They were more like social networking, or blogging. A lot of it was things that they are interested in but might not be the objective of a lesson.

Often, what students shared were sites designed for entertainment and socializing.

However, some students did share educational sites, which Nancy discussed with them, asking, “Do you really understand how that formula is written?” She used questions in helping students to determine if a site was an appropriate one for their purposes. Often, it was not. She commented:

A lot of them used Wikipedia, and I'm not a fan of Wikipedia, and basically had to explain to them that anybody can come in and modify and do their own. . . An everyday, average person with no credentials could go in and modify a Wikipedia [entry]. And so that was something I tried to kind of get them away from . . .

She continued:

Other than that, I would recommend like, Purple Math or Wolfram. Generally, I have started to provide resources for them to go look up stuff on the Internet. I created my own website for them to go to where they can access those resources.

She encouraged her students to stay away from certain kinds of sites and directed them to more helpful educational sites.

One of the items on the questionnaire asked, "Has your opinion of technology use in education changed in any way since you entered the teaching education program at the University of Houston? Please explain." Nancy's response was:

I never had an opinion on technology use because I wasn't sure how to incorporate it, and at the time wasn't able to compare and contrast. After I finished my student teaching, I was hired part time for students that needed remediation. I noticed that when students completed independent practice, they often asked to listen to the music on their phones or ipods. It's against school policy to have these out. However, I noticed that they were constantly disengaged (even when on the computer!) if they did not have music of some kind to listen to. So I allowed ipods and cell phones out while working quietly. As a result, students were highly engaged. I introduced to my students Spotify, and we were able to add songs as part of our classroom playlist.

When Nancy allowed students to listen to music on iPods, they became more engaged in their class work. She even added a classroom playlist through Spotify, a music streaming service. She continued her response as follows:

In this way they are multi-tasking. Their brain is processing many things at one time through the use of technology as they have developed over time (these cognitive process are much different than the older generations). How they process academic input is much slower because they are multi-tasking; however,

without the continued use of technology, their cognitive processes are much slower. Because of this experience, my opinion changed and I have adapted to HOW my student learn and use it to my advantage.

Nancy formed both a theory and an opinion about the importance of technology in student learning, that although students process academic input more slowly when multi-tasking with the use of technology, their cognitive process is faster with the use of technology than without. Her observations influenced Nancy to think about how her students learn.

I found interesting that Nancy had decided to go against school policy and allow her students access to their cell phones and iPods during class time to listen to music as they worked. Her response on the questionnaire led me to ask her during our interview, “Do you feel that school policies sometimes hinder students in their productivity—that they can listen to music and focus on their school work, for example?” She responded:

Yeah, I think so. I also think, you know, I kind of break the rules when I work with the kids. They’re not supposed to have their devices out, or whatever. But I think the reason why they [school administration] have those [rules] in place is because some teachers don’t know how to control what’s going on around them, and they’re kind of afraid that the kids are not learning.

Nancy believes that the reason schools have rules against students accessing mobile devices is because some teachers lack classroom management skills and because of the general concern that the devices will distract students from learning during class. She explained that as an experiment both during student teaching and as a part-time remediation teacher following student teaching, she played music during independent practice time. She added:

My cooperating teacher wasn't sure about it at first. She was like, "Well, if that's how you want to do it, then you do it that way." She would ask me a lot of questions about it. She kind of felt that they would be off-task. Doing that specifically, that was sort of my student-teaching project.

Nancy's cooperating teacher allowed Nancy to experiment with the use of technology in managing classroom behavior during independent practice sessions.

Because the school decided to hire Nancy part-time during the semester of her student teaching, her cooperating teacher retook control of her classes earlier than expected. Nancy reported:

So, once I left the classroom . . . she noticed that the kids just went crazy, that they didn't have their music. And so it was almost like she didn't have a choice because she kind of had to go with the flow with it—with what the students responded to. And so, she was like, "Okay. I'll let it happen." She was like, "This is great." She started talking to some of the other teachers about it.

The cooperating teacher had to keep in place Nancy's established routine for classroom management strategies, which she decided to share with some fellow teachers. In addition, a couple of teachers had previously approached Nancy with interest in her strategy. Nancy continued:

I had two teachers come up to me and tell me that they started doing what I was doing, and that it was like a miracle. They were able to manage their students better. Substitutes were able to come in and maintain the classroom.

Nancy was able to influence other teachers to try her strategy with music in the classroom.

Nancy's attitude towards the use of technology. Nancy stated on the questionnaire:

I never had an opinion on technology use because I wasn't sure how to incorporate it, and at the time wasn't able to compare and contrast.

She had entered the teacher education program without an opinion about the importance of using technology in the classroom because she had not experienced it in her own learning. After having experimented with technology in student teaching and the part-time teaching that immediately followed, she determined that technology in the classroom is important. She feels that today's students are able to multi-task because of their use of technology.

Nancy's motivation to use technology during student teaching. Nancy was encouraged to use technology during her student teaching by her field supervisor and the school administrator, with both emphasizing the importance of technology in the classroom. Prior to entering student teaching, she was intrigued by a book she had read for a methodology course, Rosen's *Rewired: Understanding the iGeneration and the Way They Learn*. She stated:

I read a book *Rewired: The iGeneration*, or something like that. . . And so, after having read it a year before doing my student-teaching, I kind of had the idea that that's [technology] what the kids are geared towards nowadays, and so it was something I just wanted to try. And the kids always asked anyways, you know.

Reflection made Nancy anxious to try out theories of how to engage students through uses of technology. Students in her classroom further encouraged and motivated her to use technology in teaching through guiding her on use of the Smart Board based on their experiences as students in other classes. She gained additional support and encouragement to use technology from her cooperating teacher's co-teacher who introduced new skills and resources for use of the Smart Board.

Nancy's plans to use technology in her future teaching. When asked on the questionnaire to describe her ideal classroom, Nancy had responded:

My classroom will have desks that are grouped into fours, preferably, and a smartboard will be set up at the front of the classroom. My whiteboard will have homework assignments, objectives, topic, and TEKS written down. Additionally I will have a separate whiteboard calendar that includes everything we will be learning for the month. I will have shelves that will contain resource materials for teaching, and books for students to read as well as literature that I will be implementing in my lessons. We will have TI-Nspire's available for each student to use as we go through Algebra. There will be three computers (one lap top). One computer will be the teacher's computer and one will be a computer for the students. I generally use this extra computer for students that need modifications.

Nancy's description is rich in technology, with the mention of Smart Board, whiteboard, electronic calculators, and computers. The atmosphere lends itself to being student-centered with the grouping of desks in clusters of four and shelves of resource materials for student use. Nancy continued her description as follows:

Each group will have an art caddy that has markers, coloring pencils, scissors, glue sticks, manipulatives, and handouts. I have discovered during my previous experiences that these are quite necessary. I plan on decorating my classroom with various works of art (some I've created myself), student work, and a "vine of kindness" that will hopefully wrap itself all the way around the room. I will have plants in various corners of the classroom, and home decor to make the room look inviting. I would like to put in some stand-alone lamps with natural lighting. This is generally how I would like my classroom to look. It will be very organized and neat, with a system in place to maintain it.

Nancy envisions an inviting classroom equipped with various tools and materials for hands-on learning.

Research questions regarding Nancy's case. I was able to answer the research questions based on information gained from Nancy through her responses to the

questionnaire, the provided lesson plan with a technology component, and responses to the interview questions.

Nancy's vision of teaching with integrated technology. Having noted that Nancy described her ideal classroom as having a Smart Board, computers, and calculators, I asked Nancy during the interview that if she could have had any technology available to her during her student teaching that she did not have, what it would have been. She replied:

Recorded lessons. I would like my students to have access to the lessons that we recorded that day or have access to the concept we are going to teach the next day so they can go home and watch it and come the next day prepared for what we are going to learn. So, I will be providing them with QR codes, like, links to that in the classroom or around the building so that they can get it on their phones because some kids don't have computers. They just use their phones to watch videos, and they can access it through their phones with a QR code.

Nancy would like for students to utilize tools outside of the classroom in preparation for the day's lesson. She continued:

I would like for us to be using our class website. There's a discussion forum on there. There's always resources. There's going to be a link for videos and then quizzes afterwards, and I'll be able to compile data at some point so I can open up my website and say, "Okay. You guys missed--everybody missed question 2, and so obviously we need to focus on this." And so they will be able to see the statistics on how everybody is doing as a whole."

Nancy also sees using features of a class website to provide focus for students on areas of needed improvement. Nancy added:

I would like for them [students], you know, to get a look at the online calendars at home and, I guess, kind of better prepare themselves so that they have access to the resources outside the classroom. So, you are kind of like stretching or expanding and covering more time as far as education, not just learning it in the

classroom and not ever work with it again, but you can go home and get online, and they can get into it online.

Nancy, furthermore, envisions utilizing various features of a course website as a way to maximize the face-to-face time she had with students in the classroom. I asked her if this was her vision of technology integration and she responded, “Yes. Absolutely!”

Nancy clearly has a vision of technology integration for her future teaching. I noted that in one of her responses to the questionnaire, she stated:

. . . it is necessary for the educator to constantly implement NEW forms of technology as often as possible, since our world is constantly evolving in this realm. Only using the Smart Board for example, is not necessarily "implementing technology" if it's not interactive and the students aren't manipulating it themselves. In addition to that, there are various modes of technology that can constantly be implemented. Students are your best source (sometimes) at determining new avenues of technology to introduce within a lesson so that it's interesting and engaging but also enhances the learning experience and meets learning objectives.

Part of Nancy’s vision of technology integration is constantly researching new tools that can help her students to learn and using her students as one of her resources in seeking out or creating new tools. Nancy is “thinking with technology.”

Figure 5 illustrates Nancy’s vision of teaching with integrated technology. First, she determines what her goals and objectives are for herself as a teacher and what she ultimately wants her students to be able to do. Second, she imagines how technology might be able to help her achieve her goals and the goals and objectives she has established for her students. Third, she thinks about her role as a teacher and her students’ roles in utilizing technology to achieve goals and objectives. Finally, she considers what tools might be available to her and her students, how the tools will be developed, how the

learning environment will be set up, and what kinds and levels of interaction will take place.

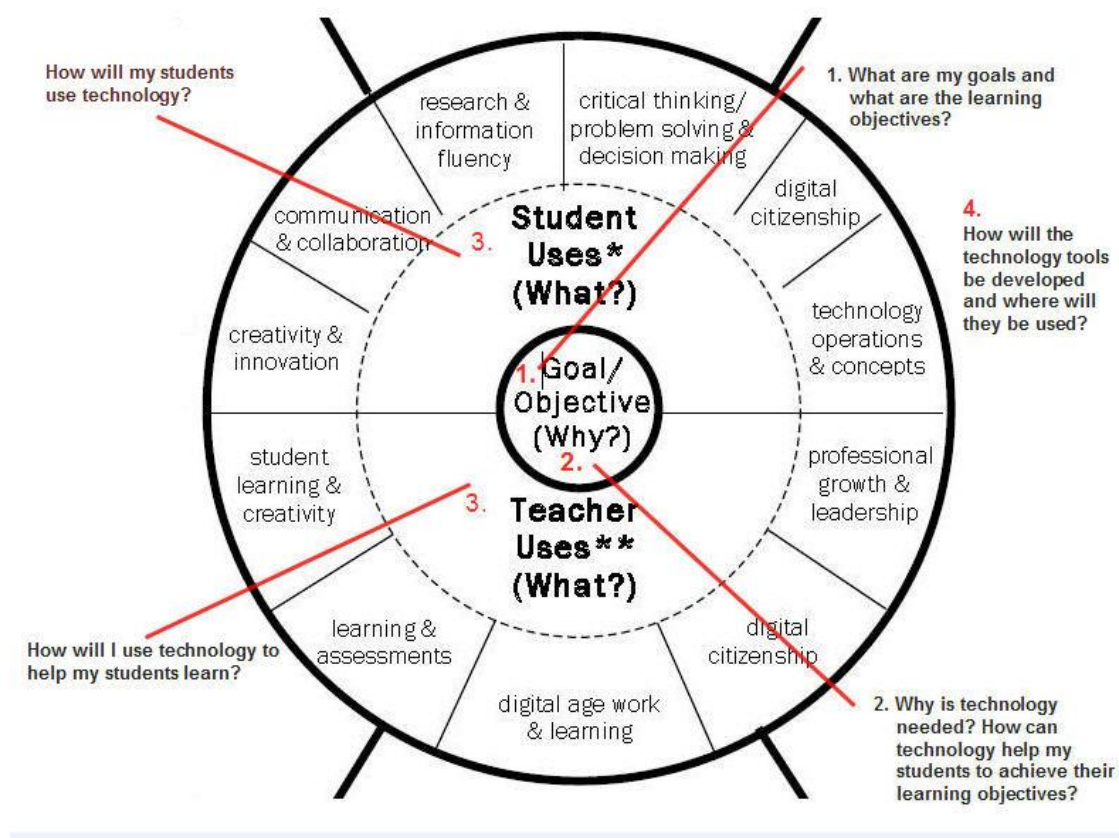


Figure 5. Nancy's vision of teaching with integrated technology.

Factors that influenced the development of Nancy's vision. Throughout the interview, Nancy mentioned several factors that influenced her development of a vision of teaching with integrated technology. She first got the idea of creating a website through her creation of a professional website on Google in her first technology education course. This spurred some of her ideas on utilizing the website to foster a

hybrid learning environment, utilizing strategies and resources both online and in the classroom.

In addition, her math core content professor's use of a Smart Board pad to record lessons, which the professor placed on the course website for student-viewing, influenced Nancy's vision of teaching with integrated technology, again leaning towards a hybrid learning environment. The limited uses of the Smart Board in the math course at least piqued her initial interest in using the Smart Board. Being required in a methodology course to read from a list of books resulted in Nancy's selection of Rosen's *Rewired: Understanding the iGeneration's and the Way They Learn*. Reading this book was a pivotal moment in her insight that technology will be ubiquitous in her future students' lives and could be used to engage them in learning. Other factors that influenced Nancy's development of a vision of teaching with integrated technology came through her experiences in student teaching with seeing how her students responded to simply being able to listen to music on their iPods when working independently during class, their engagement in seeing a video that focused on real-world applications for what they were about to study, and their enjoyment of hands-on use of technology in learning and demonstrating their knowledge and skills.

How Nancy's vision played out during student teaching. I asked Nancy if her attitude towards using technology in teaching fit her use of technology during student teaching. She replied:

Absolutely! I had a real positive influence on the students as far as integrating technology into the lesson and letting them use their iPods or the cell phones, or

whatever, while they're doing their independent practice. I also had students to introduce technology to me.

Nancy went into student teaching with theories, influenced by Rosen's book, thus, engaging students through the use of technology, sometimes as an educational source, and sometimes as a strategy for classroom management during independent practice sessions. She showed an educational video clip to help students relate to real-world applications of concepts to be learned in class. She allowed GT students to use the library computers for research and technology-based presentation of their projects, with a student-developed website and use of a spreadsheet for calculations and presentation of data. Nancy was also able to use skills she had learned in her technology education courses to build a website with links to resources for her students to access from home. Furthermore, she was able to use her own students and a co-teacher to help her develop more technology skills to provide interactive learning activities for her students.

How experiences in student teaching influence Nancy's intentions. When I asked Nancy what her goals are for using technology in her future teaching, she responded:

My goals are to be able to address learning deficits. And also, my goal at the other end of that is to enhance their [student] strengths. I would like to be able to use the technology in the classroom and be able to reassess their learning. There are so many things you can do as far as online quizzes and watching videos and doing discussions. I can go back and look at it and say, "Okay. They're really good at this. Let's use this [learning strategy] to work on weaknesses." Or I can go back and say, "We really need to do a reteach on this topic." So, my main goal is to address what it is they need to continue to work on and what it is they are really good at, and emphasizing those two.

Nancy's anticipation in using technology in her future teaching is very straightforward. She is aware of her goals as a teacher. She plans to identify the learning objectives and

then she plans to use technology to help her students to achieve those learning objectives. She sees this as helping students to both enhance their strengths as well as to address their deficits so that they can be successful in their learning endeavors. In addition, Nancy has already begun to explore possible uses of technology and levels of interaction she has not experienced in her own learning, such as providing QR codes for her students so that they can use their personal computers from home and cell phones at school to access learning videos she will develop and upload to the Internet. Nancy noted that middle school students have difficulty taking notes in class. Being able to access teaching videos on their own time will allow the students to not only replay the videos as often as needed, but will also allow them to take notes at their own pace.

Case 3: Olivia

Olivia is a preservice teacher in her mid-twenties who recently completed student teaching in seventh grade math. She had no teaching experience prior to entering the teacher education program. In response to the questionnaire item asking about her experiences in using technology as a K-12 student, she responded:

We would go to the computer lab one time every few weeks or so and play games that involved typing our names and other basic activities. In middle school, there was even less technology use until I got into the 8th grade. We were required to take a computer course that actually taught me quite a bit about basic computer skills. We learned not only how to use a word processor and other basic programs, we also learned how to operate a computer and used them every day. That was where I first learned how to save a file to a different location.

Olivia's experience with technology mostly involved basic computer skills. She continued:

We also did a science experiment in our science course and did a technology presentation in our computer course. We turned in the project to both teachers. Our science teacher, of course, graded us on the science content of the project and our computer teacher graded us on the technology portion of the project.

Olivia experienced some technology integration when her eighth grade science teacher and her technology applications teacher collaborated on student science projects. She explained, “We actually had to learn how to use an Excel spreadsheet. We actually had to type up our paper. It had to be in all the correct formatting.” She added that the technology applications teacher encouraged students to research and read articles, resulting in Olivia’s developing interest in science. Other than that, she felt that the technology course she took in high school had nothing relevant to offer. It was a stand-alone technology course with outdated materials and equipment. Her most meaningful experience was the technology integration she experienced in developing her eighth grade science project.

Olivia’s field experiences. I asked Olivia to talk about the technology that was available to her and her students in the classroom during her student teaching assignment.

There was a screen, like a basic projector screen. You had the projector, and the computer, and the Interwrite Pad, and that was about it. There was a computer lab pretty close to the classroom.

In addition to technology in the classroom, Olivia and her students had access to a nearby computer lab which they used to access the Internet.

. . . . so they were playing this computer game where they had to fill 3D shapes. It was like a website program they could get on, and so they really liked that. . . I think some of them might have [played it at home] because it was a game, and because it showed them a view—like, this is what it looks like from the top, and this is what it looks like from the side and the front. And you had to build it.

She was aware that the students really enjoyed the simulation game on three-dimensional shapes. However, the computer lab was used only for that set of TEKS and at no other time during the semester.

Olivia also noted that students were not used to the Interwrite Pad.

Sometimes we would let the kids write on it, and they really liked it. But the problem was . . . a lot of times you couldn't read their writing, or it took them a really long time to use it. So, when it was supposed to be a one or two-minute warm-up, it turned into a five or seven-minute warm-up.

Using the Interwrite Pad was difficult for the students and so its use was limited. I had asked if what was written on the Interwrite Pad could be saved and printed out, and

Olivia replied that it could, but that neither she nor the cooperating teacher did so. I asked if she had students with learning differences or disabilities who could have benefited from having the material printed out. She replied:

Mostly, it was ADHD. It wasn't anything like they couldn't see. You know what I'm saying? . . . And they take medicine. But we didn't have anyone that extreme. . . . In their 504's, it was just preferential seating, things like that.

She had a few ADHD students who were identified as 504's (referring to Section 504 of the Rehabilitation Act of 1973 protecting qualified individuals from discrimination based on their disabilities). She saw no reason to print out notes for those students.

Olivia had the opportunity to observe another teacher.

There was a science teacher . . . showing minerals or something. . . It was pretty interesting because it [the video] really explained it [the subject matter]—like, I'm a really visual learner, and so if you're just telling me about minerals . . . Just trust me. It's going to be like, "It's boring." But actually seeing it, and seeing a really good video on it—that really helped me. I actually learned something that day in the class.

Olivia found the use of a video clip to demonstrate concepts effective. She also observed a science teacher's use of the clicker response system.

One of the science classes used . . . an anonymous way for the kids to answer questions with the clickers. . . The kids were given a multiple choice pop quiz and could answer without any pressure on them. The teacher was able to see how much of the class understood the material without anyone fearing embarrassment in front of their peers.

Olivia liked that students could offer answers in class without feeling self-conscious. She added:

Another thing I found interesting was that they had this entire room full of math manipulatives. I mean, tons of them everywhere . . . we learned about all that stuff here [in the teacher education program], and they [the professors] told us, "Well, you may not have access to that stuff at the school where you're at. It just depends." And so, I wasn't really expecting anything, but they really didn't use a whole lot of it. There were just times when they said, "Okay. We're going to use these shapes," or something like that . . . and there were kids who were really struggling with certain aspects of things.

Olivia was disappointed to not see much use of manipulatives by her cooperating teacher. She commented that a number of students in her classes struggled with math concepts and that the concrete objects could have helped them to develop an understanding of the concepts.

Olivia was surprised at how little technology was used, considering that the school appeared to be affluent.

I just didn't see a whole lot of it. And I guess it was just kind of surprising because the school I was at . . . had a lot of parent involvement. . . the parents were there every day volunteering, making copies, and doing all these things. So, it wasn't like, "Oh, we're not getting any help," or anything like that. And the school was, I don't remember what percentage they said the school was of low-economic students, but it wasn't very high.

Olivia felt that since there were so many parents volunteering at the school that the teachers should have had more time for planning use of technology in their lessons. She continued:

Many of the lessons were simply having the students complete worksheets or take notes. I notice that many teachers claim to lack the time in the classroom to do interesting activities. However, I saw a lot of down time in the classroom. Many times, the students were done taking notes and completing their worksheets and they had nothing to do so they got into trouble.

She felt that the math teachers, as a whole, did not make good use of instructional time.

In reference to a class website, Olivia added:

I don't think she [the cooperating teacher] used it very much, but some other teachers did . . . for every unit they were studying, they had a study guide the kids were supposed to do. . . So, we might have fractions these days, and so there were three fractions in their study guide, or something like that. So, they'd have a copy of that on the website.

Although Olivia did not think her cooperating teacher used her class website much, she was under the impression that other teachers posted materials to theirs.

Olivia's attitude towards the use of technology. In reference to the importance of technology in the classroom, Olivia had responded:

I think it is important but only when done properly. I think it is a waste of time to incorporate technology that is outdated or not commonly used simply for the purpose of saying [that] you're incorporating technology. If the technology will be useful in the future, it can be a great thing. My 8th grade teacher is a perfect example of that. Although what I learned in her class is currently outdated, at the time I was able to use everything I learned in that course, which she had us apply. She also encouraged us to stay current with technology, which has stayed with me to this day. The other classes I was required to take were poor excuses of how technology use can be "faked."

Olivia clarified her statement in the questionnaire and during the interview by stressing that the technology component should not be added to a lesson for the sake of satisfying a requirement that the lesson include the use of technology.

Olivia's motivation to use technology during student teaching. Other than her students' enthusiasm for using technology, Olivia did not feel that she had any encouragement or motivation to use it during her student teaching. She stated:

I didn't feel like I could contribute much to the classroom. The teachers had their lesson plans and many of them [the lesson plans] had been done [taught] for years and they [the teachers] did not seem open to new suggestions.

She thought that her cooperating teacher was not open to new ideas.

Olivia's plans to use technology in her future teaching. Olivia says that she definitely plans to use technology with her future students. She shared some of her ideas.

Well, I have seen students create like a YouTube video, you know, create a song on whatever subject they're learning. . . I know a lot of times, the parents—they may know the math, but they may not know the way that it is being taught now. So, they're frustrated. It's, "This isn't the way I learned it. I don't know how to help my kids." Well, I thought about making my own videos, my own YouTube videos.

Olivia expressed a desire to develop and post how-to videos for parents. She went on to say,

I would also have videos for my absence. In case I have a substitute that does not know the material, they can just play my video and the kids will still get the material that day instead of a wasted day.

In addition to providing video tutorials for the substitute teacher, Olivia mentioned utilizing social networking for academic purposes.

One of my teachers [college professor] mentioned that if she was still teaching now that she would possibly have liked a Twitter account. . . And so we were talking about ways we would interact with our students and things like that. And I probably would do this . . . I think it might be good for discussions . . . if a kid was struggling through something, like, “I have no idea how to do this,” he could go on there and ask a question. I could get on there and say, “I’ll be on Twitter from 7-9. If you have any questions . . .” You know--something like that. . .

Olivia sees benefits of a Twitter account and of a class website. She went on to explain:

I would just put information on there . . . It wouldn’t just be around my classroom. It would be, “There’s a basketball game tonight,” or “Happy Birthday to these students.” “Congratulations to these students for doing so well in band or basketball or something.” So, I would just kind of have it to where it was their website. Kind of like I mentioned in the questionnaire—that the classroom should be theirs, and so the website should be theirs.

She views the website as an extension of a supportive classroom environment where students feel ownership.

Although Olivia discussed how she would use a class website in her future teaching, she stated that she did not feel she has the ability to use technology in the classroom and could not see herself doing so without a co-teacher. When I had asked her to describe her vision of technology integration, she replied:

There’s only so much I can do in 45 minutes or an hour. So, I’m going to try to work with another teacher and say, “I can get some of your stuff done in my class, and you can get some of my stuff done in your class. That way, instead of them having 45 minutes of math and 45 minutes of science . . .” Math and science integrate so well together. I mean, they could almost be co-taught.

Olivia can see teaming with a science teacher for a double period in working on projects. She mentioned how two of her college professors within the teacher education program did so. One taught an introductory educational technology course and the other a course on diversified learners.

And I think that was great. I think that math and science courses should do that more because I don't think that one teacher can cover absolutely everything. I can't sit here and teach math and still get the technology to them. But if they were in a technology class, and I was working with that teacher, and I said, "Okay. I'm going to give them this math assignment, but you teach them how to do this technology. "

Olivia plans to use technology in the classroom, but very sparingly unless she has a co-teacher to take responsibility for some or most of the technology component of the lesson or project. She does not think that she has enough expertise or the time to incorporate technology into her future teaching. She further commented that she felt school and department policies would make incorporating technology in the classroom unlikely.

. . . just based on what I saw in a public school, there's so many restrictions on scheduling . . . The district says we have to spend two days on this topic. So, it was almost like, I don't really have control over this class. It's what the district says, and it's what the math department has decided . . . I think that the time restrictions that you have would stop me from using technology because I would think, "Well, I've got to get them to learn this topic, and they need to practice it, and so I don't have time to take them to the computer lab because I only have two days to do this, and it will take a whole day just getting them into the computer lab and getting them set up. And it would be a really great experience for them, but I can't lose that time."

Olivia thinks that district and department mandates on what is to be taught and in what time period will interfere with her ability to use technology with her students. Although she observed smaller uses of technology in the classroom, such as the clicker response system and the showing and discussion of a video clip, she did not mention these kinds of uses in her future plans to integrate technology in the classroom.

Research questions regarding Olivia's case. I was able to answer the research questions based on information gained from Olivia through her responses to the

questionnaire, the provided lesson plan with a technology component, and responses to the interview questions.

Olivia's vision of teaching with integrated technology. In response to the questionnaire item regarding her vision of an ideal classroom, Olivia had stated:

I think an ideal classroom is a comfortable place that the students feel belongs to them as well as the teacher. There should be interesting material that relates to the subject matter that is current. I also think a classroom should include a section where the students help design it. This should include their own pictures, accomplishments and other things that are important to them.

Both during the interview and on the questionnaire, Olivia expressed that her ideal classroom would be a welcoming one for her students, one that reflects their personalities and interests. She wants her students to feel valued as individuals. She mentioned having materials in the classroom relating to subject matter being taught but did not elaborate on what those tools or materials might include. She did not specifically mention technology tools when describing her ideal classroom.

The lesson plan Olivia provided for me at our interview was one that she and a classmate in a methodology course had developed together, stating, "The topic is leverage. It's a science topic. . . I developed this lesson with a partner using online resources." Although Olivia's teaching field is math, the core content area of the lesson plan she provided me with was for science. She explained:

You know, I was looking through all my lesson plans to find one that really integrated technology, and I couldn't find one because, like I said earlier, I don't want to just throw it in there as a check mark. So, I don't think we [students in the teacher education program] are really prepared to integrate it [technology].

She was unable to provide me with a lesson plan she had developed on her own that she felt confident integrated technology. She remarked that she did not know how to integrate technology into the classroom. As stated earlier, Olivia does not see herself integrating technology into the classroom in her future teaching unless she has a co-teacher.

I asked Olivia what the first step is that she takes when developing a lesson plan. She said that the first question she asks herself is, “How can I make this subject interesting or what can I do with it that the kids haven’t seen before that they would find interesting?” Just like when she described her ideal classroom on the questionnaire, she did not mention technology when talking about her beginning process in developing a lesson plan. She focuses on how her students feel in her classroom and if they are enjoying learning in her class.

Basically, Olivia’s vision of integrating technology in the classroom involves teaming with another teacher, either a science teacher or a technology teacher, who would share or completely assume the responsibilities of overseeing the technology component of the lesson plan. Figure 6 illustrates Olivia’s vision of teaching with integrated technology. First, Olivia thinks about what her role will be as the teacher and how she will be using technology, and what her students’ roles will be and how they will be using technology. Second, she establishes goals and objectives for herself as a classroom teacher and determines what her goals and objectives are for her students. Third, she thinks about why technology is needed to help her achieve her goals and

objectives and to help her students achieve the goals and objectives she has established for them.

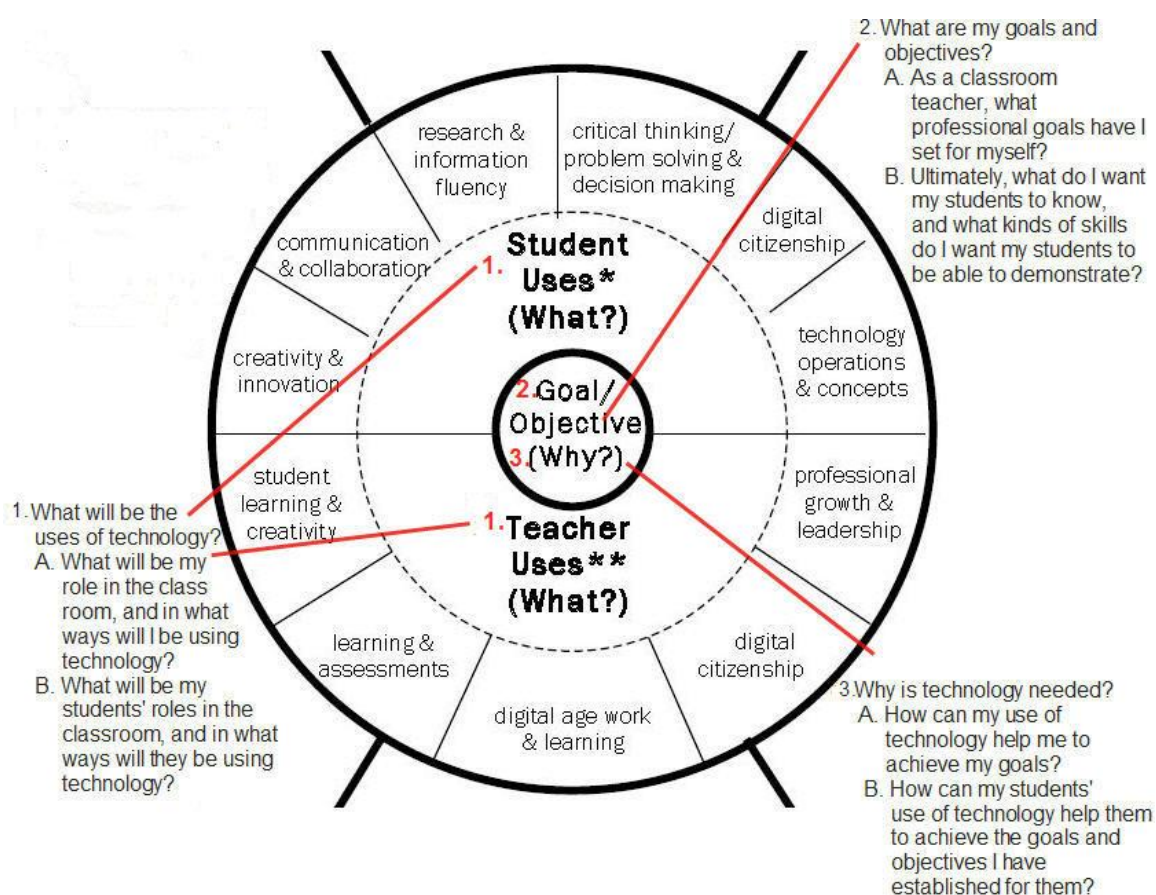


Figure 6. Olivia's vision of technology integration.

Factors that influenced the development of Olivia's vision. Two major factors influenced the development of Olivia's vision of teaching with integrated technology. One factor stems from her K-12 learning experiences and the other from her learning experiences in the teacher education program. Except for one science project in eighth grade, Olivia's K-12 learning experiences with technology were limited to technology classes that focused on how to use the computer and common applications, and how to conduct basic Internet searches. However, she was impressed with how her science

teacher and her technology applications teacher teamed up to facilitate her eighth grade science project. The idea of using team-teaching to address the integration of technology into the classroom was further imprinted on her mind during her participation in the teacher education program. Her methodology instructor and her technology education instructor teamed in facilitating technology-based projects for their two courses. I had asked Olivia what had turned the light on for her in beginning to understand technology integration, and she replied:

Probably a combination between the technology class I was in—the first one—and the differentiating class. And so this class, it was learning the different applications [that] gave you some ideas on what you might do with your students. Also, that first educational technology course [and the differentiating course] did the same thing that my 8th grade science and technology teachers did. They said, “Okay. You have to do this project for this class, but we’re looking at all the applications that you’re doing [in that class] . . .”

The methodology instructor said to the technology education instructor, in effect, “This is my subject matter and learning objective. What applications are you teaching in your technology class, and how can we use those applications to address my learning objective?”

The methodology instructor also influenced Olivia’s views on developing a lesson plan with a technology component. The instructor stressed to her class the importance of not using the technology component in a lesson plan as simply an add-on, that integration was not taking place unless the use of technology was meaningful. Olivia said, “. . . she [the instructor] was the one who had actually said, “You know, you can technically use technology, and it’s not really [using technology].” Olivia commented:

She [the methodology instructor] said, “How do you define a good lesson plan?” . . . She was talking about what makes a good lesson plan. And she [the instructor] was saying that there was no good formula for it--you could say that [you include] the use of technology and the use of this and the use of that—and she gave us a really bad example, but it included everything we said.

So, Olivia also walked away without an understanding of how to develop a technology-enhanced lesson.

How Olivia’s vision played out during student teaching. Olivia’s vision of teaching with integrated technology did not play out well during student teaching. She had stated that she did not feel that she knew how to integrate technology and that she did not see integrating technology in her future teaching unless she was team-teaching. She also did not feel that she could take the initiative to try any of her own ideas during student teaching. For example, even though she thought the use of available manipulatives would have been helpful to some of her students in their struggles to understand math concepts, she did not venture to suggest their use to her cooperating teacher because she felt she was intruding. Olivia did not take ownership of her classroom during student teaching.

How experiences in student teaching influence Olivia’s intentions. Clearly, Olivia’s experiences in student teaching helped to provide some ideas on how she might use technology in the classroom. She was impressed with the technology she saw used by her cooperating teacher and a science teacher. She liked how enthused and engaged the students were when they played the simulation game for learning three-dimensional shapes and when they used the Interwrite Pad. She found showing YouTube videos for understanding concepts very effective for visual learners and talked about wanting to

create and publish some educational videos on YouTube for her students. She was impressed with how the clicker response system allowed students to participate anonymously while still providing needed feedback for the teacher on how well the class understood a concept. She noted that some teachers used their class websites to post information about homework, upcoming tests, and study guides. Olivia discussed her plans to use both a class website and social sites, such as Twitter, for communication with parents and students and as a way of posting resources. Her experiences in student teaching clearly had a positive effect on her and have gotten her thinking about possible uses of technology in her future teaching.

Olivia said that she does anticipate using technology as a practicing teacher. However, she also stated that she does not see herself using technology in the classroom without the support of a co-teacher. In addition, she said that technology use in the classroom for teaching is unlikely because she anticipates not being able to fit it in with the school or department's time table for addressing specific learning objectives.

Case 4: Penny

Penny is a preservice teacher in her early twenties who completed her student teaching in 7th grade language arts. In response to the questionnaire item asking if her opinion about the importance of technology in education had changed since entering the teacher education program, she had responded:

When I was learning as a K-12 student, the teachers I had did not incorporate technology into the classroom. I never felt connected to technology or the world of technology. My family did not own a computer or a television until I was a freshman in college.

Penny did not grow up with technology in her home. In response to the item on the questionnaire asking about her experience with technology integration in the classroom during her K-12 educational experience, however, she contradicted herself when she replied:

I remember that a few of my teacher's used PowerPoint presentations. My math teacher's allowed me to use a graphing calculator. There were times that a few of my teacher's incorporated the use of technology in project rubrics such as typing a formal report, creating a Microsoft PowerPoint presentation, or developing a short video. [*sic*]

She later stated during the interview that these uses of technology in her K-12 education can be considered examples of technology integration but that she considers them to be low-level uses, which may be why she initially contradicted herself. Penny had no experience teaching in the classroom prior to entering the teacher education program.

Penny's field experiences. I asked Penny to discuss the technology tools available to her and her students in the classroom during her student teaching assignment, and she replied, "We had a document camera which I definitely used in most of the lessons I created . . . and there was a computer and a projector." A document camera allows for the projection of an object to be viewed on a screen. Penny decided to have her students develop a folded manipulative to help them form noun plurals. She explained:

The students saw what I was working on, and I guided them step-by-step . . . they were able to see my hand movements on the projector screen. And from there on, I set up a system of rules on the manipulative. That way, I showed the students the rules, and we were able to view it on the board, and I showed them a summary and examples of the activity we were doing.

In addition to the use of the document camera, Penny also utilized PowerPoint slides to project grammar problems onto the screen, which the class then discussed. In addition,

she observed other uses by her cooperating teacher, such as the showing brief video clips from an educational site called BrainPop. Penny did encounter one problem in using the class computer. Sometimes the custodian would inadvertently disconnect some of the cables while cleaning during the weekend. Penny did not know how to reconnect the cables, and so one Monday she had to wait to use the computer technology until the cooperating teacher came into the classroom and reconnected the cables for her.

Although the school had a computer lab, the cooperating teacher chose not to use it the semester during Penny's student teaching. Penny commented:

I think they used it the semester before. During this time [during my student teaching], they were just preparing for the STAR test and they were pretty much just reviewing and writing.

She felt certain that the cooperating teacher chose not to use the computer lab because the students were preparing for the state-level exam. Penny further stated:

I think that they [the students] would have greatly enjoyed using a Smart Board or using some kind of technology component to review instead of just doing worksheets or doing questions.

She thought that the students might have enjoyed some kind of interactive review for the exam as opposed to worksheets.

Penny observed another teacher during her student teaching.

iPods were used by the students to take some kind of survey. The iPods were based on the effectiveness of an assessment. I'm sorry. It was an iPhone . . . I think it sort of was like a clicker. . . The iPhones were provided, and there were 10 of them.

Penny was impressed with a math teacher's use of an iPhone application as a classroom clicker response system.

Penny's attitude towards the use of technology. An item on the questionnaire asked for Penny's opinion about the importance of technology in education. She responded:

It is imperative to incorporate the use of technology in education because it not only helps students visualize the concepts, but it also serves as making connections with students. Technology helps students be creative and become critical thinkers.

Penny feels that it is of the utmost importance that technology be incorporated into education for higher order skills and creativity.

Penny's motivation to use technology during student teaching. Penny felt encouragement to provide a visual for the students in working out grammar problems. In addition, she had support from her cooperating teacher in using the document camera.

I sort of borrowed some of these ideas from her because she created a lot of manipulatives in her classroom, and I wanted to create one specifically for plurals. So, she loved the idea that I was just feeding off from her ideas and creating something that was just my own.

Penny was further encouraged to use technology because of the students' level of engagement in creating their manipulatives. She recalled, "Well, they really liked that they were working on that manipulative so they were very engaged." Even though Penny was aware of her students' enjoyment of using technology, Penny's technology use during student teaching did not go beyond use of the document camera, PowerPoint slides, and video clips from BrainPop.com.

Penny's plans to use technology in her future teaching. One of the questionnaire items asked the participant to describe her ideal classroom. Penny had responded:

In an ideal classroom, students would come in and immediately sit in their assigned seats; then, they would begin on a journal response that would be written on a PowerPoint slide. This would be part of a daily routine. The lesson would begin with a short, educational video clip that engages students and places a focus on the objective for the day. . . In the ideal classroom, the teacher would guide students through the modeling part of the lesson with the assistance of a document camera. Students would be engaged in the lesson.

Penny looks forward to using technology in her future teaching. She commented that her two primary purposes for using technology will be to capture her students' attention when introducing a lesson and for guided practice. She added:

I definitely would have a Smart Board if that was somewhere in the building to use. In one of my technology courses, I used it. All we were doing was just learning how to use the very basics, like writing on the Smart Board. It was like an educational game we were doing on the board. . . I would like to have interactive, maybe review games just projected on the screen using a computer. Either that or just find maybe other websites that have video clips that I could use in the classroom.

Penny learned some basic functions for the Smart Board in her teacher education program and would like to learn some strategies for student interactivity. She continued:

She [a college professor] introduced us to several websites. One of them was readthinkwrite [www.readthinkwrite.org]. I discovered a lot of lesson plans that incorporate technology, and so there are several tools there that I was not fully aware of before I was in the program.

Penny also plans to explore the Internet for lesson plans that include technology components.

Research questions regarding Penny's case. I was able to answer the research questions based on information gained from Penny through her responses to the questionnaire, the provided lesson plan with a technology component, and responses to the interview questions.

Penny's vision of teaching with integrated technology. When I asked Penny to discuss her vision of teaching with integrated technology, she responded:

That [technology] is something I hope to be a part of and that is a part of everyday in my classroom. It [technology] is something that I just want students to be very familiar with, and I want to put it into my lessons. That way, students are connected, and they have a relevance for what is being presented. Well, my vision just includes students just being aware of what's there and how they can just learn, just different processes . . . I would have students be actively engaged in the lesson and be participating, using different aspects of technology.

Penny wants her students to be aware of what technology tools are available to assist them in their learning endeavors, and she plans to use technology to actively engage her students in the learning process.

I asked Penny what the first step is when developing a lesson plan. She responded, "Well, the very first thing I do is to focus on the objective we're going to cover. . . [Then] I try to find a way that will engage the students." She explained that by "engage" she means:

. . . . to introduce a concept to the students so that they're able to be interested in the subject and to remember it--pretty much to introduce the lesson and to keep them focused and to build on prior knowledge.

Basically, Penny has the idea that technology can engage and support her students in the learning process and that technology integration involves more than computer use. She is

aware that there are a variety of tools and strategies for integrating technology into the classroom. Her vision of teaching with integrated technology involves identifying the learning objective, capturing student attention and focus on the objective of the lesson through use of technology, and using technology to actively engage students in the learning process. Figure 7 illustrates Penny's vision of teaching with integrated technology. First, Penny determines what her goals are as a classroom teacher and what learning objectives she has established for her students. Second, she thinks about why technology is needed to help her achieve her goals and her students to achieve the

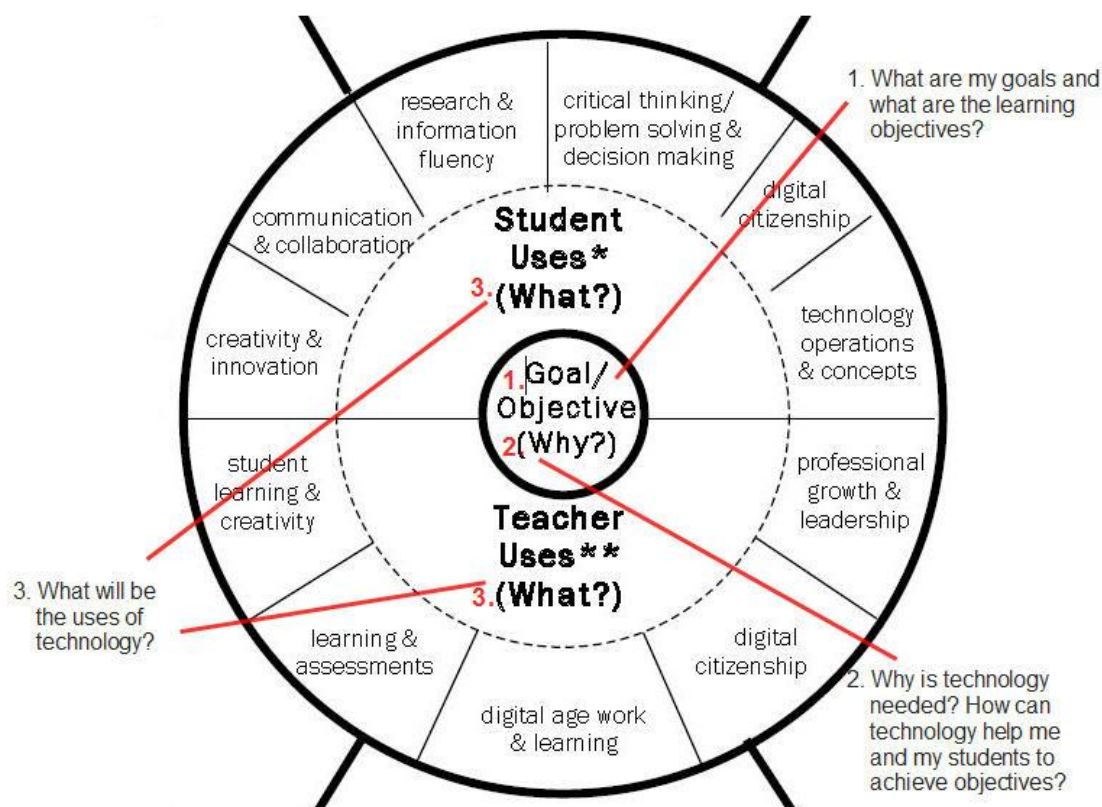


Figure 7. Penny's vision of technology integration.

established objectives. Third, she thinks about how technology will be used by her and by her students.

Factors that influenced the development of Penny's vision. Penny was clearly impressed with her cooperating teacher's use of a document camera, a technology tool with which she was not familiar prior to student teaching. She enjoyed her cooperating teacher's use of video clips to introduce the day's lesson, and she liked using PowerPoint slides to place grammar problems for the class to work out and discuss. These influences are evident in her description of the ideal classroom, as reflected in her response to the questionnaire. In effect, Penny plans to utilize the same tools and practices she observed during student teaching. In addition, she found that the technology tools and strategies she learned in her introductory technology education courses to be helpful in her plans to use technology in the future. She stated:

I really enjoyed working on the jumping-off page because in that sense students are guided step-by-step. I feel that's very important for students to be able to be guided and to follow instructions that are set for them.

A jumping-off page is a strategy for providing a set of instructions for student guidance in accessing and utilizing an educational website. The assignment for creating a jumping-off page for one of her courses provided Penny with ideas on how to use technology with her students. In addition, the introduction to the Smart Board in one of her educational courses helped to foster a desire to develop some interactive learning opportunities for her students, as well.

How Penny's vision played out during student teaching. During the interview, I asked Penny if she felt that her use of technology during student teaching fit her attitude towards technology in education. She responded:

I don't think that they were that much in agreement because I learned about going to the computer lab with students and using a Smart Board and including a variety of videos and instructions when I was here at the university. But when I was in student teaching, the only thing that I used was PowerPoint, a few videos, and the document camera.

She talked about the strategies and uses of technology she learned in the teacher education program but did not get to employ during her student teaching. She did ask her cooperating teacher about available technology in the school. Penny recalled:

She [the cooperating teacher] said there was never an opportunity for those [technology tools such as the Smart Board] to be on the campus. . . Well, she [the cooperating teacher] did tell me that it [the school population] was disadvantaged. Maybe that was one of the reasons why they [the school] didn't have as much technology available.

Penny's cooperating teacher told her that other than the computer lab and what was available in the classroom, that the school did not have the opportunity for more technology. The teacher gave the impression that the school did not have much money.

How experiences in student teaching influence Penny's intentions. Penny's experiences in student-teaching helped to provide some ideas on how she might use technology in the classroom, such as the use of PowerPoint slides, video clips, and the document camera, as well as the interactive use she observed with the iPhone application. She mentioned these tools in describing her ideal classroom in addition to other tools such as interactive slides on a Smart Board for review in game format.

Cross-Comparison of Case Studies

Although Molly, Nancy, Olivia, and Penny had differing experiences in student teaching and have different views on the importance of technology in the classroom, they also expressed some common concerns and experiences, as well.

In cross-comparing the four case studies, common themes emerged between and among the participants, as illustrated in Table 1. Themes include no mention of TPACK, limited understanding of what technology integration is, recognizing examples of technology integration, influences on the development of a vision of teaching with integrated technology, quality of technology integration in college courses, the selection of cooperating teachers for student teaching, issues involving the digital divide, and issues involving self-efficacy.

Understanding what technology integration is. Each of the four participants talked about technology integration as if each has at least a beginning understanding, but none discussed the interaction of technological knowledge, pedagogical knowledge, and content knowledge, or specifically mentioned TPACK. Furthermore, none demonstrated their understanding that technology integration involves the interaction of the three knowledge bases. When asked to explain what is meant by technology integration, all four talked about both teachers and students using technology in various parts of the lesson. They expressed an understanding that technology involves a variety of tools, not just the use of a computer and access to the Internet. From there, though, explanations and examples were varied, vague, and limited.

Table 1. Common themes that emerged among the participants.

Themes that emerged	Molly	Nancy	Olivia	Penny
No mention of TPACK	X	X	X	X
Limited understanding of technology integration	X	X	X	X
Develops lesson by first establishing objective		X		X
Influenced by K-12 experiences in dev of vision			X	
Influenced by teacher education in dev of vision	X	X	X	X
Influenced by student teaching in dev of vision	X	X	X	X
Concerns about lack of technology use in courses	X	X	X	X
Little use of technology by cooperating teachers	X	X	X	X
Issues with digital divide during student teaching	X	X		
Lack of self-efficacy during student teaching	X		X	X

Molly thought that integrating technology meant that either the teacher or the student had to use technology to create a product. She missed other possible uses of technology by the teacher and the students, such as communication, collaboration, or problem-solving. In addition, she seemed unaware that technology integration involves not only selecting the appropriate technology tool to address a specific learning objective, but also how to take into consideration student guidance in using the tool, classroom management strategies, etc. She did not provide guidance for students in accessing the Internet for research, such as providing a list of sites and a set of instructions to follow once they accessed the sites.

Nancy understood that technology integration involves the use of technology to facilitate instruction. However, in her explanation of technology integration, she stated:

... sometimes it can be the primary method of delivering instruction as long as the students are interacting with it. So, when you integrate technology, not only are you introducing it to the students, but you are letting them explore with it, as well.

This explanation of technology integration is limiting if one criterion for technology integration is that students must always be interacting with the technology as opposed to using it to facilitate the role of the teacher, for example. Although Nancy mentioned some innovative uses of technology, she never mentioned any technology tools that specifically addressed facilitating student understanding and development of content knowledge and skills, other than the use of a video clip.

Olivia stressed that technology integration involves using technology in a meaningful way, as opposed to using it as an add-on component. However, she did not feel capable of developing a lesson that successfully integrated technology, stating that all her lessons used technology as an add-on. She saw technology integration as involving trips to the computer lab for developing technology-based projects.

Penny understood that technology can be used in various parts of a lesson to help engage students in learning, but she gave no examples of technology in the hands of the students other than the students submitting an electronic answer to a teacher-provided question or writing an answer on a piece of paper beneath the document camera, which was used like an overhead projector would be. She offered only low-level uses of technology by students and teachers as examples of technology integration.

Recognizing examples of technology integration. Despite somewhat faulty and narrowed views as to what is meant by integrating technology into teaching in the classroom, the participants were able to offer some examples of technology integration, such as providing a class website with resources, using communication tools like Twitter,

having students utilize technology for presentation or productivity purposes, using video clips to demonstrate concepts, and using interactive tools in the classroom such as Smart Boards and classroom clicker response systems. The participants all provided lesson plans that had stated objectives, technology and non-technology materials needed, and sequencing of activities. (Olivia provided a lesson plan developed with a fellow classmate in a methodology course.) In addition, all the participants stated that technology was to be used in a meaningful way, not just an add-on.

On the surface, one might assume that these preservice teachers have a solid foundation in their understanding of what is involved in successfully integrating technology. They appear to be able to “talk the talk.” However, one does not realize how incomplete their understanding is until they go into more depth in discussing what is and is not an example of technology integration. For example, Molly stated that showing a video is not technology integration because neither the teacher nor the students are developing a product by watching the video. Both Nancy and Olivia commented that the teacher’s use of technology to facilitate the role of teaching was not technology integration because the technology is not in the hands of the student. These comments highlight the concern that the participants in this study do not recognize as examples of integrated technology the numerous ways technology can be utilized to support teaching and learning.

Even the lesson plans provided by the participants must be called into question because the participants used “fill-in-the-blank” templates. The information is there, but how was the lesson plan developed? When each of the participants was asked what the

first step was in developing a lesson plan, only Nancy and Penny responded that they begin first with the learning objective. Olivia actually stated that there is “no good formula” for developing a quality lesson plan—and she did not feel that any of her lesson plans demonstrated true technology integration. Molly seemed to focus on what technology was available before developing a lesson plan.

Influences on the development of a vision of teaching with integrated technology. In all four case studies, the preservice teacher’s vision of teaching with technology integration was influenced by experiences with training received in their teacher education courses, observations of their college professors’ uses of technology, and field observations of practicing teachers utilizing technology in the classroom. In addition, Olivia was influenced by experiences with technology integration as a K-12 student.

For example, Molly stated that she started to understand what was meant by technology integration during her participation in her first technology education course. The instructor provided the technology and asked the course participants what assignments they would give their students that would match that technology tool. Molly took to heart that initial approach in learning to use instructional technology and began building her vision of technology integration based on that first experience with technology in the teacher education program. Olivia’s first experience with technology integration involved the collaborative efforts of her eighth grade science teacher and her technology applications teacher to facilitate the development of her class science project. The idea that technology integration in the classroom could not be achieved without

team-teaching was further impressed upon her when Olivia experienced team-teaching in her teacher education program between a methodology instructor and a technology education instructor. Olivia came away with the idea that one looks at what kinds of assignments can be developed to match the available technology and that technology integration involves team-teaching, with one teacher responsible for content and the other for technology. How pedagogical considerations are addressed is unclear.

Both Molly and Olivia participated in an introductory technology education course designed to introduce them to a variety of computer applications and to help them to begin thinking about instructional technology use with pedagogical considerations to address content objectives, such as using a Smart Board for student interactivity, and creating an educational website and short instructional videos. However, both came away with the unintended message that one has to look at what technology tools are available and then determine what kinds of assignments to develop that can match the available technology. This approach limits them in imagining what tools might exist or can be developed to achieve goals and objectives. In Olivia's case, the additional message was that technology integration cannot be achieved by the classroom teacher alone, that two teachers are needed, with one focusing on content and the other focusing on technology.

Nancy and Penny also displayed some similarities in how their experiences in the teacher education program helped them to begin their vision of technology integration in the classroom. Both reported that they had no opinion of technology use in the classroom prior to entering the teacher education program. However, they both had experiences in their own learning in the teacher education program that influenced their development of

a vision of technology integration in the classroom. For Nancy, it was the required reading in a methodology course that got her to thinking about how students learn differently in the 21st century and how technology can influence that learning. For Penny, it was strategies like providing written instructions for student use of educational websites, the possible uses of a class website, and the interactive uses of a Smart Board. All four participants further developed their vision of teaching with integrated technology based on experiences and observation made during student teaching, such as observing uses of a classroom clicker system, the Smart Board, video clips, a document camera, and virtual manipulatives.

Although the participants created some projects in their teacher education courses and observed some good uses of technology during student teaching, they did not observe enough. Not only did they not observe enough examples of how to integrate technology, there was not enough reflection and dialogue on what they did observe, leading to misconceptions about what is meant by integrating technology in teaching in the classroom. As illustrated in Figure 8, two of the preservice teachers began their vision with establishing goals and/or objectives to be achieved, leading to a sound foundation on which to continue building, while the other two did not begin with establishing goals or objectives, leading to a faulty foundation and a narrow scope. Nancy's development of a vision follows the model for developing a vision of technology integration in respect to first determining the teacher's goals and the goals and learning objectives the teacher has for the students, then deciding why technology should be used, for what purposes it should be used, and by whom. Nancy is the only participant who appears to have a well-

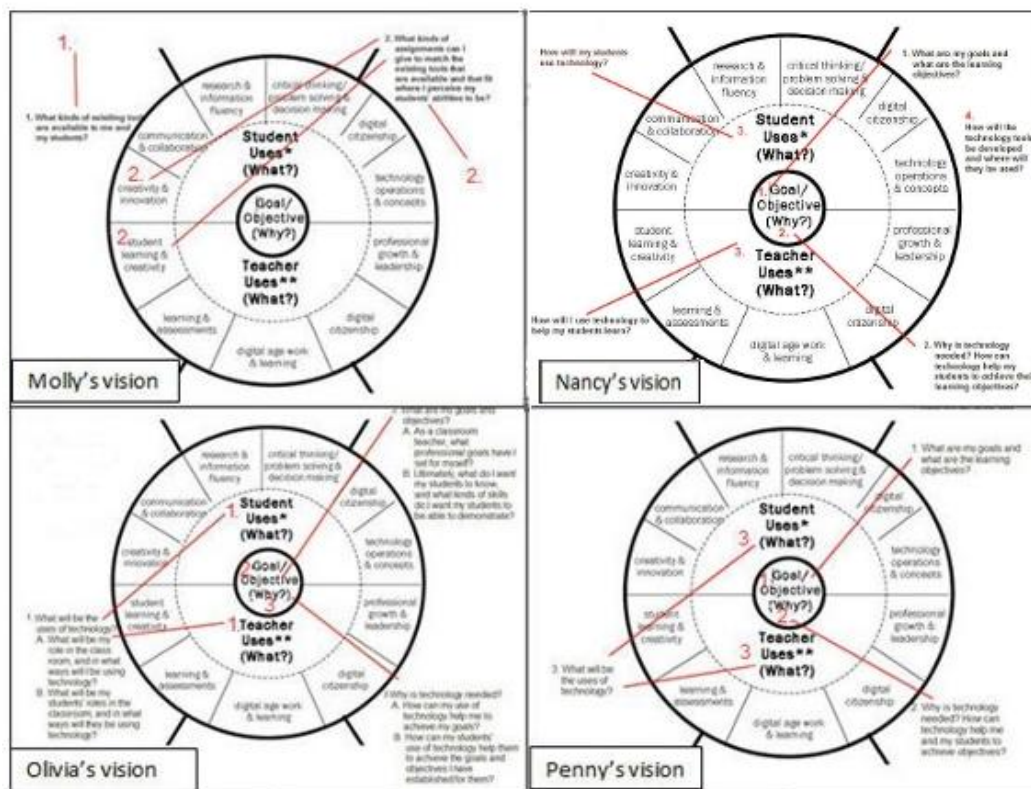
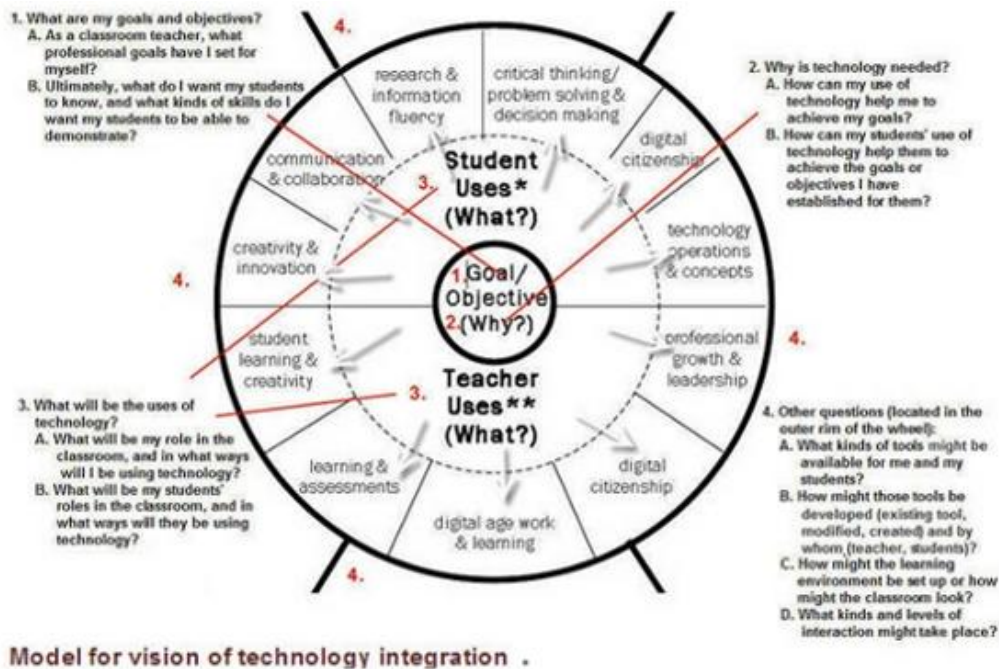


Figure 8. A comparison of the participants' visions of technology integration.

developed vision of what technology integration would look like in the classroom. Penny has a lesser-developed vision but begins with determining goals and objectives and then deciding why technology should be used, for what purposes, and by whom.

On the other hand, both Molly and Olivia's visions of technology integration follow a different pattern of sequencing, resulting in a limited and flawed vision for each. For example, instead of focusing first on determining goals and objectives she has established for herself as a teacher and for her students, Molly focuses on what technology is readily available to her and her students and then determines what kinds of assignments she can match to that technology. In addition, although Molly can think of many ways to integrate technology, her definition of technology integration has a narrow focus: Either the teacher or the students must be creating a product with technology for it to be considered technology integration. Because of her limited definition, Molly does not necessarily recognize when she is integrating technology.

Like Molly, Olivia's vision of technology integration is both flawed and narrow in focus. She feels that she must co-teach with someone, either a science teacher or a technology applications teacher, who will assume most or all of the responsibility for the technology component of the lesson. Olivia lacks self-efficacy in utilizing technology in the classroom for student learning purposes. Because of this concern, Olivia focuses first on what her role and her students' roles will be in the classroom before determining the goal or objective to be achieved. Like Molly, Olivia can think of many ways to integrate technology, but she does not always recognize those ways as examples of technology

integration. Her focus is narrowed to a co-teacher providing student support in utilizing applications in a computer lab.

The quality of technology integration in college courses. Each of the participants found certain activities in the college courses or the modeling of technology use by instructors helpful in understanding technology integration and in beginning to build a vision of teaching with integrated technology. However they also conveyed that there was not enough of it.

Molly discussed how beneficial her first technology education course was in helping her to begin understanding how to integrate technology into the classroom. She talked about how she was encouraged to approach the use of technology as if she was a middle school student using applications to complete assignments or projects. She was also introduced in her education classes to the basic components of a Smart Board. Even so, she commented that her second technology education course did not offer anything new in learning applications. She did not mention any of her course instructors addressing the issues of pedagogy in conjunction with using technology to address student learning needs. She did mention, however, that one core content college professor discouraged his students from using the Internet to locate sources that might help them to understand content material. Molly recalled, “He [the college professor] specifically said, ‘Just don’t use the Internet because you can’t trust it.’ There was one-- PhysicsClassRoom.com--he would let us go to.” The college professor’s concern was the lack of accuracy of the information on the Internet. He offered one site that his students

might use but offered no assistance in how to evaluate the quality of sites for educational purposes.

Like Molly, Nancy was introduced to the Smart Board in one of her college classes. A math methodology instructor used the Smart Board pad to record lessons which he placed on the course website. This practice helped to provide Nancy with a vision of a hybrid learning environment for her future middle school math students, which might allow the optimizing of face-to-face time with students during class. Even though Nancy benefited from some of her required reading and observations of technology use by a couple of professors, she was critical of her instructors, stating:

I think they should work more towards finding resources to use in the classroom and using those to deliver their lessons because we do our own lessons, and we write our own lesson plans and stuff. So there should be, you, know, mandatory components for using those resources. Yes. There's a constant, evolving technology going on every day. There's always a new website that came up to help you with instruction. I think technology for the methodologies -- I think we should be required to record instruction using the Smart Board. There should be more of the using of the Smart Board. I don't think there are a lot of courses that have Smart Board in it.

Nancy felt that college professors need to locate more technology tools to be utilized in instruction and by their students.

Olivia also exited the teacher education program with some important understandings about the use of technology in the classroom. She understood that its use has to be meaningful, that a technology component cannot simply be added to a lesson to satisfy the requirement that technology must be integrated into a lesson. She learned to use some applications, such as Animoto and Windows Movie Maker for creating short videos. However, she commented that she did not see how some of the uses of

applications could be considered examples of technology integration, such as Microsoft Word to create products to be used by students in the classroom. She also expressed lack of self-efficacy in integrating technology into her future teaching.

Like the other participants, Penny found the introduction of the Smart Board beneficial in helping her to think of ways to utilize technology in her future teaching. She picked up on pedagogical considerations in using technology to address learning needs, such as providing students with written instructions on what to do when accessing an educational website for a specific activity—a strategy not employed by Molly and her cooperating teacher when they sent their students to the computer lab to research information on planets. However, Penny was not able to offer much more in how her college courses helped provide her with an understanding of what it means to integrate technology in teaching in the classroom. She could not recall much of what she learned in using technology in her own educational endeavors or what she observed in her college instructors' use of technology in teaching. Furthermore, Penny lacked self-efficacy in problem-solving a relatively minor barrier. She sometimes had to wait to use the computer on Monday mornings because she did not know how to reconnect wires accidentally dislodged by the cleaning staff over the weekend. Penny did not appear to have learned strategies for addressing common minor barriers encountered in the classroom.

Selection of cooperating teachers for student teaching. A major reason preservice teachers are provided field experiences throughout the teacher education program, especially the opportunity to student teach, is to allow them to observe, to

develop and deliver lessons, and to become acquainted with some of the basic issues of education in and out of the classroom. Field experiences such as student teaching allow preservice teachers to observe how practicing teachers manage their classrooms, develop lesson plans, coordinate with other teachers, and how they teach curriculum (Fleming et al., 2007; Lambert & Gong, 2010). With so much emphasis placed on the importance of novice teachers entering the classroom ready to integrate technology, one might assume that much care would be taken in selecting teachers with whom to place student teachers—technology-using teachers who would encourage student teachers to try some of their ideas in helping students to learn. However, the participants in this study were placed with classroom teachers who utilized very little technology.

Molly's cooperating teacher had a couple of uses of technology, such as the use of the classroom clicker system and the student use of a digital camera to take photos to document the stages of an experiment focusing on speed, velocity, and acceleration. However, the cooperating teacher's PowerPoint slides contained a large amount of text and he repeatedly utilized the same image throughout the presentation. In addition, he convinced Molly that her use of a video clip in one of the work stations would result in a classroom management problem. Molly lacked the self-efficacy to resolve possible concerns through effective classroom management strategies.

Nancy fared better in that her cooperating teacher permitted her to experiment with classroom management strategies even though it meant going against school policy in allowing students to access their cell phones and iPods during school hours. The cooperating teacher also did not discourage Nancy from using the Smart Board, which

the teacher had not utilized previously because she did not know how to use it. In effect, Nancy was assigned to a non-technology-using teacher who provided her with the freedom to experiment with technology. Nancy grew in technology use by her own initiative and help from her students and another teacher, but she did not learn how to integrate technology from her cooperating teacher.

Olivia's cooperating teacher used applications accessed in a computer lab to encourage students to explore three-dimensional shapes with a simulation game, and she used an Interwrite Pad to enable students to project their work onto a screen for the class to view. Otherwise, the cooperating teacher did not make use of any tools, including a room full of manipulatives that could have helped her students to understand math concepts in a more concrete manner. Olivia lacked the confidence to make any suggestions to help students, and she gave the impression that she was not encouraged to do so by her cooperating teacher. Olivia stated that the same lessons appeared to have been used for years and she felt the teacher planned to continue using them in the future.

Penny was impressed with her cooperating teacher's use of a document camera, and the teacher was pleased with Penny's initiative to use the document camera to instruct students in constructing a manipulative for learning the rules for creating noun plurals. However, Penny mentions no other uses of technology by the cooperating teacher, other than the showing of brief video clips streamed from the Internet, grammar problems placed on PowerPoint slides, and the low-level uses of the document camera. The cooperating teacher utilized the document camera the way that teachers have used

overhead projectors in the past. Indeed, Penny mentioned her plans to use a document camera and PowerPoint slides in the same manner in her future teaching.

Issues concerning the digital divide in student teaching. Molly brought into focus the different kinds of issues concerning the digital divide. One has a tendency to think of the digital divide as a contrast between those who have access to technology and those who do not. However, the digital divide can be perpetuated in a number of ways. One is through having a teacher who chooses to use technology versus a teacher who chooses not to use technology (Cifuentes et al, 2011; Wachira & Keengwe, 2011). Another way is through the attitude of the teacher towards students. For example, Molly was willing to use technology with the more affluent students whom she viewed as having desired literacy skills, social skills, and technology support from home. However, she felt that technology use was not feasible with the students from a low socio-economic background whom she judged as having poor literacy skills, poor social skills, and lack of technology support from home. Nancy also demonstrated an issue concerning the digital divide. The gifted and talented students in her class were given passes to use the computers in the library for their projects, but the other students were restricted to using the non-technology materials in their classroom. Even though a cart of notebooks was available to check out for classroom use, Nancy felt discouraged in trying to use them. Other teachers had reported that the notebooks were outdated and technical problems always arose in trying to use them, and so the notebooks went unused (Kress, 2011; Wachira and Keengwe, 2011). In addition, the school had a computer lab that might have been available to Nancy and her students; however, she did not check for availability.

Nancy did not attempt to problem-solve in providing technology access for all her students.

Summary of Chapter IV

Chapter Four restates the research questions. Next, the chapter presents each participant as an individual case study, relating the thoughts and experiences of the participant as they pertain to the stated research questions. After all individual case studies have been presented, a cross-comparison of the individual case studies is made in relationship to the stated research questions to determine common themes that emerged in two or more individual case studies. Chapter Five restates the research questions. A discussion section follows for each case study. A conclusion with implications section brings the study to an end.

Chapter V: Discussion and Conclusion

This study was designed to understand how preservice teachers perceive their own development of a vision of teaching with integrated technology in the classroom. The significance of this study is that it may provide information for teacher education programs in helping preservice teachers to develop a vision of technology integration, thereby influencing them to use technology effectively and meaningfully in their future teaching.

This chapter restates the research questions, presents a discussion section, followed by a conclusion to summarize findings across cases, with an implications section for future research and practice.

Research Questions

This study was designed to address the following research questions:

1. What is the preservice teacher's vision of teaching with integrated technology?
2. What factors influence the development of the preservice teacher's vision of teaching with integrated technology?
3. How does the preservice teacher's vision of teaching with integrated technology play out in the classroom during student teaching?
4. How do experiences in student teaching related to technology use influence the preservice teacher's anticipation in using technology as a practicing teacher?

Discussion of Molly's Case

The interview with Molly provided insight into her understanding of what technology integration is and from where her understanding possibly originates. Molly's responses also provide insight into her thoughts on students with limited skills and limited access to technology, her perception of the teacher education program through which she progressed, as well as her opinions on the importance of technology in the classroom.

Molly's understanding of what technology integration means. Because Molly thinks of technology integration as the teacher or the student creating a product with technology, she misses out on thinking about other uses of technology as examples of technology integration. Furthermore, she lacks a clear understanding of what is meant by technology integration, which is the intersection of technological knowledge, pedagogical knowledge, and content knowledge (TPCK, TPACK, AACTE, 2008; Pierson, 2001).

For example, in reference to the video clip of the acrobatic team, Molly understood the content, and she partially understood the technology needed. However, she did not understand the pedagogy needed to successfully utilize the technology, in this case, how to manage her class as they progressed through work stations. As an additional barrier to integrating technology, Molly felt that she could not show the video to the whole class as a large-group learning structure because she was restricted by the school in using streaming video.

Finally, Molly did not explore options for downloading and playing the video other than stating that Zamzar, a web application for converting files, was not available to her. The issue about not being allowed to stream video illustrates Molly's lack of ability to problem-solve for minor barriers to using technology in the classroom, which sometimes hinders preservice teachers during student teaching (Chen, 2010). For example, Molly could have talked with a school IT person and asked why video streaming was not allowed. Perhaps there was a technology-glitch or a concern about bandwidth. Perhaps a solution could have been worked out.

Molly mentioned a few times throughout the interview that she looks to see what technology is available and then decides what assignments can be done with the available technology. Such an approach limits her development of a vision of technology integration. Having a vision of technology integration means that the teacher sets goals and objectives for himself/herself and for students and then tries to imagine how technology might help to achieve those goals and objectives (Doering et al., 2003; Ertmer, 2005; Pierson, 2001). Molly does not give herself an opportunity to imagine how technology might help her and her students reach the goals or achieve learning objectives she has established for a lesson or unit. Her approach does not lend itself to researching what tools already exist, can be modified according to needs, or can be newly developed.

The other point that this missed opportunity brings into focus is whether Molly identified the planned use of the video in her lesson plan as an example of technology integration. She had stated that when she was a K-12 student, teachers showed films. She commented that the projector and film were simply in the classroom being used, and

neither the teacher nor the students were creating a product; therefore, technology integration was not taking place. So, if students are watching a video to view examples of real-world applications and are making predictions and offering rationales for those predictions, then they are employing higher order thinking skills and are exhibiting a certain level of interactivity which lends itself to a more powerful learning environment than passive learning, such as simply watching the video or listening to a lecture (Cifuentes et al., 2011; Denton, 2012; Doering et al., 2003; Partnership for 21st Century Learning, 2009). However, neither the teacher nor the students are creating a product while watching and responding to the video. Does Molly not see that use of technology as an example of technology integration? When discussing what technology integration is, Molly did not mention using technology to foster creativity, to develop problem-solving skills, decision-making skills, literacy skills, communication skills, or collaborative skills—all skills considered necessary for 21st century living (ISTE, 2008; Partnership for 21st Century Learning, 2007). She mentioned only the specific use of technology to create products.

Molly's experiences with the digital divide. Molly noted the socio-economic differences between the student populations in the schools she was assigned to for QUEST 2 and QUEST 3. This brought into focus two major concerns. One is that, according to Molly, preservice teachers assigned to the less affluent school for field experiences were told not to expect students to read their textbooks. Molly's comment makes me wonder why preservice teachers are placed in a school where teachers and administrators accept that students are not going to complete reading and writing

assignments and convey to their student teachers that they should not expect much from these students.

The other concern is that Molly felt that using technology with the students in her QUEST 2 assignment was not an option. The classroom had a Smart Board and a classroom clicker system, neither available for use, even though the systems were in the classroom throughout the entire semester. The classroom also had a screen for projecting onto and showing videos. Despite what Molly said about technology not being an option with the students, she did use technology in a meaningful way. She showed a video that demonstrated how the Periodic Table is arranged in reference to chemical reactions, including the demonstration of a chemical reaction that cannot take place in a school lab. Again, according to how Molly defines technology integration, she may not see showing the video as an example of technology integration, though it was. However, Molly's main reason for stating that using technology with these students was not an option is because she noted that their literacy skills, social skills, and technology skills were low and that she suspected most did not have access to the Internet at home unless it was through their parents' iPhone.

One of the major appeals to using technology in the classroom is to actively engage students in learning (Cifuentes et al., 2011; Doering et al., 2003; Partnership for 21st Century Learning, 2007). Instead of accepting that these students have low-level skills and are not engaged in learning, Molly could have looked for opportunities to excite her students in learning. She talked about how important hands-on activities are, but she never mentioned doing any with these students. She talked about what technology

was available in the classroom and her frustration in not being able to use the Smart Board or the clicker system. However, she did not seek out the school's IT person and ask what could be done. Molly did not mention checking the library to see if digital cameras could be checked out or to see if a computer lab was available. Instead, she commented during the interview that she was concerned that the students' abusive-like neighborhood culture would extend itself in their computer use.

Molly's attitude towards what is and is not available to students at home perpetuates the digital divide (An & Shin, 2011; Warschauer & Matuchniak, 2010). Those who have technology and tech-savvy parents at home are in a position to create engaging videos, while those who don't are left to create PowerPoint presentations, poster boards, or to write the traditional paper. But Molly's attitude towards students is also extended to the parents. Molly talked about how wonderful technology is in notifying parents of their students' progress through email, eliminating the need to call parents or to mail progress reports, but what about those parents who do not have email accounts, Internet access, or technology expertise? Molly commented during the interview that she thought it was great that parents could choose whether to check their students' grades online. She expressed that those who were interested would, and those who did not care would not. If parents do not have the means or the knowledge of how to check their students' grades online, do we assume they do not simply because they don't care about their students' academic progress? Finally, if students' families cannot afford Internet access at home, are those parents likely to have smart phones with data plans? There is an unconscious insensitivity in Molly's remarks, not only in reference to

expectations of low socio-economic students, but about students in general and limitations on what they can do based on access to technology both in the classroom and at home.

Molly's perception of technology use in the teacher education program.

Molly loved her first technology education course. She learned to use some software programs and to create products that could be used in the classroom. However, she expressed disappointment in the second technology education course because she learned only one new software program, and that was Windows Movie Maker. She said that she developed several products for the course but that she already knew how to develop those products.

I wondered if Molly had learned anything about strategies in using technology with her students, for example, how to search for and evaluate Internet resources. When I asked Molly if she had done anything to help students learn to evaluate the quality of Internet sites for research purposes, she replied that she did not feel that was something she would do in a science class, that the information technology (IT) teacher should be responsible for teaching students to evaluate sites. Molly mentioned that she had experienced frustration in college with seeking information from the Internet in understanding physics, that each site she visited seemed to offer information that was contradictory to what she found on other sites. When she had approached her physics professor with the contradictory information she had located on the Internet, asking him which information was correct, he told her to stay away from the Internet, except for one site he named, that the Internet was full of misinformation—which echoes what Molly

did with her own students in the first research assignment she gave during student teaching. Molly was not equipped to help her students navigate the Internet to quality sites because she had not learned how to evaluate the quality of online resources in her core content or teacher education courses (Chelsey & Jordan, 2012).

Molly's comments about her disappointment in the second technology course gives the impression that she felt the course should be about learning to use more applications. The question comes into play as to the purpose of that course. The first course focused on teaching how to use applications. Was the purpose of the second course to learn how to use more applications or was the objective to focus on content knowledge and pedagogical considerations when deciding what technology to use and how?

Molly's perception of the importance of technology integration. Molly made a couple of interesting statements when discussing the importance of technology in education. One statement was that yes, technology is important, but not all important, in that teachers had been successfully teaching for the past thousand years without it. I clarified with Molly that she was referring to digital technology, but even so, the statement is attention-getting. To say educators have been teaching without technology for the past thousand years is an untrue statement. Of course technology has developed through the years and has been increasingly utilized in education. Tools continue to be developed. Technology has been growing at an exponential rate in recent decades and continues to change rapidly. To say that new advances that can impact how well a student learns is not very important because it is new and others managed to learn prior to the

availability of that new technology is ignoring how much better and faster a student might learn, and it ignores the issue of whether or not some students learn at all without the use of certain technology tools.

The other interesting comment Molly made about the importance of technology is that we must be careful not to rely on it too much. Her example was the ease and time-saving features of assessments done with objective tests. Molly was concerned that students need the opportunity to articulate their answers and to be provided with more authentic assessments done through hands-on activities. She mentioned the use of standardized testing specifically in talking about the reliance of technology for time-saving assessments. Certainly, like so many activities, digital technology can save time in performing many tasks, but it is not at the crux of the overuse of multiple-choice testing. Teachers relied on short objective quizzes long before digital technology entered the classroom. Because of Molly's limited understanding of technology integration, she misses out on how technology can be used in exploring and experimenting with real-world applications, problem-solving, decision-making, creating, collaborating, and communicating—all skills needed for 21st century learning and living (ISTE, 2008; Partnership for 21st Century Learning, 2007). Unfortunately, Molly's views concerning the importance of technology in the classroom is sometimes shared by other preservice teachers upon entering the teacher education program (Davis et al., 2010). Such deep-seated beliefs held prior to entering a teacher education program can be difficult to change with the limited training of technology integration afforded by a teacher education program.

Conclusion regarding Molly's case. If one pays attention to surface appearances and keeps in mind that Molly is a preservice teacher who is just beginning to develop TPACK, that is, her technological, pedagogical, and content knowledge bases and how they interact, she appears to be on the right track for understanding technology integration and using technology effectively during her student teaching. She has some technological know-how. She utilized a video clip during QUEST 2 that demonstrated concepts the students could not have experienced in a school lab. She understood how to develop an interesting and effective PowerPoint presentation, as well as how to engage students with use of a classroom clicker system. She showed eagerness to learn how to use an interactive board. She had her students creating videos, PowerPoint presentations, and conducting online research. She and her cooperating teacher provided their students with digital cameras to document the stages of a project that involved problem-based learning. In addition, Molly utilized a class website to post an educational source for her students and their parents, and she emailed to parents students' progress reports. It is not until one examines Molly's thought process, though, that one realizes that Molly has an incomplete understanding about technology integration and misconceptions about some of the issues of using technology in the classroom that could derail her success in integrating technology in her future teaching.

First, Molly has a limited view of technology integration. Though she is actually integrating it in a number of activities, she may not recognize that she is doing so because she states that technology integration is not taking place unless technology is being used by the teacher or the student to create a product. Second, when thinking about

technology, Molly focuses on what technology is available to her and on where her students are in their ability to use technology. Then, she decides what assignments she can create to match available technology and student skills. Such an approach does not allow for Molly to focus on goals and objectives first and then to explore and problem-solve in what she needs to reach that goal or achieve that objective. Therefore, her future use of technology in the classroom may be limited to what she has in front of her, her perception of what the students have at home, and her perception of what her students are able to do with the tools available at school and home. Third, Molly accepts on the surface the school's policies without exploring why those policies are in place and problem-solving. Fourth, Molly appears to not be completely aware of the potential power of educational technology to actively engage her students in the learning process. If she did, perhaps she would have used technology to engage the low-performing students at the school to which she was assigned during QUEST 2. Finally, Molly appears to not be aware of some basic issues encountered in the classroom, such as the digital divide. Not only did Molly feel that technology use with students in the economically-disadvantaged school was not possible, she seemed oblivious to the idea that some parents may not have skills or access to email or the Internet for checking student progress.

Discussion of Nancy's case

The interview with Nancy, in addition to analyzing her lesson plan and reading her responses to the questionnaire, provided some meaningful insight into her understanding of what technology integration is and the factors that led to that understanding.

Nancy's understanding of what technology integration means. When asked to define technology integration, Nancy stated that it involves students interacting with the technology.

To me, it [technology integration] means that you are using it. It is not necessarily always used as a tool in the classroom, but it's being used to help facilitate instruction and sometimes can be the primary method of delivery of instruction as long as the students are interacting with it. So, when you integrate technology, not only are you introducing it to the students, but you are letting them explore with it, as well.

Nancy's use of technology in student teaching and her stated vision of technology integration in the classroom clearly match her definition of technology integration. She is focused on how technology can help to achieve her goals and stated learning objectives while addressing pedagogical considerations for doing so.

Prior to entering student teaching, Nancy had already been inspired by a book she had read. It led to her experimenting with letting students have access to their cell phones and iPods for listening to music while working independently. She took it upon herself during student teaching to learn to use the Smart Board, allowing students to demonstrate for her various features and uses. She accepted suggestions from a co-teacher and explored resources. She also developed a website for the class and posted links to resources for her students. In addition, she asked her students to share resources they had discovered on the Internet.

Nancy remembered useful strategies she had seen modeled by a couple of her college professors, and she began to imagine how she wanted her classroom to look and what kinds of tools she might be able to develop, as well as what kinds of interaction

might take place among her, her students, and the subject matter being taught. Nancy's experiences and her ability to imagine what can be led her to a solid understanding of how technology can actively engage students in the learning process and facilitate their understanding of content as well as their development of skills needed for 21st century learning and living (ISTE, 2008; Partnership for 21st Century Learning, 2007).

Nancy's perception of technology use in the teacher education program.

Nancy certainly benefited from her courses in the teacher education program in which she participated. A required reading in a methodology course inspired Nancy to take risks in student teaching and to begin to imagine how else she might use technology in her future teaching. The requirement in the technology education courses to develop a professional website and link assignments to it spurred her to develop a class website with links to resources for her students during student teaching. In addition, a core math professor's use of the Smart Board pad to record lessons not only influenced Nancy to want to do the same in her future teaching, but also led to her to the idea of providing QR codes for her students so that they could access the teaching videos from school or home with various electronic devices, such as their cell phones and personal computers.

Although Nancy developed skills and insight due to her participation in the teacher education program, she commented that professors need to utilize technology more in their own teaching, such as using the Smart Board for more than slide presentations. She is aware that technology is constantly evolving, and she feels that college professors should be using it in their teaching, not simply as role models for

preservice teachers, but because technology can facilitate teaching and learning on all levels of education in all content areas.

Nancy's perception of the importance of technology integration. When asked about how important technology is in teaching, Nancy stated,

I think that you have to use it in your teaching. Kids now-a-days are surrounded by technology. They're always on their phones. They're on iPads. They're on their iPod at the same time they're face-booking and twittering.

This insight is probably the beginning point for Nancy in wondering how to best help students to learn. She understands that technology is ubiquitous in the lives of today's students and that they use technology for entertainment and socializing. Why not for learning? So, Nancy began to observe, research, and explore how she might use technology to engage students in addressing real-world issues, problem-solving, making decisions, creating, collaborating, and communicating—all skills needed for 21st century learning and living (ISTE, 2008; Partnership for 21st Century Learning, 2007).

Conclusion regarding Nancy's case. Nancy's experiences and observations demonstrate the positive impact of reading and reflecting on educational literature. Her responses to the questionnaire and to the interview questions indicate the value of hands-on activities in learning such as building a professional website and using online discussion forums. She expressed the value in having college professors who demonstrate the use of technology, such as recording lessons to post on the course site. She, though, also noted that there is not enough use of technology by college professors and feels that they, too, should be required to have certain components in their lessons, that they also,

should be exploring evolving technology to see what is available to facilitate their teaching and to support their students in learning.

Nancy was able to take a few meaningful assignments and experiences in learning from her college courses, plus mentoring from a co-teacher, to develop a solid vision of technology integration in the classroom on which to continue building. However, such few experiences and observations may not be enough for other preservice teachers to develop as solid a vision as Nancy did. For example, Nancy was fortunate to have her cooperating teacher's co-teacher provide resources and possibly model for her some effective uses of instructional technology. However, the cooperating teacher to whom Nancy was assigned did not use technology, even though she had a Smart Board in her classroom. Assigning Nancy to a non-technology-using cooperating teacher seems to be at odds with the encouragement from her field supervisor and school administrator to use technology in her student teaching, with both stressing the importance of technology in the classroom.

Discussion of Olivia's case

The interview with Olivia, plus her responses to the items on the questionnaire and her comments about the technology component in her lesson plans, provides insight into her understanding and vision of technology integration.

Olivia's understanding of what technology integration means. When asked to define technology integration, Olivia stated, "It's not just throwing it [technology] in

there [into the lesson]. It's using technology to accomplish a goal." She then referred back to her experiences as an eighth grade science student.

Like the project I was given. We used technology to give our science presentations. So, it wasn't, "Oh, there was a video. There was a PowerPoint." It wasn't anything like that. We actually had to learn how to use an Excel spreadsheet. We actually had to type up our paper. It had to be in all the correct formatting . . . And you could even go farther today because this is before YouTube and all these things.

Olivia experienced as an eighth grade student that technology can support a student's learning endeavors. She understands that technology should be used to accomplish a goal, that there should be a reason for using technology. However, her understanding of technology integration is incomplete. Despite observing some examples of technology integration during student teaching, she still thinks of technology integration as trips to the computer lab for major projects. She does not recognize how technology can be used in small, low-key ways to help her students learn.

Olivia's perception of the importance of technology integration. In response to the item on the questionnaire asking if her opinion about the importance of technology in the classroom had changed after entering the teacher education program, Olivia responded:

Now that I have been educated, I see from a teacher's perspective, how important using technology in the classroom is. As a student, I only thought about what was a waste of my time and what was useful. In a way, I still feel the same way about that. I do not want to give my students anything that will be a waste of their time. I want them to leave my class knowing that they have learned something valuable that can actually be used outside of my class.

In this statement, Olivia appears to be focused more on learning technology for the sake of technology rather than focusing on its usefulness in helping students to master core

content learning objectives and to develop skills useful in 21st century learning and living, such as higher order thinking skills. Again, she appeared to focus on learning technology for the sake of technology when she stated:

Well, I think it [technology] is very important, but I think that a lot of the technology that kids learn—it's really not what they learn in school. They learn from the things that they have. They learn from the things that their friends have. That's a lot of the stuff that they learn. And if they could use that in school, then they might be more interested in it [technology] and might actually benefit from it. You could use Twitter or YouTube, or anything like that. Or, I don't know if you could use their video games or anything like that . . . You know, most kids are really into their computers, and I know a lot of kids who are proud of their video games. Well, if they were in a class where they would learn, you know, "Well. I have this computer, and I want to run this video game. What do I need to do to make that happen?" I think that would be a useful technology class. I can't do that as a math teacher, you know.

The comment about students needing a technology class to further their interest in developing technology skills shows that Olivia is missing the idea of using technology in the classroom to facilitate understanding concepts and developing skills in a core content area. On one hand, she says she understands that effective utilization of technology involves employing it to achieve an academic goal or learning objective, and she stresses that technology should not be added simply for the sake of satisfying a requirement to include a technology component in a lesson plan. On the other hand, she easily gets off-track by focusing on what technology skills will be useful to students outside of the classroom and in their future, an attitude sometimes shared by other preservice teachers when considering the importance of technology in the classroom (Davis et al., 2010).

Olivia's poor recognition of technology integration. In addition to sometimes losing focus on the purpose for utilizing technology in the classroom, Olivia does not

always recognize examples of technology integration. She mentioned that she did not see the point in some of the assignments she had to complete in her introductory technology education courses. For example, she did not understand how teachers using Microsoft Word to create a worksheet is an example of technology integration. For clarification, I asked her if she thought a teacher using technology to facilitate the role of teacher was an example of technology integration. She confirmed that she did not consider that to be an example of technology integration. Based on that reasoning, then a teacher's development of a technology tool to introduce students to a concept or to use for individual practice or for assessment purposes might not be considered examples of technology integration.

Again, Olivia's comments about the need for a co-teacher and concerns about not having the time to take students to the computer lab are indications that she does not fully grasp subtle ways that technology can be utilized in the classroom for instruction, such as use of the clicker response system or the showing and discussion of a short video clip to introduce or demonstrate a concept. Olivia's vision of technology integration centers on the use of a computer lab to facilitate major projects.

Olivia's perception of technology use in the teacher education program.

Olivia did not feel that there was enough technology use in her college courses. In reference to what she would like to have experienced in her courses, she remarked:

I'd say just using more stuff that was more updated, I guess. I mean, some of the stuff was recent, but a lot of it was, I just felt like I was [they were] just adding it in there to add it in there because that was part of it.

Olivia did not think that her college professors used enough technology or used it in a meaningful manner. She also felt that her professors were not up-to-date on what is available for teaching and learning. She was able to offer only two examples of technology use by her college professors. One was from a math methodology course where the students taught each other a lesson, audio-recorded it, and submitted it to the professor with a written reflection on the teaching session. The other example was the technology-based project she did for a methodology course on diversified learners. Olivia stated:

I think the most useful technology that I learned was in . . . one of the first classes . . . she taught us a lot of things that I could see actually using in a classroom. . . There's a program where you can post pictures online. You know, we posted pictures of technology uses in the classroom, and then we did a description of them, and everybody was able to see it, and everyone's pictures. But other than that, there really was no technology.

Even Olivia's example of technology use for a course project focused on technology as opposed to how to utilize it to facilitate the development of content skills and concepts while addressing pedagogical considerations. Her experiences in learning with technology in her teacher education program and her core college courses were extremely limited. She had practically no modeling in using technology in her own learning.

Furthermore, Olivia voiced that she anticipates a disconnect between what preservice teachers are taught to expect in the classroom and what they experience when they enter the classroom (Pierson & Cozart, 2004). She commented:

And I think it all stems from how the schools do it because they can't say, "Okay. We're going to teach you how to do this," and when you go into a school, there's no way they're going to do it this way, you know.

She is concerned that preservice teachers are taught to expect certain materials or procedures but that these expectations so not play out in the reality of the classroom.

Olivia's vision of technology integration prior to entering the teacher education program. Like practicing teachers, preservice teachers often enter the teacher education program with their own vision of teaching, which may or may not include technology (Bullock, 2004). Olivia entered the teacher education program with a vision of what technology use in the classroom looked like during a time-period when schools were first being introduced to computers, applications, and the Internet. Classes for technology applications were being created, and classroom teachers often depended on team-teaching with a technology applications teacher in order to facilitate technology use for their students in completing projects. Olivia still has that vision of technology integration, formed as an eighth grade science student. She feels that she has to team with another teacher in order to achieve technology integration, that she cannot do it alone as a math teacher. She would have benefited from observing her professors' use of content-specific technology. She was able to offer only one example of a professor who did this, and that was the use of audio-recording of students teaching their peers.

Olivia had commented that she would like to see new technology tools introduced into the educational technology courses. When I asked if she was familiar with Web 2.0, she remembered being introduced to Web 2.0 in an educational technology course. She described a web page with hundreds of links to Web 2.0 applications. She said that she had forgotten about that site. It is possible that Olivia was introduced to a number of

strategies and ideas during her teacher training that she simply was not able to retain during the length of the program.

Conclusion regarding Olivia's case. Olivia did not have much experience in using technology in her own learning prior to or during her participation in a teacher education course. She developed a misconception about what technology integration in the classroom involves, based on both her experiences in her K-12 learning and her participation in the teacher education program. Added to that, she received the erroneous message that there is no single good procedure for developing a sound lesson plan. Furthermore, she lacks self-efficacy in developing a lesson plan that contains a technology component, and therefore, lacks self-efficacy in integrating technology in the classroom.

Olivia needed role models, college professors who integrated technology effectively in their own classrooms. She needed examples of content-specific technology tools for teaching math concepts. She also needed opportunities to verbalize her understanding of what technology integration is and how to achieve it. In addition, Olivia needed opportunities to voice her concerns about perceived barriers to successful technology integration. Finally, the teacher education program and the school administration needed to take more care in selecting Olivia's cooperating teacher, selecting one who utilizes technology in his/her own teaching and who would encourage and support Olivia in her efforts to implement ideas during student teaching.

Discussion of Penny's case

The interview with Penny, plus her responses to the items on the questionnaire and her comments about the technology component in her lesson plans, provided insight into her understanding and vision of technology integration.

Penny's understanding of what technology integration means. When asked to define technology integration, Penny stated:

It means I incorporate technology into different aspects of the lesson for the students. So, it's not only done just through the computer. It can be different aspects, like I mentioned, the iPhone or the document camera. It's just different things [ways] the students could be more engaged in the lesson and in the classroom.

Penny has a general, beginning idea of what technology integration is, gleaned from her experiences in the teacher education program where she was introduced to information and ideas for using technology in the classroom and from observations made during student teaching. She understands that technology can be utilized in various forms throughout the structure of a lesson, and she understands that it has the potential to engage students in learning. However, her understanding is limited to the experiences she had in her teacher education program and in student teaching. The examples of technology use she offered in describing her ideal classroom are low-level uses, and the classroom described is teacher-centered, with almost no real examples of technology in the hands of the students. Penny is in need of seeing how students can use technology to communicate, collaborate, create, and problem-solve.

Penny's perception of technology use in the teacher education program.

Penny mentioned a lesson in one of her courses that introduced some basic features of the Smart Board and utilized it to play an educational game. She also commented that the instructors in the teacher education program were wonderful in that they introduced ideas and information on how to incorporate technology into teaching, like the jumping-off page for guiding student use of an educational website. Another example is when a core professor introduced her class to the readthinkwrite.org site as a resource for lesson plans on the writing process. Penny also remembered being introduced to a web page with links to Web 2.0 applications and commented that there were too many for her to explore all of them. She said that she is aware that there are tools available with which she is not even acquainted. She also mentioned wanting to find other sites to access for video clips rather than just BrainPop.com which was utilized by her cooperating teacher.

Penny's perception of the importance of technology integration. Penny grew up without computers or television in her home, and so she did not feel a connection with technology until after her first year in the teacher education program. Because of experiences in the teacher education program, her opinion about the importance of technology has changed considerably from when she first entered the program. In response to an item on the questionnaire regarding the perceived importance of technology in the classroom, Penny stated:

It is imperative to incorporate the use of technology in education because it not only helps students visualize the concepts, but it also serves as making connections with students. Technology helps students be creative and become critical thinkers . . . Now as the world of technology is constantly changing and

technology is already a daily part of most students' lives, technology should be incorporated daily into the implementation of classroom lessons.

Penny does have a sense of the potential power of technology to help students develop 21st century skills needed for living and learning. She simply needs some examples on how to use technology to help her students develop those skills.

Conclusion regarding Penny's case. Penny did not have much experience in using technology in her own K-12 learning, and she identified those experiences as low-level uses. However, she did not appear to recognize some of the uses of the document camera in student teaching as low-level uses as well, including planned uses she described in her ideal classroom. She needed more content-specific modeling of technology integration in her teaching field, both by her college professors within the teacher education program and core content courses (Chelsey & Jordan, 2012), and she would have benefited from having a cooperating teacher who went beyond using a document camera as an overhead projector. She needed to experience more technology in her teacher education training, where she utilized technology as a student, and she needed more strategies on how to place technology in the hands of students to help them develop an understanding of concepts and to develop skills.

Conclusion

The teacher education program that Molly, Nancy, Olivia, and Penny progressed through included the typically required three-semester hour introductory educational technology course (Banister & Vannatta, 2006; Swain, 2006). It was broken into three one-semester hour courses so that the preservice teachers could experience technology

training throughout the three phases of their teacher education program, thereby prolonging and sustaining their exposure to technology training and use (Bullock, 2004; Sutton, 2011). As is common in teacher education programs, all three courses included assignments designed to teach the preservice teachers to use certain applications, to encourage exploration with tools such as Web 2.0, and to develop technology-enhanced lessons (TEs) designed to address learning objectives with pedagogical considerations in their targeted teaching content areas (Garcia & Rose, 2007; Browne, 2009; Doering et al., 2003; Lambert & Gong, 2010). All four participants said they understood that technology use should not be an add-on, that it should have a meaningful purpose. In addition, they participated in methodology courses that were also designed to address the use of technology in education (Pope et al., 2002). They were afforded hands-on activities during field experiences and were encouraged by the teacher education facilitators to use technology in their lessons during their field experiences and during their student teaching.

The purpose of such experiences was to allow the participants to construct their own understanding of technology integration with the intention that such experiences would improve their perceived self-efficacy in using technology (Chen, 2004), which in turn would facilitate their development of a vision of technology integration (Pierson & Cozart, 2004), and thereby, influence their intentions to use technology in their future teaching (Anderson & Maninger, 2007; Smarkola, 2008). Even so, Molly and Olivia developed flawed visions of technology integration. Molly thought that technology integration required the development of a product, and Olivia envisioned technology

integration as the development of a major project that necessitated the use of a computer lab and a co-teacher. Olivia lacked self-efficacy in developing a technology-infused lesson plan. Both Molly and Penny lacked self-efficacy in problem-solving for relatively minor barriers to using technology during student teaching, a problem common for both practicing teachers and preservice teachers (Choy et al., 2009). For Molly it was installing a program that would allow her to download a video clip. For Penny, not knowing how to reconnect cables at the back of the document camera and computer caused a disruption in the sequencing of her daily lesson plan.

Nancy was the most successful participant in developing a vision of technology integration, imagining how she might use technology in her future teaching, such as developing a hybrid course where time in class with students would be maximized with the utilization of a course website, links to sources, and the use of QR codes for accessing teacher-developed educational videos. The ability to imagine what tools might exist or might be created to address goals and learning objectives is a key component in developing a vision of teaching with integrated technology (Doering et al., 2003; Pierson & Cozart, 2004). Even so, all four participants found their field experiences and college courses lacking in providing examples of content-specific technology uses, examples that are necessary in helping preservice teachers envision how to integrate technology into teaching (Chelsey & Jordan, 2012).

When asked during the interviews how they might use technology in their future teaching, all four participants offered some good ideas. They talked about the use of video clips to introduce or illustrate concepts. They were interested in using interactive

tools such as the Smart Board and the classroom clicker system. They envisioned uses of a class website for linking resources. They mentioned such social sites as Twitter for a possible classroom communication system. Nancy talked about QR codes. On the surface, these preservice teachers seem to understand what is meant by technology integration. They could “talk the talk” and they could produce lesson plans they developed containing a technology component. They appear to have a sound foundation on which to build in using technology in their future classrooms. It is not until we begin peeling back the layers of their perceptions that we realize, though, that they do not necessarily have a complete or accurate concept of technology integration, and therefore, are at risk for not being successful in integrating technology in their future teaching.

Preservice teachers often enter teacher education programs with preconceived ideas as to what a classroom looks like, what the roles of the teacher and the students are (Bai & Ertmer, 2008; Davis et al., 2010), and even what technology in the classroom looks like (Bullock, 2004). Such is the case with Olivia who experienced technology integration when developing her eighth grade science project. She carried into her teacher education program the concept that technology integration involves the use of a computer lab and team-teaching with a content teacher and a technology teacher. This image of technology integration was reinforced with the team-teaching of an educational technology professor and a methodology professor in her teacher education program. We need to be careful, such as in the case of Olivia, that we understand what their preconceived ideas are and that we give them ample opportunity to discuss their

perceptions so that misconceptions about what technology integration means can be addressed.

In addition, we need an open and continuous dialogue with preservice teachers about, not only what the goals of the educational technology courses and methodology courses are but also the objectives of the assignments. Otherwise, we stand the chance of miscommunicating and perpetuating misconceptions about technology integration. This happened with Molly and Olivia. Because the first technology education course focused on learning to use applications, Molly developed the concept that one has to first determine what applications are available and then decide what kinds of activities to develop that will fit with the available technology tools. Olivia already had a vision of technology integration that involved team-teaching from her experience as an eighth grade student. The team-teaching of her technology education professor and methodology professor reinforced her vision of technology integration as involving co-teaching in a computer lab for major projects. Neither Molly nor Olivia understood the reason why the first educational technology course was orchestrated in the manner in which it was.

The first technology course the participants took was designed to specifically address the first stage of the adoption theory, to learn technology (Geoghegan, 1994; Rogers, 1995). The participants mentioned the utilization of some of the applications often required in an introductory educational technology course, such as desktop publishing, video creation, Website creation, and the development of technology-enhanced lessons (TEs) for their specific content grade levels (Browne, 2009; Doering et al., 2003; Lambert & Gong, 2010).

The second stage in the adoption theory for technology integration involves examining beliefs in the value of technology to address learning needs (Anderson et al., 2011; Russell, O'Dwyer, Bebell, & Miranda, 2004; Sugar, 2002). Like practicing teachers, preservice teachers need to learn how technology can effectively be used to address the diverse and varying needs of students. Assignments in a course that focuses on examining the value of technology in education can take the form of reading and discussing articles and/or teaching videos. In addition, preservice teachers are afforded opportunities for developing and delivering lessons that are aimed at solving instructional problems and/or making their own teaching more productive, as well as requiring their students to use technology to help construct understanding of concepts taught (Doering et al., 2003; Lambert & Gong, 2010).

Olivia complained that her QUEST 2 technology course only taught her one new application. Although I did not teach the participants in this study, I have taught the QUEST 2 technology education course for 4-8th grade level preservice teachers. I emphasized to my students that a major objective of the course was to focus on content knowledge and pedagogical considerations when deciding what technology to use and how to use it in addressing student learning needs, as opposed to learning new applications for the sake of learning technology. One of the objectives of the course was also to explore a variety of tools and strategies, including Web 2.0 tools and educational websites. Even so, I still had students who occasionally complained about not learning enough new applications during that course. It is possible, like some of my students have done, that Olivia missed the major focus of that course, that it was about examining the

value of technology in addressing student learning needs, as opposed to learning how to use a specific application. Making clear the purpose of a course and having a continuous dialogue about how the activities in the course are tied into the purpose of the course is crucial in helping preservice teachers make connections that help them to develop a sound vision of teaching with integrated technology.

In addition, we need an open dialogue with preservice teachers on what is and is not an example of technology integration. All four participants showed at least some confusion on this point. For example, Molly thought that viewing a video for educational purposes was not an example of technology integration. Olivia thought that the use of a technology application for developing an assessment tool was not an example of technology integration. So, is using Microsoft Word to develop a worksheet for student use an example of technology integration? Is the development of a five-minute video to be used as part of an anticipatory set an example of technology integration? Viewing and discussing videos of teachers integrating technology in the classroom could greatly facilitate preservice teachers' understanding as to what is and is not an example of effective technology integration (Derry et al., 2002; Stirling et al., 2004).

Furthermore, preservice teachers need to see how teachers handle students, set up classrooms, and utilize technology in their classroom (Chelsey & Jordan, 2012). Group observations and discussions of video recordings of teachers using technology in their classrooms, again, could help preservice teachers to understand pedagogy and how it relates to using technology to address learning needs, in addition to solidifying preservice teachers' understanding as to what are examples of technology integration--what are low

levels of use, and what uses help to promote 21st century skills (Derry et al., 2002; Stirling et al., 2004; U. S. DOE, 2010; Vannatta & Beyerbach, 2000). Molly could have benefited from such observations when she was preparing for students to progress through workstations. She eliminated the workstation that utilized technology partly because she did not know how to handle the students. Olivia could have benefited from viewing and discussing such observations to help her understand that technology integration is not just using a computer lab to develop a major project, that a teacher can utilize technology in a variety of small ways in his/her daily teaching to address core content skills and concepts.

Another concern in preparing preservice teachers for the classroom is their ability to develop lesson plans, which includes assessment strategies. When preservice teachers are assigned to develop TELs, we need to provide opportunities for them to talk through the process, rather than handing them a template (Chelsey & Jordan, 2012; Vannatta & Beyerbach, 2000). Otherwise, we risk preservice teachers simply filling in the blanks and regurgitating what they think their professors want to hear (Davis et al., 2010). Even when they are provided a visual, such as Pierson's Technology Planning Target model (see Figure 2), they may not comprehend exactly what that model conveys, such as the kinds of questions they should ask themselves in developing a lesson or the sequencing involved in developing a lesson. Olivia showed a lack of understanding in how to develop lesson plans. As a result, she provided a lesson plan focusing on a science objective that she and a peer developed for a methodology assignment. She did not feel

confident enough in her ability to develop a lesson plan to provide one to me for this study that she had developed for the teaching of math.

Furthermore, as pointed out by the four participants, college professors in all content areas need to become technology-proficient, utilizing content-specific technology tools and strategies in their teaching while requiring their students to use it in their learning (Chelsey & Jordan, 2012; Sutton, 2011). Otherwise, two potential problems may come into play. One is that preservice teachers like Penny may come away with an understanding of what technology integration is, but because she has not seen enough of it modeled and has not experienced enough of it in her own educational experiences, lacks a well-developed vision. This may result in low levels of use in her future teaching. Indeed, Penny's examples of how she plans to use technology in her future classroom were all low-level, such as using PowerPoint slides to display the day's writing prompt or to present grammar problems.

The other concern is that preservice teachers, like Molly, may decide that technology is not essential. After all, her college professors did not use it much. Being given the message that technology is important but observing that college professors and cooperating teachers do not utilize technology in their teaching or expect students to use it in their learning causes a disconnect between expectations and reality (Chen, 2010; Pierson & Cozart, 2004; Sutton, 2011). Added to that disconnect is that methodology professors not only should be using a variety of technology tools in their courses, but they should be having an ongoing discussion with their students as to what they are doing, how they are doing it, and why they are doing it. This may help preservice teachers to

become aware of what technology tools and strategies are being used to address what objectives.

Furthermore, we need to have open discussions about social issues preservice teachers are likely to encounter in their assigned schools, such as the digital divide and the various forms it can take and the ways it can be perpetuated (Warschauer, & Matuchniak, 2010). Molly was not willing to try to use technology with the lower socio-economic students in her QUEST 2 assignment because she thought their low skills and neighborhood culture would make doing so too difficult. In addition, she made a blanket statement that parents who did not check their students' grades online chose to do so because they were not interested in their students' progress. She missed the idea that parents might not have access or expertise in checking student progress online. Such attitudes perpetuate the digital divide (An & Shin, 2011).

Nancy perpetuated the digital divide in a different manner. She provided her GT students with passes to the school library so that they could develop technology-based projects. Although she could have checked out notebooks from the library or sought to book the school computer lab, she did neither. She did not want to problem-solve updating the notebooks, and she did not want to be concerned about scheduling students into a lab that was often booked in advance by other teachers. However, the result was that most of her students did not get to use technology for a project, whereas a few advanced students did—and those students received extra assistance from Nancy outside of class time. One of the benefits of using technology is that it can help actively engage students in the learning process (ISTE, 2008; Partnership for 21st Century Learning,

2009). What partly makes Nancy's decision surprising is her strong stance on the importance of integrating technology into the classroom. She experimented with classroom management strategies by allowing students access to their iPods and cell phones during class, and she talked about providing QR codes for her future students so that they could access resources on a class site from personal mobile devices. However, she was not willing to problem-solve in how to provide technology access to all her students for the development of a project.

A final concern is the selection of the cooperating teachers (An & Shin, 2011; Bullock, 2004; Chelsey & Jordan, 2012). It is through the opportunity for authentic learning during field experiences such as student teaching that preservice teachers begin to understand how to achieve technology integration in addressing student learning needs, leading to the decision to use technology in their future teaching (Karagiorgi, 2005), which is the third stage of the adoption theory for integrating technology (Geoghegan, 1994; Rogers, 1995). How can the facilitators from a teacher education program and school administrators emphasize to student teachers the importance of using technology in their teaching and then assign them to classroom teachers who use little to no technology in their own teaching? Molly's cooperating teacher not only used very little technology, he actually discouraged Molly from using it by convincing her that using technology in one of the work stations would prove a distraction to students at the other work stations.

Nancy's cooperating teacher did not even use digital technology in her classroom; yet, the teacher education facilitator and school administrator had stressed to Nancy the

importance of integrating technology in the classroom. Olivia felt no encouragement to offer suggestions or implement ideas, and Penny's cooperating teacher utilized the document camera like an overhead projector. Giving out the message that technology in education is important and then being assigned to cooperating teachers who use little to no technology in their teaching causes a disconnect between expectations and reality (Chen, 2010; Pierson & Cozart, 2004; Sutton, 2011).

Implications and Future Research

Teacher education programs use various strategies in preparing their preservice teachers to enter the classroom ready to infuse technology into their teaching. Often, these strategies include activities in their required educational technology course that focus on developing technology-enhanced lessons with various applications, participation in electronic discussions, wikis, and blogs, developing an electronic portfolio, and viewing and discussing videos of classroom teachers using technology with their students (Davis et al, 2010). In addition, many teacher education programs seek to sustain preservice teachers' experiences with technology through technology-infused methodology courses (Pope et al., 2002). Focus continues to increase on preservice teachers' development of TPACK, including the development of instruments to measure preservice teachers' TPACK (Lux et al., 2011). However, care needs to be taken to peel back preservice teachers' layers of perception and understanding through dialogue, whether oral, written, face-to-face, online, one-on-one, or in small and large groups. Otherwise, preservice teachers may mimic what they are taught and repeat what they

think their professors want to hear (Davis et al., 2010), hiding deep-seated beliefs and misconceptions that can derail successful technology integration in their future teaching.

Furthermore, most of preservice teachers' experiences in using technology in their K-12 education were for purposes such as learning how to use a computer and some basic applications, word-processing, and Internet searches. The majority of preservice teachers have difficulty developing a vision of teaching with integrated technology because they have not experienced it in their own K-16 learning, since many classroom and college professors also do not utilize much technology in their teaching or expect their students to use much in their learning (Maddux & Johnson, 2006; Project Tomorrow, 2008). College professors in all content areas need to develop and demonstrate TPACK in their teaching (Chelsey & Jordan, 2012; Sutton, 2011). Not only do they need to do this because it lends itself to quality teaching, but also because not to do so sends out a contradictory message to preservice teachers about the importance of technology in education (Chen, 2010; Pierson & Cozart, 2004; Sutton, 2011).

Added to this concern is that preservice teachers often are not being placed with cooperating teachers who encourage and support preservice teachers in utilizing technology in their teaching during field experiences or student teaching. The selection of schools and of cooperating teachers is an important issue when placing preservice teachers for student teaching and other field experiences (Bullock, 2004). For one, teacher education programs need to be careful about perpetuating the digital divide, not simply in regards to what technology is available in schools, but more importantly, what practicing teachers are technology-using teachers (An & Shin, 2011). Even then, teacher

education programs need to make clear the expectations that the cooperating teacher will allow the student teacher to utilize technology within the classroom and that the student teacher understands that he or she is expected to do so. A cooperating teacher can have a major impact on a student teacher on whether the student teacher attempts to integrate technology into the classroom, thereby, influencing that student teacher's decision to utilize technology in his/her future teaching (An & Shin, 2011; Bullock, 2004).

Collaboration between the cooperating teacher and the student teacher should be encouraged.

In addition, preservice teachers seem to lack problem-solving skills in overcoming relatively minor barriers to using technology in the classroom (Choy et al., 2009). More time needs to be spent in teacher education programs in addressing minor barriers, such as not having access to specific software applications. Many preservice teachers are not aware of the various ways applications can be used and have limited knowledge of using blogs, wikis, and less common Web 2.0 tools such as Twitter, Second Life, and podcasts (Ertmer et al., 2011; Project Tomorrow, 2010). An and Shin (2011) even go so far as to suggest that student teachers be placed in schools with limited technology but with technology-savvy cooperating teachers so that student teachers learn to prepare for teaching in schools with little access to technology. Such a placement during student teaching might help preservice teachers to develop strategies for problem-solving in overcoming barriers to using technology in the classroom. For example, teacher education programs need to introduce preservice teachers to open sources to use with their students, that is, applications on the Internet with free access. In addition,

preservice teachers must learn how to meet the National Educational Technology Standards for Students (ISTE, 2007) while addressing higher order thinking skills and creativity in schools with limited access.

Preservice teachers are typically required to take an introductory technology education course (Banister & Vannatta, 2006; Swain, 2006). Whether that course is taught as a one three-hour course or is broken into three one-hour courses staggered throughout the program, preservice teachers need more experiences than the required technology course to internalize what they are taught or are expected to retain. Three semester hours of an introductory educational technology course, some technology infused in methodology courses, and a few observations of low technology use during field experiences are not sufficient in helping preservice teachers to develop a vision of technology integration on which to continue building (Bullock, 2004; Sutton, 2011). They require numerous experiences with technology and opportunities to reflect on their beliefs about the value of educational technology in the classroom. Such experiences and reflections make it more likely that they will use technology in their future teaching (Fleming et al., 2007).

Even with technology infused into methodology courses, preservice teachers are being asked to simultaneously develop content knowledge, skills in learning how to teach, and basic technology skills. However, they are not being afforded enough opportunities to see how these knowledge bases interact in teaching students. Preservice teachers need multiple opportunities throughout their teacher education program to observe and practice technology integration, allowing them to construct their own

understanding of technology integration, leading to the improvement of their perceived self-efficacy to utilize technology in their teaching (Chen, 2004). They need to observe modeling of content-specific technology in their own learning and during the field experiences in the classroom. They also need multiple opportunities to develop and teach technology integrated lessons so that they can discover what technology tools and strategies are relevant to their discipline (Wang, Ertmer, & Newby, 2004). Such opportunities influence preservice teachers' intentions to use technology in their future teaching (Anderson & Maninger, 2007; Smarkola, 2008).

The need for multiple opportunities to observe and experiment with technology in the classroom, that is specifically, to develop TPACK, leads to a final concern. Are expectations realistic concerning preservice teachers' abilities to sufficiently develop the knowledge bases needed to integrate technology when they enter the classroom as novice teachers? They are beginning to develop their content knowledge at the same time they are developing technology skills and an understanding of pedagogy. Although provided with field experiences and student teaching, too often preservice teachers do not utilize technology during those hands-on opportunities. They have little opportunity and not enough time to implement their own lesson plans or to research and experiment with content-specific technology (Bullock, 2004; Sutton, 2011). Perhaps teacher education programs and states should consider a two-year teaching certification that requires a novice teacher to meet certain requirements before earning another level of teaching certificate that must be renewed periodically through professional development or course work (Reid, 2003) or some kind of residency program where novice teachers gain

experience as classroom teachers for one or two years with the support of mentor teachers (Sawchuk, 2011).

Even with residency programs, though, there is still the challenge of finding technology-using classroom teachers to support novice teachers in developing TPACK. One answer is to develop a partnership between the teacher education program and the school to develop TPACK among selected classroom teachers and then have them to serve as mentors in a residency program or to novice teachers holding a two-year teaching certificate before being awarded a teaching certificate for a longer period (Wright & Wilson, 2007). One example is the Master Technology Teacher (MTT) partnership in 2000. As part of the Preparing Tomorrow's Teachers to Use Technology (PT3) grant initiative, practicing teachers were taught how to integrate technology while mentoring preservice teachers from the University of Alabama to teach with integrated technology (Wright, 2010). Ultimately, if we are to utilize the potential power of technology in teaching and learning, to prepare our students for 21st century living, then these are the issues that must be addressed.

One area for future research centers on preservice teachers' understanding of the goals and objectives of their teacher education courses. For example, do they understand how a course is designed and why it is designed that way? Do they take seriously assignments that involve reflection or electronic discussions over required reading? Do they recognize all the subtle ways their instructors model technology integration for them in various learning environments? In order to help preservice teachers develop that vision of teaching with integrated technology in the classroom, we need to ensure that not only

are preservice teachers given the opportunity to observe and experience it in their own learning (Bai & Ertmer, 2008; Pope et al., 2002), but we need to make certain that they recognize it when they see or experience it.

Another area for future research focuses on the selection and orientation of cooperating teachers. The role of the cooperating teacher is very important (An & Shin, 2011; Bullock, 2004). How do schools select who will serve as a cooperating teacher? What training, instructions, or guidelines are provided for them in fulfilling expectations? Such a study might help inform teacher education programs about how to partnership with local school districts in not only facilitating the development of TPACK within preservice teachers, but also in classroom teachers who might then serve as mentors during preservice teachers' field experiences or as cooperating teachers for student teachers.

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Appendices

APPENDIX A
QUESTIONNAIRE

UNIVERSITY OF HOUSTON
CONSENT TO PARTICIPATE IN RESEARCH

PROJECT TITLE: PRESERVICE TEACHERS' DEVELOPMENT OF A
VISION FOR TECHNOLOGY INTEGRATION

You are being invited to participate in a research project for a dissertation in partial fulfillment of the requirements for the degree Doctor of Education for Judy Meyers from the Department of Curriculum and Instruction at the University of Houston. The project is being conducted under the supervision of Dr. Melissa Pierson.

I. NON-PARTICIPATION STATEMENT

Your participation is voluntary and you may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to answer any question. If you are a student, a decision to participate or not or to withdraw your participation will have no effect on your standing.

II. PURPOSE OF THE STUDY

This study was designed to understand how preservice teachers perceive their own vision of technology integration in the classroom. The duration of the entire study is 3 months. However, your participation in completion of the questionnaire should take approximately 30 minutes.

III. PROCEDURES

A total of approximately 50 participants will be asked to participate in this project by responding to the attached questionnaire.

Description of research project:

1. Responses to the attached questionnaire concerning your experiences and attitudes towards technology use in education will be used to select potential participants for the study.

IV. CONFIDENTIALITY

Every effort will be made to maintain the confidentiality of your participation in this project. Each participant's name will be paired with a pseudonym by the principal investigator. This pseudonym will appear on all written materials. The list pairing the subject's name to the assigned pseudonym will be kept separate from all research materials and will be available only to the principal investigator. Confidentiality will be maintained within legal limits.

V. RISKS/DISCOMFORTS

There are no foreseeable risks or discomforts associated with this research, physically, mentally, or psychologically.

VI. BENEFITS

While you will not directly benefit from participation, your participation may help investigators better understand how preservice teachers perceive their own development of a vision of technology integration in the classroom.

VII.**VIII. ALTERNATIVES**

Participation in this project is voluntary and the only alternative to this project is non-participation.

IX. PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual subject will be identified.

1. I understand that informed consent is required of all persons participating in this project.
2. All procedures have been explained to me and all my questions have been answered to my satisfaction.
3. Any risks and/or discomforts have been explained to me.
4. Any benefits have been explained to me.
5. I understand that, if I have any questions, I may contact Judy Meyers at University of Houston at 713-743-4961 or through email at jameyers3@uh.edu. I may also contact Dr. Melissa Pierson at University of Houston at 713-743-4961, faculty sponsor, at University of Houston at 713-743-2255.
6. I have been told that I may refuse to participate or to stop my participation in this project at any time before or during the project. I may also refuse to answer any question.
7. ANY QUESTIONS REGARDING MY RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT THE UNIVERSITY OF HOUSTON ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT.
8. All information that is obtained in connection with this project and that can be identified with me will remain confidential as far as possible within legal limits. Information gained from this study that can be identified with me may be released to no one other than the principal investigator and her faculty sponsor. The results may be published in scientific journals, professional publications, or educational presentations without identifying me by name.

I HAVE READ (OR HAVE HAD READ TO ME) THE CONTENTS OF THIS CONSENT FORM AND HAVE BEEN ENCOURAGED TO ASK QUESTIONS. I HAVE RECEIVED ANSWERS TO MY QUESTIONS. I GIVE MY CONSENT TO PARTICIPATE IN THIS STUDY. I HAVE RECEIVED (OR WILL RECEIVE) A COPY OF THIS FORM FOR MY RECORDS AND FUTURE REFERENCE.

Study Subject (print name): _____

Signature of Study Subject: _____

Date: _____

I HAVE READ THIS FORM TO THE SUBJECT AND/OR THE SUBJECT HAS READ THIS FORM.
AN EXPLANATION OF THE RESEARCH WAS GIVEN AND QUESTIONS FROM THE SUBJECT
WERE SOLICITED AND ANSWERED TO THE SUBJECT'S SATISFACTION. IN MY JUDGMENT,
THE SUBJECT HAS DEMONSTRATED COMPREHENSION OF THE INFORMATION.

Principal Investigator (print name and title): _____

Signature of Principal Investigator: _____

Date: _____

Dear _____,

Because of your participation in the University of Houston teacher education program as a student teacher, you are being invited to participate in a research project for a dissertation in partial fulfillment of the requirements for the degree Doctor of Education for me, Judy Meyers, from the Department of Curriculum and Instruction at the University of Houston. The project is being conducted under the supervision of Dr. Melissa Pierson.

The responses to this questionnaire will be used initially to select potential participants for a study focusing on the use of technology during student teaching. Your identity will not be revealed at any time, nor will your responses be used in the study without your written permission.

Response to the questionnaire should take no more than 30 minutes of your time. You can either type the response into an email message to me, sent to jameyers3@uh.edu, or you can download the Word document onto your computer, type in the responses, save, and then email the document back to me as an attachment to jameyers3@uh.edu.

Thank you for your time and consideration in responding to the attached questionnaire.

Judy Meyers

Questionnaire

1. Can you remember any uses of technology in your own learning as a K-12 student? If so, please describe it.

2. Did you have any experiences with teaching or substitute teaching prior to entering the teacher education program at University of Houston? If, so, how many years of experience, and on what grade level, in what subject areas?

3. Do you think that technology use in education is important? Please explain.

4. Has your opinion of technology use in education changed in any way since you entered the teaching education program at the University of Houston? Please explain.

5. Describe what an ideal classroom would look like.

APPENDIX B

EMAIL INVITATION TO PARTICIPANT IN THE STUDY

Dear _____,

Because of your participation in the UH teacher program as a student teacher, you are being invited to participate in a research project for a dissertation in partial fulfillment of the requirements for the degree Doctor of Education for me, Judy Meyers, from the Department of Curriculum and Instruction at the University of Houston. The project is being conducted under the supervision of Dr. Melissa Pierson. This project has been reviewed by the University of Houston Committee for the Protection of Human Subjects (713) 743-9204.

Your participation would include an interview conducted on the UH campus, which should last no longer than 1 hour. A follow-up email with the transcribed interview and my comments on how I interpret or understand your responses will be sent to you so that you can check the accuracy of the way I have recorded your responses to the interview questions. **You are also requested to bring with you to the interview a lesson plan you developed with a technology component. (Please bring a copy that I may keep.)** Responses to a recent questionnaire concerning your previous experiences and attitudes towards technology use in education were used to select the participants in the study. The responses to the questionnaire will also be used to provide portrait of each participant in reference to experiences with and attitudes towards instructional technology. At no time will your identity be revealed to others.

Please find attached a consent form to be filled out and returned to me at the time of the scheduled interview. I also request that you respond to this email to let me know if you are willing to be a participant in this study. We will then determine a date, time, and location at the UH campus for the interview. As a thank you for participating in my study, and as a way of defraying the cost of interviewing on UH campus, you will receive a \$50 Visa Gift Card for your participation, awarded at the completion of the interview and confirmation of data records. Please note that you will be responsible for payment of your own parking at University of Houston. Thank you for your time and consideration of my request that you participate in my study.

Judy Meyers

APPENDIX C

CONSENT TO PARTICIPATE IN THE STUDY

UNIVERSITY OF HOUSTON CONSENT TO PARTICIPATE IN RESEARCH

PROJECT TITLE: PRESERVICE TEACHERS' DEVELOPMENT OF A
VISION FOR TECHNOLOGY INTEGRATION

You are being invited to participate in a research project for a dissertation in partial fulfillment of the requirements for the degree Doctor of Education for Judy Meyers from the Department of Curriculum and Instruction at the University of Houston. The project is being conducted under the supervision of Dr. Melissa Pierson.

X. NON-PARTICIPATION STATEMENT

Your participation is voluntary and you may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to answer any question. If you are a student, a decision to participate or not or to withdraw your participation will have no effect on your standing.

XI. PURPOSE OF THE STUDY

This study was designed to understand how preservice teachers perceive their own vision of technology integration in the classroom. The duration of the entire study is 3 months. However, your own participation will be at most 2 ½ hours occurring over just 3 individual days.

XII. PROCEDURES

A total of approximately 4 to 8 participants will be asked to participate in this project.

Description of research project:

2. Responses to a recent questionnaire concerning your experiences and attitudes towards technology use in education were used to select you as a potential participant in the study.

If you agree to participate, responses to the questionnaire will also be used to describe each participant in the study in reference to experiences and attitudes towards the use of technology in the classroom.

3. I will conduct a face-to-face interview with you. The approximate time of the interview will be 1 hour. The interview will be audio-recorded for accuracy. I request that you bring to the interview a lesson plan you developed with a technology component. Interview questions will center on your experiences with using technology in your student teaching, the development and use of your lesson plan, as well as your anticipation of the use of technology in your future teaching.

4. A transcript of the interview, along with a statement of my understandings and interpretations gleaned from the interview will be emailed to you within two days after the interview has been conducted. I will ask that you reply to the email with any comments or thoughts you may have in reference to the interview and my comments or thoughts. Depending on need for clarity, another email interaction may be required. The purpose of the email(s) is to assist me in making sure that the transcript of the interview and my interpretations of what was said in the interview are accurate to the best of your knowledge.
5. Total time commitment for your participation is 1 hour of interview time and approximately 1 hour of reading and responding to the written interview transcript and my comments through email interaction. If another email follow-up is needed, the time commitment for response should be no longer than half an hour.

XIII. CONFIDENTIALITY

Every effort will be made to maintain the confidentiality of your participation in this project. Each participant's name will be paired with a pseudonym by the principal investigator. This pseudonym will appear on all written materials. The list pairing the subject's name to the assigned pseudonym will be kept separate from all research materials and will be available only to the principal investigator. Confidentiality will be maintained within legal limits.

XIV. RISKS/DISCOMFORTS

There are no foreseeable risks or discomforts associated with this research, physically, mentally, or psychologically.

XV. BENEFITS

While you will not directly benefit from participation, your participation may help investigators better understand how preservice teachers perceive their own development of a vision of technology integration in the classroom.

XVI. INDUCEMENT OR REWARDS

Participants passing the screening questionnaire, and who complete the research interview, and who email confirmation of data records will be compensated for their participation with a \$50 Visa Gift Card.

XVII. ALTERNATIVES

Participation in this project is voluntary and the only alternative to this project is non-participation.

XVIII. PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual subject will be identified.

XIX. AGREEMENT FOR THE USE OF AUDIO TAPES

If you consent to participate in this study, please indicate whether you agree to be audio taped during the study by checking the appropriate box below. If you agree, please also indicate whether the audio tapes can be used for publication/presentations. (Potential participants who do not agree to be audio taped during the interview will still be considered for participation in the study.

☐ I agree to be audio taped during the interview.

- ☐ I agree that the audio tape(s) can be used in publication/presentations.
- ☐ I do not agree that the audio tape(s) can be used in publication/presentations.
- ☐ I do not agree to be audio taped during the interview.

SUBJECT RIGHTS

9. I understand that informed consent is required of all persons participating in this project.
10. All procedures have been explained to me and all my questions have been answered to _____ my _____ satisfaction.
11. Any risks and/or discomforts have been explained to me.
12. Any benefits have been explained to me.
13. I understand that, if I have any questions, I may contact Judy Meyers at University of Houston at 713-743-4961 or by email at jameyers3@uh.edu. I may also contact Dr. Melissa Pierson at University of Houston at 713-743-4961, faculty sponsor, at University of Houston at 713-743-2255.
14. I have been told that I may refuse to participate or to stop my participation in this project at any time before or during the project. I may also refuse to answer any question.
15. ANY QUESTIONS REGARDING MY RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT THE UNIVERSITY OF HOUSTON ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT.
16. All information that is obtained in connection with this project and that can be identified with me will remain confidential as far as possible within legal limits. Information gained from this study that can be identified with me may be released

to no one other than the principal investigator and her faculty sponsor. The results may be published in scientific journals, professional publications, or educational presentations without identifying me by name.

I HAVE READ (OR HAVE HAD READ TO ME) THE CONTENTS OF THIS CONSENT FORM AND HAVE BEEN ENCOURAGED TO ASK QUESTIONS. I HAVE RECEIVED ANSWERS TO MY QUESTIONS. I GIVE MY CONSENT TO PARTICIPATE IN THIS STUDY. I HAVE RECEIVED (OR WILL RECEIVE) A COPY OF THIS FORM FOR MY RECORDS AND FUTURE REFERENCE.

Study Subject (print name): _____

Signature of Study Subject: _____

Date: _____

I HAVE READ THIS FORM TO THE SUBJECT AND/OR THE SUBJECT HAS READ THIS FORM. AN EXPLANATION OF THE RESEARCH WAS GIVEN AND QUESTIONS FROM THE SUBJECT WERE SOLICITED AND ANSWERED TO THE SUBJECT'S SATISFACTION. IN MY JUDGMENT, THE SUBJECT HAS DEMONSTRATED COMPREHENSION OF THE INFORMATION.

Principal Investigator (print name and title): _____

Signature of Principal Investigator: _____

Date: _____

APPENDIX D
INTERVIEW PROTOCOL

Hello. Thank you for meeting with me today. As you are aware, the reason you and I are meeting is that I would like to get some feedback from you on how your student teaching went in reference to the use of technology in the classroom. This feedback may help to shed some light on how teacher education programs can help preservice teachers in their understanding and use of technology in their future teaching. I am interviewing several students from our introductory technology course who appear to have varied experiences with technology before entering the teacher education program and who seem to have differing opinions of technology use in the classroom before and after completing our introductory technology course. Please keep in mind that your identity is completely confidential, and so speak freely and honestly.

This interview should take no longer than 1 hour. At the completion of the interview, I have for you a \$50 Visa card as a token of my appreciation in you taking the time and effort to meet with me today for this interview.

To begin with, I would like to ask you some question about your use of technology during student teaching.

1. In what subject and grade level did you complete your student teaching?
2. What technology tools were available to you and your class?
3. Tell me about one way you used technology with your students.
4. Did you encounter any problems or concerns in using technology with your students?
 - a. (probe) If so, what was one problem you encountered in using technology tools with your students?
 - b. (probe) How did you resolve that problem?

Now, I am going to ask about other experiences you had in student teaching related to technology use.

5. What was one motivation or encouragement you had in using technology with your students?
6. Did you observe your cooperating teacher use technology with his/her students?
 - a. (probe) If so, did anything surprise you about your cooperating teacher's use of technology?
 - b. (probe) Why did you find that surprising?

Before we finish, I have a few questions to ask you about technology integration and your thoughts about the teacher education program in reference to preparing you to use technology in teaching.

7. What does technology integration mean to you?
 - a. (probe) How did you arrive at that meaning of technology integration?
8. Do you feel that what you learned in your methodology courses helped prepare you to integrate technology in your student teaching?
 - a. (probe) If so, how did your methodology courses help in your preparation to integrate technology in your student teaching?
 - b. (probe) If not, what do you think could have been done in your methodology courses to help you better prepare to integrate technology in your student teaching?
9. Do you feel that what you learned in your content courses helped prepare you to integrate technology in your student teaching?
 - a. (probe) If so, how did your content courses help in your preparation to integrate technology in your student teaching?
 - b. (probe) If not, what do you think could have been done in your content courses to help you better prepare to integrate technology in your student teaching?
10. What would an ideal introductory technology course in a teacher education program look like?

This completes our interview. I will be sending you an email within a couple of days with a transcript of our interview, along with comments on my understanding of what you said. I ask that you read through it and provide comments on anything you feel is not accurate. Please accept this Visa gift card as a show of my appreciation for your time in participating in this study.

Suggested general probes:

Please tell me more about _____.

You mentioned _____. Tell me about _____.

